INNOVATION MANAGEMENT

OF LOGISTICS SERVICE PROVIDERS

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1 Introduction

This work[1] investigates the innovation management of Logistics Service Providers (LSPs). In particular, it aims at exploring why they are perceived not to be particularly innovative.

1.1 Motivation

Innovation can lead to immediate benefits such as additional revenues or improved processes (e.g. Khazanchi, Lewis and Boyer 2007), and it can create competitive advantage (e.g. McGrath and Ming-Hone 1996). Innovation is manageable (Drucker 1985), but its management is different to routine management (van de Ven 1986). The innovation management discipline is therefore highly relevant.

With respect to LSPs as the specific context of this work, numerous works have expressed the notion that they are not particularly innovative (Ackerman 1996; Darkow, Jahns and Pedrosa 2007; Ellram and Cooper 1990; Peters, Lieb and Randall 1998; Straube et al. 2005; Wagner 2008; Wallenburg 2009; Wilding and Juriado 2004; ZEW 2005; ZEW 2009h). This lack of innovation achievements[2] could not yet be explained from the discipline on general, i.e. not LSP-specific, (service) innovation management (cp. e.g. Adams, Bessant and Phelps 2006; Ernst 2002; Johne and Storey 1998), nor from the discipline on LSP research (cp. e.g. Maloni and Carter 2006; Marasco 2008; Selviaridis and Spring 2007). Besides, there are calls for industry-specific studies (respectively for cross-industry comparisons[3]) of innovation management (Damanpour 1991; Evan and Black 1967; Nijssen et al. 2006; Wolfe 1994) or even of LSPs' innovation management (Flint et al. 2005; Göpfert and Hillbrand 2005). There is hence a research gap: "*[L]ogistics research has largely ignored the concept of innovation*" (Flint et al. 2005, p. 113).

LSPs' apparent lack of innovation achievements appears counterintuitive when contrasted to the facts that customers expect solutions innovation from their LSPs (Langley et al. 2005), and that for a specific type of innovation[4], it could be shown that it leads to increased

[1] The term *work* is used to refer to the entire book.

[2] The chosen verbal expressions of the motivating research problem, that LSPs may *not be particularly innovative* or *have low innovation achievements* are for the moment fuzzy and not entirely congruent. That fuzziness is in fact part of the research problem itself, namely that it is unknown what actually poses LSPs' problem. Thus, analysing this problem and identifying its main components is a key aim of this project. With respect to verbal expressions, the term (not) *being innovative* is used due to its easy accessibility. However, the related noun *innovativeness* has – at the level of the firm – been defined as the propensity to innovate, i.e. the willingness and ability to do so (e.g. Ettlie, Bridges and O'Keefe 1984; Garcia and Calantone 2002; Wolfe 1994). As a behavioural explanation cannot be assumed ex ante, the phrase is substituted by *low innovation achievements*. It can safely be assumed that low innovation achievements reflect at least a partial explanation of the research problem.

[3] The central motivation to this work, that LSPs' innovation achievements are noticeably low is implicitly also a cross-industry comparison because that statement requires a point of reference (which is clearly not a chronological one for the works cited in the introduction).

[4] Namely proactive improvements, i.e. unsolicited incremental innovations in existing relationships between LSPs and individual clients (cp. Wallenburg 2009)

customer loyalty (Wallenburg 2004; Wallenburg 2009), as well as to improved outcomes of the logistics outsourcing relationship for the customer (Deepen et al. 2008). Considering LSPs' central supply chain positions (Selviaridis and Spring 2007), the boundary-spanning role of the logistics function (Mentzer, Min and Bobbitt 2004; Morash, Dröge and Vickery 1997) and the logistics affiliation with flow orientation (Weber 2002), LSPs are actually in particularly advantageous positions to be innovative. Nevertheless, as of today, logistics-related improvements are often driven by LSPs' customers, and not by LSPs (Flint et al. 2005; Flint, Larsson and Gammelgaard 2008; van Hoek 2000).

The need for LSPs to be innovative has even increased over the years: First, the more LSPs extend their service offerings towards more sophisticated services (Langley et al. 2006; Lieb 2005), the more innovative they have to be. Second, globalization, which often goes hand in hand with consolidation, increases competitive pressure and the need to be innovative (Capacino and Britt 1991; Langley et al. 2005; Semeijn 1995). A third environmental trend is deregulation (Allen 2005; Jensen and Stelling 2007; Lewis, Semeijn and Vellenga 2001) which increases competition for quality and thus the pressure to be innovative, as well (Kimura 2005; Oster Jr. and Strong 2000; Stapleton and Hanna 2002).

If the reasons for LSPs' low innovation achievements are understood, then recommendations for their innovation management can be derived, LSPs can profit from the previously discussed benefits, and they can also improve the effectiveness and efficiency of the supply chains they operate in. Thus, the research gap is clearly relevant. The research-motivating question of this work is accordingly phrased as follows: *"Which reasons can be proposed as to why LSPs are not particularly innovative?"*

The remainder of this introductory chapter contains the deduction and description of the explorative approach of this work, as well as a delineation of the course of the investigation and the structure of the presentation in Chapters 2 to 7.

1.2 Methodological Approach

LSPs' innovation management has only been focused on in very few works (cp. the later Chapter 3). While additional fragmentary knowledge can be collected from works that broached the subject, the specific research is at a very early stage. That is a first, partial reason to choose an explorative approach (Eisenhardt 1989; Glaser and Strauss 1967).

The facts that the calls for industry-specific investigations cited in Chapter 1.1 were undertaken in the light of expected differences between various industries and that LSPs' low innovation achievements could not yet be explained raises the question of possible LSP specificity. Even though there is an established stream on LSP research (cp. Chapter 2.1), it has not regarded typical LSP features or even specialities (cp. Chapter 2.3). This means that a confirmatory approach could not take LSP specificity into account, but would be forced into an unspecific investigation. An explorative study is therefore highly recommendable.

A third reason for the choice of an explorative approach lies in the complexity of the topic which is characterized by numerous interrelated facets (cp. Chapters 2.2.1 and 2.2.2), so that "*neither the variables nor the exact relationship between the variables is fully definable*" ex ante (de Graaf and Huberts 2008, p. 641). Complexity can be acknowledged in explorative

research which allows generating a deep and holistic understanding of the research context (Eisenhardt 1989; Glaser and Strauss 1967; Strauss and Corbin 1990).

As regards the nature of exploration, Lamnek (1995a) points out the following: "*Exploration is per definition a flexible procedure in which the scientist changes from one method of investigation to another, in which he adopts new positions of observation over the course of his study, in which he moves into new directions that he had not taken into account before, and in which he changes his opinion about what are important data when he has acquired more information and a better understanding"* (Lamnek 1995a, pp. 102-103; translation by the author). In line with Lamnek's explanation, this work makes use of a plurality of methods (the choice of which is explained in the related Chapters 3.1, 4.1, 5.1 and 6.1) and continuously refines its focus.

A central decision in the planning of an explorative study is the level of supposedly established knowledge with which the scientist begins the research project[5]. The more contextual data is understood as accepted knowledge, the narrower is the scope of what can be questioned. Questioning supposed truths is at the core of each scientific endeavour, so that demands have been made to start explorative work without any knowledge at all and to ground all theory purely in the data which is collected and coded until newly established categories are saturated (Glaser and Strauss 1967). As Eisenhardt (1989) points out, Glaser and Strauss (1967) put little emphasis on generalizing findings from a Grounded Theory, but focus on the case at hand. Various problems can result from this: At best, re-discoveries of previous findings are unnecessary. Possibly resulting novel category labels for existing concepts can produce confusion among later researchers. The costs of research are very high, and it is difficult to stick to the demand of not taking data into account which is regarded as acknowledged. Last, but not least importantly, if the researchers are not aware of existing concepts, they are likely to lack theoretical sensitivity, i.e. an *"awareness of the subtleties of meaning of data"* (Strauss and Corbin 1990, p. 41) and hence miss relationships between concepts which more theoretically sensitive researchers would have noted. According to Strauss and Corbin 1990), theoretical sensitivity can stem from "*literature, which includes readings on theory, research and documents […] of various kinds*" (p. 42), from professional experience or personal experience[6]. Their weaker approach towards existing literature allows *"thinking about and getting the study off the ground"* (Strauss and Corbin 1990, p. 56), as well as to undertake comparisons between findings based on primary data and existing literature. A very similar position on handling literature was taken by Eisenhardt (1989).[7]

The conflict of interest between sensitivity of the researcher and connectivity of the research with established literature on the one hand and focus on the case under investigation and originality of the findings on the other hand necessitates a trade-off: In this research with its focus on LSPs, *content-related findings* of the LSP-unspecific literature such as innovation management activities, actors, instruments, antecedents and consequences etc. are ex ante not

[5] That decision is actually difficult to take, as Strauss and Corbin (1990) point out, because researchers may *"carry […] unrecognized assumptions"* within themselves which by definition cannot be dropped consciously (p. 49).

[6] Here, literature and professional experience could be made use of, but not personal experience.

[7] As previous literature is used merely to create theoretical sensitivity, the explorative approach requires that in Chapters 2 to 5, attention will be paid solely to LSPs. The penultimate Chapter 6 amends a cross-industry comparison.

taken for granted to be applicable to LSPs.[8] The reasons are precisely the ones that necessitate an explorative approach. On the other hand, established *structural findings* such as definitions, scope of innovation and innovation management, research streams etc., were respectively will be built on.[9] This allows for connecting the results better to previous literature than a grounded-theory approach (Glaser and Strauss 1967) could do. The decision is justified ex ante by the long tradition of innovation management research[10] and ex post by not having identified any need for other categories.

1.3 Course of the Investigation

The research-motivating question, which reasons can be proposed as to why LSPs are not particularly innovative, can be broken down into multiple research questions which determine the general course of the investigation and the structure of the presentation. Each of the main Chapters 3 to 6 contains considerations on the choice of its methods, together with their description, the chapter's results, and its individual conclusion consisting of summary, managerial implications, as well as of limitations and research implications, so that each chapter is relatively accessible on a stand-alone basis. The structure also reflects the formation of this work in a quasi-cumulative way.[11]

As the previous chapter showed, possible LSP specificity is central to the justification of an independent study on LSPs' innovation management, as well as to the understanding of differences between LSPs' and other service providers' related achievements. Thus, research question 1 is: "*Which features of LSPs', their services and their environment provide a special context for LSPs' innovation management?"* Research questions 1 is answered first[12] by means of a literature review and theoretical considerations. It is found that, even though no works explicitly treated LSP specificity, certain relevant features and peculiarities of LSPs', their environments and their services can be identified and linked to one another by means of conceptual considerations.

The motivation in Chapter 1.1 listed a few works that focused on LSPs' innovation management. It can be assumed that there are others which at least broached the subject. Their

[8] Thus, a literature review will concentrate on LSP-specific literature (cp. Chapter 23); a process model will derive an LSP-specific model that takes into account LSPs' typical features (cp. Chapter 4), and a systemic analysis will derive contingency factors and their effects from empirical LSP data (cp. Chapter 5).

[9] Cp. e. g Chapters 2.2.3 and 3.1.2. The proceeding is highlighted particularly well by comparing the approaches of Chapters 4 and 5: In Chapter 4, the evolvement of innovation generation processes from phase to phase is identified to be industry-specific. Thus, established process models are classified as *content-related findings*, so that their applicability has to be questioned. In Chapter 5, the make-up of innovation management systems out of various elements is identified not to be industry-specific. Thus, a framework on that represents an applicable *structural finding*.

[10] For example, *Schumpeter* published the first edition of *The Theory of Economic Development* before the First World War (Schumpeter 1911).

[11] A quasi-cumulative dissertation is characterized by having excerpts from it submitted to or published in peer-reviewed form and as articles in edited books, before being aggregated. Those excerpts and this work as a whole contain the highly valuable feedback of the official advisors of this dissertation, Prof. Dr. Dr. h.c. Jürgen Weber and Prof. Dr. Stephan M. Wagner, and of the unofficial third advisor, Prof. Dr. Carl M. Wallenburg. One of the published articles also contains a contribution of a fellow Ph.D. candidate that was not related to the topic of this dissertation and is not presented herein.

[12] Chapters 4 and 5 amend empirical data to the answer of research question 1. Chapter 6 tests the concluding proposition that LSPs' context is indeed specific.

findings should be integrated. Hence, research question 2 is formulated: "*What is the state of knowledge on LSPs' innovation management? Can it be explained from that why LSPs are not particularly innovative? If so: How?"* The answer to research question 2 is based on a review of LSP-specific literature which focused on or broached the topic of innovation management. A large amount of fragmented knowledge on LSPs' innovation management can be integrated, but previous works lacked comprehensive studies of LSPs' innovation management processes and systems,[13] and do not directly refer to the underlying reasons of LSPs' low innovation achievements.[14]

Given the lack of empirical studies of LSPs' innovation management and its context, primary empirical analyses are amended in Chapters 4 and 5. Chapter 4 begins with a procedural perspective.[15] It suggests itself to link research question 3 to the study of LSPs' innovation processes. However, a number of interrelated problems hindered such an outset (cp. the introduction to Chapter 4). A LSP-specific process model had to be developed first with the help of an action research approach. Due to the researcher's interaction with the research context, it was decided to postpone the usage of the developed process model until its validity is confirmed by subsequent scholars. Hence, research question 3 is formulated as follows: *"Which explanations of LSPs' low innovation achievements can be proposed from the development of a LSP-specific model of an innovation process?"* The development of the process model occurred for a typical LSP, i.e. one that is characterized by precisely those four features which were identified as typical in answer to research question 1. Those features act primarily as barriers in LSPs' innovation generation processes.

Chapter 5 continues the primary empirical analysis by means of an analysis of LSPs' innovation management systems. To that aim, multiple cases of LSPs' innovation management systems were studied. LSPs' typical features are mirrored in contingency factors.[16] Thus, research question 4 can be formulated as follows: *"Which explanations of LSPs' low innovation achievements can be proposed from the study of LSPs' innovation management systems?*" The case study analysis confirms the typical features once again and refines them to some extent.[17] An ex-ante expectation[18] of bad quality of LSPs' innovation management that already could not be proposed after Chapters 3 and 4 does not find support in Chapter 5, either.

In accordance with the title of this work and its motivation, Chapters 3 to 5 focus on the exploration of LSPs' management of innovation. The penultimate Chapter 6 amends a

[13] In such a secondary data analysis, it is possible to integrate a procedural and a systemic perspective within a single text. The term *text* is used to refer to the top-level chapter it is used in, i.e. Chapters 1, 2, 3, 4, 5, and 6.

[14] As a side note to the research-motivating question, suggestions for future research on LSPs' innovation management are presented in Chapter 3.2.4.

[15] Cp. Chapters 2.2.2 and 2.2.3 which explain multiple perspectives on innovation management and research streams pertaining to them.

[16] Besides those, there are relevant contingency factors that do not possess mean values characteristic for LSPs and were hence not typical of LSPs.
As further side aspects of the super-ordinate research motivation, descriptive results of the cases are presented, six contingency factors are extracted, and 39 relationships linking those to 25 dependent variables are proposed.

[17] Auxiliary to the research-motivating question, the case study analysis leads to 39 propositions which describe precisely how contingency factors affect LSPs' innovation management systems.

[18] According to Strauss and Corbin (1990) and Lamnek (1995b), researchers carry assumptions with themselves at the outset of their research. These were explicated (cp. Busse and Wallenburg 2008) to become usable as validity checks of results.

confirmative view. Having identified various facets of LSP specificity conceptually in Chapter 2.3, and having observed its effects empirically in Chapters 4 and 5, Chapter 6 aims to answer research question 5a: *"Is the LSP context to innovation significantly different from that of other service providers?"* Research question 5a shifts the focus of attention from innovation management to innovation itself, and it picks up the cross-industry comparison point of view that motivated this work. Research question 5a is answered by a secondary quantitative analysis of large-scale empirical data. It is found that, indeed, highly significant differences between LSPs and other service providers exist. This allows for making another amendment to previous research, namely to interpret those differences and to aim at explaining them. Therefore, a final research question 5b is added: "*Which explanations for differences between LSPs' innovation achievements and those of other service organizations can be proposed?*" It is found that upstream effects and the LSP context established in Chapter 2.3 explain downstream effects to a large extent. Research question 5b leads to an aggregated proposition on the effect of LSPs' specific context, namely that it increases the costs associated with innovation efforts, while it seems that LSPs' benefits from innovation are similar to those of other service providers.

The final Chapter 7 draws a conclusion from this research project which aggregates the impressions and propositions on root causes of the perceived lack of LSPs' innovation achievements.[19] Besides, it lists major academic contributions.

[19] As each of the Chapters 2 to 5 already contains its own conclusions, each with a summary, an assessment of managerial implications and a depiction of limitations and further research, those are not repeated in Chapter 6.

2 Foundations

This text[20] presents the research foundations of this work. Those are firstly research on LSPs and innovation-related research. As previous research has not yet described LSP specificity sufficiently comprehensively to found this research project on it, another sub-chapter is added that is aimed at answering research question 1: "*Which features of LSPs', their services and their environment provide a special context for LSPs' innovation management?"* The answer to research question 1 integrates individual facts identified from the literature and amends theoretical considerations to them.

2.1 Research on Logistics Service Providers

Logistics, the eponym of LSPs, is an interface discipline between engineering and business studies. From a management-oriented perspective – which this work applies, logistics can be understood as a functional business discipline or as a meta-leadership discipline (Weber 1996). A functional point of view will emphasize planning, implementation[21] and control of materials flows (CSCMP 2009) and the boundary-spanning role of materials flows from one party to another (Mentzer, Min and Bobbitt 2004; Morash, Dröge and Vickery 1997). A meta-leadership perspective on the other hand will emphasize the strategic importance of flow orientation and its implementation in logistics respectively in supply chain management (Weber 2002).

LSPs were defined as *"companies which perform logistics activities on behalf of others"* (Delfmann, Albers and Gehring 2002, p. 204). The definition is adopted in this work because it is straight-forward, precise, short, and explicit. LSPs' origin hence lies in outsourcing of formerly intra-organizational logistics processes to third parties (Bolumole 2001; Bolumole, Frankel and Naslund 2007; Sheffi 1990). LSPs who handle the inbound part of their customers' material flows get in touch with their customers' suppliers; and LSPs who manage the outbound part of their customers' material flows, get in touch with their customers' customers (Selviaridis and Spring 2007). Hence, independent of the understanding of logistics management, LSPs themselves incorporate a boundary-spanning role and adopt central positions within supply chains.

LSPs belong to the LSP industry respectively to the transportation industry, to apply the economic term (e.g. Aschhoff et al. 2009; Wagner 2008; ZEW 2009h). Many LSPs provide so-called Value Added Services, which are supplementary services mostly related to production – clearly not a part of logistics (e.g. Langley el al. 2008). Accordingly, the natural

[20] Excerpts from earlier versions of Chapters 2.1 and 2.2 were published in Busse, Eitelwein and Wallenburg (2007), Busse and Wallenburg (2008) and in Wagner and Busse (2008a). They were additionally used in the not yet published articles Busse (2010), Busse and Wallenburg (2010a) and in Busse and Wallenburg (2010b). Excerpts from an earlier version of Chapter 2.3 were published in Busse, Eitelwein and Wallenburg (2007) and were used in the not yet published articles Busse (2010) and Busse and Wallenburg (2010a).

[21] Implementation is understood as the "*realization of solutions which exist in conceptual form and have to be transferred into concrete corporate action*" (Daniel 2001, p. 15; translation by the author)

point of view for research on LSPs is an institutional one, even though their name refers to their focus on certain execution tasks which originate from a business function.[22] That finding implicates that previous research must be treated very carefully where it supposedly deals with "*innovation in logistics", "logistical innovation"* and *"logistics innovation"*[23]: Innovations with a novelty in materials transport, storage or handling do not have to be relevant for LSPs. For example, a new intra-organizational production supply strategy in the automotive industry would not be.[24] Second, the institutional commonality of LSPs means they can also adopt or generate novelties which have nothing to do with materials flows, their coordination or flow orientation.[25]

In the international literature, LSPs are primarily studied as parties involved in third-party logistics (3PL) relationships between the LSP and either a seller or a buyer of goods (Marasco 2008). While no literature reviews dedicated to LSPs exist yet, there are three that focus on 3PL relationships (Maloni and Carter 2006; Marasco 2008; Selviaridis and Spring 2007), through which the centre of attention in LSP research can be assessed. According to Maloni and Carter (2006), dominant themes are functions and reasons to outsource, 3PL provider evaluation, as well as success factors, barriers, outcomes and contracts in 3PL relationships. Maloni and Carter (2006) do not acknowledge the existence of innovation, nor do they list any findings on characteristic or even typical LSP features. Marasco (2008) classifies research content into context, structure, process, outcome and comprehensive research. She merely mentions innovation casually, e.g. as something LSPs "*can benefit from*" (p. 137) in a manner not closer specified. Typical LSP features are not discussed. Selviaridis and Spring (2007) list outsourcing decision, benefits and risks of outsourcing, service offerings and usage, purchasing and marketing of 3PL services, as well as growth strategies as central themes at the firm level. At the dyad level, formation and evolution of 3PL relationships, their management, success factors and partnership models are discussed. Logistics triads and networks are mentioned at the network level. Even though some topics in Selviaridis' and Spring's (2007) review are closely related to innovation – growth, for example, can be achieved through innovation, innovation itself is only mentioned three times: According to Selviaridis and Spring (2007), LSP innovation can be achieved in collaborative relationships, can procreate competitive advantage and is currently lacking (cp. Chapter 1.1). Typical LSP features are not discussed, either. The view of Flint et al. (2005), that innovation has been disregarded in logistics, can hence be confirmed with respect to LSPs. In addition, it became clear that typical LSP features have not been investigated in detail, yet. Both assessments will

[22] Theoretical implications of the disentanglement of industries from the execution tasks originally defining them are discussed by Weber (1996).

[23] The ambiguity is not only characteristic of the English language. For example, the German terms *"Innovation in der Logistik"*, *"logistische Innovation"* and *"Logistikinnovation"* are equally misleading.

[24] From a business-studies point of view, phenomena *"in logistics"* may be in a general danger of being underspecified as a consequence of the disentanglement of the LSP industry from only logistics-related tasks. It is hence recommended to avoid those labels and strive for unambiguous ones. As the cited example highlights, the issue seems not to apply to technological studies, though, because what "*logistics*" refers to is relatively unambiguously described therein, namely the effective planning and efficient execution of materials flows themselves, as well as the development and appropriate usage of the technology supporting those materials flows.

[25] Admittedly, delivering logistics services remains LSPs' core competency (Langley 2008); and compared to other industries, logistical services are more important to LSPs than to other independent organizations. While features of logistical services thus have to be taken into account, they are not *by definition* relevant so that the differentiation must not be neglected.

be further underpinned by a systematic review of approximately 600 academic papers (cp. Chapter 3.1.1).

2.2 Innovation-related Research

In line with the methodological approach described in Chapter 1.2, this section will focus on "*structural*" output of previous innovation-related research. Innovation is characterized and defined first, followed by innovation management. Last, streams of innovation research are presented.

2.2.1 Innovation

A plethora of definitions of innovation exist.[26] An appropriate synthesis must incorporate five features of innovation:

1. Innovation implies a certain novelty.[27] The degree of novelty is not predetermined. Hence, it can lie between incremental and radical (e.g. Benkenstein and Steiner 2004; Green, Gavin and Aiman-Smith 1995; Sundbo 1997).
2. The actor who accomplishes the innovation is an organization.[28] As the difficulty of introducing something new in a company[29] arises from the novelty to the company, subjective novelty is regarded as sufficient novelty to apply the term innovation: *"An innovation is […] new to an organization and to the relevant environment"* (Knight 1967, p. 478).[30] As a consequence of this definition, organizations can and have to regard imitations (e.g., local, but not global novelties) as innovations.[31] The emphasis

[26] For example, Hauschildt (2004) groups innovation definitions into seven clusters: first those that understand innovations as new products or processes, based on the fact itself or a certain degree of novelty, second based on the character of global novelty, third on perception of that novelty. A fourth group recurs to new combinations of means and ends, a fifth to the usage of novel products and processes, a sixth understands innovation itself as a process and a final category understands innovation as novel services beyond industrial products or processes.

[27] The novelty feature is meaningful not only to the innovation which it characterises or to the company which has to manage it, but in fact also to the discipline that studies it: The feature necessitates contexts of (previous) knowledge deficits. It could hence be argued that innovation requires a behavioural perspective wherever the behaviour of individuals is investigated. This work follows that reasoning. Nevertheless, not only individual behaviour is relevant to innovation research (cp. Chapters 1.3, 2.2.2, and 2.2.3). Thus, innovation processes will be discussed applying criteria with respect to effectiveness and efficiency of workflows (cp. Chapter 4), and innovation systems will be discussed based on assessment of fit (cp. Chapter 5). At a highly abstract and highly aggregated level, even an innovation production perspective proves useful (cp. Chapter 6).

[28] This limits the scope of the present study, as it excludes new political developments, new social trends etc. The term organization is used to make reference to (parts of) enterprises, i.e. profit-making organizations. Hence, decision-making criteria such as the possible innovation's contribution to the organization's long-term success must lead to concepts such as value creation.
To avoid possible confusion, some authors apply the label "*organizational innovation*" to innovation produced by organizations (e.g. Wolfe 1994). As only that type of innovation is studied in this work, the additional label is not deemed necessary, here.

[29] In line with the above discussion, the terms "*organization*", "*enterprise*" and "*company*" are used as synonyms throughout this work. Where business units act sufficiently independently with respect to innovation efforts, they may be actors themselves and are hence aggregated under the aforementioned label.

[30] With the innovating organization as point of reference, the degree of novelty to the innovating organization provides a better measure of management challenge than a measure of degree of global novelty would do – where applicable.

[31] This makes additional sense from a managerial point of view, as the successful diffusion of the definition into corporate practise ought to increase the likelihood that any decision to "*make or copy*" be taken by the same

on the first introduction in the definition deliberately excludes roll-out activities (OECD 2005).[32]

3. Innovation is closely related to innovation processes (Brockhoff 1999; Burr 2004).[33] There are two kinds of innovation processes.[34] The process of *generating* (and thereafter implementing) an innovation is begun with an invention,[35] i.e. with a very creative endeavour, whereas the process of *adopting* an innovation is firstly a decision-making process (Damanpour and Wischnevsky 2006).[36] To avoid confusion between innovation processes and innovations themselves, it is appropriate to understand innovation solely as the technically successful result (output) of innovation processes.[37]

4. If there was just unmanageable *"random innovation"*, a discussion of the phenomenon under observation would be obsolete.[38] Due to its manageability (Drucker 1985), its differ from routine management (van de Ven 1986), and its potential benefits (e.g. Khazanchi, Lewis and Boyer 2007; McGrath and Ming-Hone 1996), a management dedicated to innovation is required.

5. Finally, innovation is not an end in itself, but a means to an exploitation purpose (Schumpeter 1939). As sales volumes, cost savings or other immediate outcome indicators are unknown at the time of concept development and as there are up-front costs such as development costs, the actual economic success of a supposed

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actor who is responsible for the overall innovation management, in particular for innovation generation. That may help to avoid unnecessary re-inventions.

[32] For de-centralized organizations and for organizations covering wide areas roll-out activities can provide a challenge. This necessitates the acknowledgement (and consequential modelling decision) that a distinction exists between overall organizational knowledge and the limited knowledge and bounded rationality of individual actors within those organizations. Nevertheless, assuming that the organization is aware of the first implementation of a certain novelty somewhere in its structure, second and subsequent implementations can be facilitated to such an extent that they pose a much smaller challenge than the first introduction.

[33] Given a minimum complexity, an innovation process is typically organized as a project from a certain maturity stage onwards (Browning and Ramasesh 2007).

[34] The understanding of innovation processes is such that they are either aborted prematurely or finished as soon as the (technically successfully generated or adopted) innovation has been handed over to the routine organization.
Garcia and Calantone (2002) point out the danger of confusing an innovation process with a process innovation. An innovation process is – as was pointed out – a process which is supposed to lead to the adoption and usage or to the generation and exploitation of a novelty, whereas a process innovation is a certain type of novelty, namely one pertaining to "*the efficiency improvement of the production process*" (Garcia and Calantone 2002, p. 112).

[35] As no invention by the organization is required for it to adopt an innovation, the often cited equation *"innovation equals invention plus exploitation"* does not hold, at least not its implicit own-invention meaning. Instead, the exploitation of either a self-developed or a third-party-developed invention suffices.

[36] According to Weber and Schäffer (2006), decision-making processes can be described as four-phase models: In the first phase, an intention is created based on the ability and willingness to anticipate. This is followed by the decision-making act and by a result of that act. The result can in the ultimate phase be measured and compared against the intended result. A feedback loop ensures that the subsequent intention creation phase takes the quality of former decision-making processes into account.

[37] As for example the marketing of a new product innovation will emphasize its novelty "*for a while*", it can be argued that the term innovation is appropriate *"for a while"* from the time on when it was first generated or adopted and until the time it is handed over to the routine organization. In economics, it is very common to regard novelties which were generated or adopted within the previous three years as innovations (e.g. Aschhoff et al. 2009; ZEW 2005; ZEW 2009h). That standard does not reflect varying speeds of technological or organizational developments, though.

[38] Admittedly, efforts on the brink of being innovative or those of a microscopic scope might not be worth to have a conscious management process applied to. All other innovation efforts have to be managed, though.

> innovation can only be judged at the end of its life time. *"The innovation manager works with an expected innovation success, not a realized one"* (Hauschildt 2004, p. 27; translation by the author).[39]

Damanpour and Wischnevsky (2006) identify a fragmentation of innovation definitions into one group based on the generation phenomenon and another based on the adoption phenomenon. To maintain the close relationship between innovations and innovation processes while acknowledging the difference between those two types of processes, innovation is in this work understood to encompass both *an organization's invention of a novelty, combined with its subsequent exploitation and the cognitive and affective initiation of the first introduction of a novelty within an organization and its subsequent implementation*. That definition is the author's synthesis of the definitions of Damanpour and Wischnevsky (2006) and of Williams and Rao (1998), as well as of the above innovation features. The definition covers the novelty feature, the organizational point of reference, as well as the close tie to innovation processes.[40] Manageability is reflected implicitly for generation (in basically all cases, inventions do not occur at random, but due to previous conscious development efforts) and explicitly for adoption (conscious choice). Vice versa, the exploitation purpose is reflected *expressis verbis* in the case of generation,[41] and implicitly (adoption decision-making criteria) in the case of adoption.

Beside the distinction of generated innovations from adopted innovations, another three classical typologies exist (Garcia and Calantone 2002; OECD 2005): A first distinguishes product (respectively service) innovations, i.e. innovations where a novel or improved product (or service) is being offered, from process innovations, i.e. innovations for which the novelty lies in the production (or service provision) processes. Another distinction can be made between organizational respectively administrative innovations and technological innovations. Third, innovations can be distinguished by various degrees of novelty,[42] ranging from incremental to radical.

2.2.2 Innovation Management

Thom (1992) points out that innovation's aimed for novelty affects complexity, uncertainty and risk. He further argues that due to opportunity costs of resource investments, the amount of potential conflict rises with aimed-for novelty and risk. Thus, innovation processes pose particular challenges and frequently require a certain novelty in management processes, as well (cp. van de Ven 1986). That is a core justification why innovation management is worth an independent study: Innovation process management differs from the management of routine decision-making because it requires a large amount of flexibility and is less open to detailed preliminary planning.

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[39] Given the possibility that a an innovation may fail economically, while in the applied terminology an innovation process was necessarily successfully finished that produced the innovation, the term *successful innovation* should be used only to refer to economically successful innovations.

[40] The prominent distinction between the two basic types of innovation processes serves to cover the perceived wide neglect in previous research.

[41] The wide term exploitation allows for other than intra-organizational economic usages such as, e.g. licensing.

[42] If it is not stated otherwise, the degree of novelty as understood in this work refers to a realized degree of novelty for the innovating organization. Other points of reference could for example relate to planned novelty or to the degree of novelty for the market or the world.

Similarly to innovation, numerous definitions of innovation management[43] can be found in the literature. The understanding of innovation management which will be applied in this work can be derived from the innovation definition and its features: As was pointed out before, the *raison d'être* of innovation management is that it deals with specific challenges which stretch beyond routine decision making. Due to the planned degree of novelty and innovation's typical complexity, the processes and projects of generating or adopting innovations are the key challenges associated with innovation (Utterback 1971; Thom 1992). It is thus appropriate to understand innovation management to a large extent as the management of innovation processes in order to produce an innovation, i.e. as management *for* innovation. It was shown by Tatikonda and Montoya-Weiss (2001) that operational success, i.e. successful generation or adoption of an innovation, is a necessary precondition of market success. In line with the exploitation aspect of the innovation definition, this operational success is not an end in itself, but a means towards market success (Tatikonda and Montoya-Weiss 2001). Therefore, innovation management includes the management of existing innovations, as well. Accordingly, innovation management can be understood as management *for* innovation plus management *of* innovation.[44]

As regards research perspectives on innovation management, a procedural point of view – innovation management as the management of innovation processes – on innovation management is the most modern and dominant one (e.g. Hauschildt 2004; Wolfe 1994). However, a number of facets which apparently belong to innovation management are not covered by it, but by a systemic[45] perspective: In that, innovation management incorporates also the management of resource conflicts between innovation processes, and of the aggregate of innovation processes. This includes their linkage to innovation strategy and overall strategy, their organizational anchorage, portfolio aspects such as risk, size and timeline alignment (Bard, Balachandra and Kaufmann 1988; Cooper, Edgett and Kleinschmidt 1999). To be effective from a company-wide, i.e. systemic, perspective the right innovation processes have to be started and managed by the right set of people (cp. Amabile et al. 1996; Damanpour 1991) with the right knowledge (cp. Hull and Coombs 2000; Nonaka and Takeuchi 1995) and right amount of resources (cp. Hipp and Grupp 2005; Parthasarthy and Hammond 2002). Further, the commercialization of innovations must be planned and managed (Chakravorti 2004; Tatikonda and Montoya-Weiss 2001). All these activities are largely influenced by an organization's innovation culture and structure (Burns and Stalker 1961; Lawrence and Lorsch 1967). Accordingly, an organization's innovation management

[43] The term *management* can be used institutionally or functionally. The institutional view refers to organisational responsibilities and to agents of internal power, whereas the functional view recurs to dispositive (as opposed to executive) activities (e.g. Hauschildt 2004). Where it is not otherwise stated, this work applies a functional perspective to innovation management.

[44] In fact, the period for which an innovation exists, is called thus and is subjected to management of innovation is only the short period of early commercialization. Afterwards, the innovation is managed by the standard organization and as a standard product or process.

[45] This perspective is most notably one at the organizational level. For three reasons, it is labelled "systemic" rather than "organizational": First, confusion shall be avoided between organizational innovation, the overall topic of study, and one of its three streams of research (also cp. Chapter 2.2.3). Second, disarray shall be bewared with respect to organizational structure, an important sub-dimension of study (e.g. Cooper and Kleinschmidt 1995; Ernst 2002; Adams, Bessant and Phelps 2006). Third, Wolfe (1994) points out that there is a gap in the related stream of research which consists in the lack of attention towards the interaction between its determinants. The term "systemic" perspective transports the notion of interdependence better than the term "organizational" perspective would do.

system encompasses a number of elements which are all relevant to achieve some kind of innovation success (Adams, Bessant and Phelps 2006). Hence, innovation management is defined as *the management of innovation processes plus the design and development of an organization's innovation system* (Hauschildt 2004; Schaller, Rackensperger and Reichwald 2004).

While the innovation management definition integrates a process-oriented and a systemic perspective, its two components have different units of analysis: One investigates innovation processes, the other innovation systems. Even though this work applies an integrated understanding according to which both components are necessary to cover innovation management in its entirety, only one unit of analysis can be studied at a time.

2.2.3 Streams of Innovation Research

There are four streams of organization-related innovation research: The first two, process-theory research with its intra-organizational focus, and systemic innovativeness research with its organizational focus, correspond to the perspectives on innovation management introduced in the previous chapter. The other two streams are diffusion of innovation research, and network innovation research. The first three are already distinguished by Wolfe (1994), while the fourth stream only emerged in the last fifteen years.[46]

As outlined in Table 2-1, diffusion research, the oldest of the streams, deals with the way an innovation, the unit of analysis, is successively adopted by organizations. Diffusion research aims at the explanation or forecast of rates and patterns of adoption over space and/or time.

Research stream	**Research focus**	**Unit of analysis**
Diffusion of innovation	Diffusion of an innovation over time and/or space	Innovation (extra-organizational focus)
Systemic innovativeness	Determinants of the innovativeness of organizations	Organization (organizational focus)
Process theory • Stage model • Process model	Processes of organizational innovation generation/adoption • Stages organizations go through • Factors explaining the chain of events	Innovation process (intra-organizational focus)
Network innovation • Supply chain innovation • Lateral innovation	Joint innovation generation/adoption mechanism, risk and value sharing mechanisms	Multiple organizations (cross-organizational focus)

Table 2-1: Organizational Innovation Research Streams
(partly adapted from Wolfe, 1994)

Systemic innovativeness research[47] views organizations as units of analyses. It investigates the sources of companies' innovation achievements (e.g. Yeung, Lai and Yee 2007). There

[46] Cp. e.g. Albors, Sweeney and Hidalgo (2005); Bartezzaghi and Ronchi (2005); Bello, Lohtia and Sangtani (2004); Boer et al. (2005); Cagliano et al. (2005); Chapman and Corso (2005); Feller, Hirvensalo and Smeds (2005); Kim (2000); Kulmala, Vahteristo and Uusi-Rauva (2005); Middel, Gieskes and Fisscher (2005); Roy, Sivakumar and Wilkinson (2005), Tatikonda and Rosenthal (2000); Weck (2005); Wouters and Kopczak (2000)
[47] Labelled organizational innovativeness research by Wolfe (1994)

are plenty ways to disaggregate an organization's innovation system into sub-systems. While sub-systems can be studied independent of one another, they are interrelated. Those interrelations pose yet another reason to integrate the dispersed knowledge (cp. Chapter 3).

Process theory research uses innovation processes as units of analyses (e.g. Poskela and Martinsuo 2009). The reasons for their emergence, development, and possibly abandonment are investigated therein. Process theory research makes use of the relative stability within individual innovation process phases and of the relative lack of complexity within an individual phase. Wolfe (1994) further differentiates stage model research and (actual) process model research within process theory research.

Network innovation is a fourth stream of research which developed after Wolfe's (1994) framework was published. Its units of analyses are multiple organizations. Network innovation is classified into supply chain innovation and into lateral innovation. Based on the Mentzer et al. (2001) definition of supply chain management, supply chain innovation is defined as *a systemic and strategic joint generation or adoption of an innovation through at least two organizations in a supply chain relationship for the long term benefit of the individual companies and the supply chain as a whole.*[48] Delineated from supply chain innovation, lateral network innovation can be understood as *a systemic and strategic joint generation or adoption of an innovation through at least two organizations which are not in a supply chain relationship.*

Out of the four innovation research streams, two are particularly relevant for LSPs, namely systemic innovativeness research and process theory research. The reason is that those two streams have an (intra-)organizational focus, whereas diffusion of innovation research has an extra-organizational and supply chain innovation research has a cross-organizational focus (cp. Table 2-1). While diffusion research does not immediately relate to LSPs, the phenomenon of *diffusion* through a population must always be accompanied by a phenomenon of *adoption* by members of that population. The adoptive behaviour of LSPs belongs to process theory research, however. Similarly, relatively much research on supply-chain innovation involving LSPs may exist due to LSPs' pronounced positions in supply chains. However, the research questions of network innovation research are not industry-specific, while those of LSP-related systemic innovativeness research and of process research are.

2.3 LSPs' Innovation Management Context

A large fraction of the innovation management literature covers supposedly universal innovation management, while most often implicitly focusing on New Product Development (Adams, Bessant and Phelps 2006; Damanpour 1991; Ernst 2002; Wolfe 1994). A more specific stream of literature deals with service innovation and New Service Development (cp. Johne and Storey 1998). A recent comparison between New Product Development and New

[48] Supply chain innovation can possibly be regarded as a special case of supply chain collaboration (e.g. Min et al. 2005; Simatupang and Sridharan 2002; Simatupang and Sridharan 2005a; Simatupang and Sridharan 2005b; Stank, Keller and Daugherty 2001), but it certainly goes beyond (lead) customer integration (e.g. von Hippel 1986; Ernst 2002) respectively beyond supplier involvement (e.g. Mikkola and Skjoett-Larsen 2003; Wagner and Högl 2006) in its strategic character and its cross-company linkage at the organizational level.

Service Development found *"compelling evidence that* [those two streams of research] *may be considered to have the same underlying dimensions of innovation"* (Nijssen et al. 2006, p. 247). That is a hint towards universality of innovation management. However, empirical research shows that basic effects can significantly differ between the fields New Product Development and New Service Development (Nijssen et al. 2006).

With respect to LSPs, Flint et al. (2005) point out that general innovation management literature tends to be focused on product innovation, and within that field, on the development of technical (i.e. R&D-related) products. Accordingly, they doubt its applicability to LSPs. Some authors generally demand industry-specific analyses: Nijssen et al. (2006) belong to that group, and Flint et al. (2005) argue that the adoption of models from other contexts might not deliver the best results. Other scholars went so far as to doubt the transferability of findings from one type of organization to another (Wolfe 1994) or at least to demand cross-industry comparisons (Damanpour 1991; Evan and Black 1967). Zeithaml, Parasuraman and Berry (1985) belong to the latter. With respect to their research domain, marketing, they state that *"important differences exist among service firms, not just between service firms and goods firms. The existing literature is dominated by discussions of the differences between goods marketing and services marketing. Much less has been written about the differences among service firms"* (Zeithaml, Parasuraman and Berry 1985, p. 43).

The above reasoning brings up the question of LSP specificity. Noteworthiness of LSPs' innovation management does not require a unique context: Characteristic values of context factors for LSPs can already lead to characteristic innovation management systems and processes (Weber 1996). Therefore, LSPs' typical service provision environment, typical logistics service features, and LSPs' own features are to be investigated, as expressed in research question 1. No comprehensive set of typical context features for LSPs has been described, yet (cp. Chapter 2.1), so that the remainder of this chapter will aim at identifying facets pertaining to either of those dimensions and at linking them. The central limitation of the argumentation is that it relies heavily on conceptual considerations. The picture presented below will therefore be reviewed in later chapters, based on empirical data.[49]

2.3.1 Typical LSP Environment

Of paramount importance for LSPs' typical environment is the phenomenon of logistics outsourcing (Bolumole 2001; Bolumole, Frankel and Naslund 2007; Boyson et al. 1999; Knemeyer, Corsi and Murphy 2003) which is mirrored by a trend of LSPs' customers to focus themselves on their core competencies (Andersson and Norrman 2002; Sheffi 1990). As an advantage to their innovation-related endeavours, LSPs gain a boundary-spanning role and particular closeness to their customers from outsourcing. At the same time, it endangers LSPs

[49] The discussion of LSP specificity could theoretically be lead at a more abstract epistemological level, namely how good an object of study LSPs are. It could then be argued that for them to be a suitable object of study there should be less variance within LSPs than between LSPs and other organizations. The answer to that question – which is beyond the scope of the research problem at hand – could not affect the validity of findings from this work negatively: Even if there was another industry characterized by a context identical to that of LSPs, additional applicability of the findings elsewhere would not cause any harm. On the other hand, while differences between types of LSPs may exist, the LSP context depiction that follows does not differentiate by them, but concentrates on commonalities of LSPs. Therefore, more detailed analyses might deliver further specifications, but not falsifications.

to accept roles as vicarious agents of their outsourcing customers (Sauvage 2003; van Hoek 2000) and to focus on their existing customer base.[50] Within outsourcing relationships, contract designs currently fixate compensation per activities, as well as service levels (Andersson and Norrman 2002; Selviaridis and Spring 2007). This setting endangers LSPs to be content with their status quo, if they are not aware of the positive effects of proactive innovations (Deepen et al. 2008; Wallenburg 2004; Wallenburg 2009).

A trend toward the offering of industry-specific services was observed (Langley et al. 2005; Lieb 2005) that strengthens individual customers' importance. It should thus be relatively easy for LSPs to generate ideas with respect to specific customer wishes or needs and with respect to supply chain processes (Flint et al. 2005, Flint, Larsson and Gammelgaard 2008). Yet, abstraction from individual customers' wishes is likely relatively difficult to achieve, and dependence on customers can evolve. Another source of customer importance respectively dependence is asset specificity (Bowersox 1990; Persson and Virum 2001). It appears likely, but is not yet empirically supported, that for LSPs with their strong focus on 3PL relationships, asset specificity is higher than for other organizations.

Globalization (Hertz and Alfredsson 2003; Sheffi 1990) and consequential consolidation (Andersson and Norrman 2002) force LSPs to grow and make their environment more competitive. Globalization is likely facilitated by deregulation (Berglund et al. 1999; Sheffi 1990) which allows new competitors to enter logistics markets. Increased competition in turn will produce pressure to be innovative (Berglund et al. 1999; Sheffi 1990), in particular in a setting of time-compression (Kimura 2005; Oster Jr. and Strong 2000; Sauvage 2003). LSPs' own globalization can be partially attributed to their customers', because piggybacking[51] (Stone 2001) is a relatively easy path towards growth and because LSPs need to be spatially close to their customers: *"Although size and geographic coverage are important, so is the consistency of location expertise and global service"* (Langley et al. 2006, p. 16).

Importance of technology to LSPs has been emphasized as an important feature of LSPs' environment (Berglund et al. 1999; Lewis and Talalayevsky 2000; Sauvage 2003). However, no empirical data on the direction of its influence on LSPs' service features, on LSPs' features or on their innovation management has been presented, yet.[52]

2.3.2 Typical Features of Logistical Services

The literature on 3PL relationships contains a stream on outsourced functions (Maloni and Carter 2006; Selviaridis and Spring 2007) which provides a good proxy of LSPs' services.[53]

[50] In related research, LSPs' potential benefits from spot business appear to be neglected, as well, as the close association of LSPs with *only* 3PL relationships highlights (Maloni and Carter 2006; Marasco 2008; Selviaridis and Spring 2007), exemplified by the fact that more than 75% of 3PL research focuses only on the buyer of 3PL services (Maloni and Carter 2006).

[51] The term refers to an expansion path into foreign markets which follows a client's expansion path (Selviaridis and Spring 2007; Stone 2001).

[52] The adoption of technology through LSPs will be investigated in Chapter 3.2.3.2.

[53] However, LSPs also offer services outside of 3PL relationships, i.e. in the spot market. It appears plausible that those are relatively simpler transportation or warehousing services, as they ought to have lower transaction costs than more complex services respectively service bundles (Williamson 1985). If that is true, then surveys on LSPs services from 3PL contexts will overestimate average service complexity to some extent. As there is a lack

That research stream contains mostly surveys which enumerate various transportation- and warehousing-related services (e.g. Langley et al. 2006; Langley et al. 2008), as well as CEOs' assessments of their organizations future strategic developments (Lieb and Bentz 2005; Lieb and Kendrick 2003). No work contains a list of typical service features. There are, however, various classification schemes of services in the more general literature which can be applied conceptually (Chase 1978; Hill 1977; Judd 1964; Lovelock 1983; Thomas 1978). Neglecting non-logistical services – which for LSPs are merely additional services added to their core of transportation- and warehousing-related services (Lieb and Bentz 2005; Lieb and Kendrick 2003; Lieb and Randall 1999) – LSPs' services can be equalled to logistical services. Those will also be assessed against essential characteristics of all services (Zeithaml, Parasuraman and Berry 1985).

Zeithaml, Parasuraman and Berry (1985) identified four essential characteristics of services. These are intangibility, inseparability of production and consumption, heterogeneity and perishability. Intangibility relates to the character of performances which services have. It affects the way services are sensually experienced. Simultaneity of production and consumption occurs because unlike for goods, production does not precede consumption. Heterogeneity relates to the content and quality of services. Last, perishability reflects the inability to store services. The characteristics can be used as service property dimensions (cp. Thomas 1978) to outline specifics of logistics services as compared to other services.

As regards intangibility, Lovelock (1983) uses freight transportation as an example of a service with "*tangible action*" (p. 12), unlike, e.g. a visit to a museum. Logistical services are owned-good services (Judd 1964), respectively *"services affecting goods"* (Hill 1977, p. 319), i.e. services that improve an already existing good, in this case by transporting it to its destination, by keeping it safe through storing it, by improving its composition by commissioning it etc. Thus, while the act of service provision (cp. Lovelock 1983) for logistics services is intangible, their outcome is very tangible, because it manifests itself in the transported, stored or commissioned goods. In that respect logistical services differ from many other services which are provided to the customer and which let the customer participate in the act of service provision as an external factor (Hill 1977; Lovelock 1983): Logistics services are non-personal services. They also do not belong to the so-called professional services, e.g. legal services, which require very specialized knowledge the customer does not possess (Thomas 1978).

Due to the inseparability of production and consumption, strategies to match supply and demand are particularly important (Chase 1978; Lovelock 1983). Services' production emergence schemes are classified into equipment-based and people-based ones (Thomas 1978). As for the production of logistical services a comparatively large amount of equipment respectively capital is needed (Bachmann 2008; Meyer and Lukassen 2007; Stapleton and Hanna 2002; Wagner 2008), their service production can be classified as equipment-based. However, logistics services include a high share of standardized and easy execution tasks (Langley et al. 2006), so that they are further classified as equipment-based services with relatively unskilled operators (cp. Thomas 1978). With respect to service production,

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of data to compare LSPs' (spot) market business to their (hybrid) relationship-based business, the above reasoning cannot be assessed empirically.

Lovelock (1983) broaches the issue of the place which it occurs in. LSPs typically produce their services on many sites close to or at their customers: "*Logistics services are performed in the interface between shippers and customers, meaning that many sites are involved*" (Andersson and Norrman 2002, p. 7). This results in the mentioned boundary-spanning role of logistics (Mentzer, Min and Bobbitt 2004; Morash, Dröge and Vickery 1997). Consumption is firstly characterized by the aforementioned fact that logistical services are provided to the customer's goods. Despite the boundary-spanning role and despite LSPs' general closeness to their customers (e.g. Selviaridis and Spring 2007), the actual service production and consumption can hence occur without the need for special customer interaction skills of LSPs' workforce which would be needed for services affecting people (Chase 1978; Lovelock 1983). A relatively high operational certainty and relatively better capacity planning result from this form of (non-) interaction (Chase 1978), and for logistical services, effectiveness and efficiency are key criteria to judge the quality of operations (Chase 1978).

As services are consumed while they are produced, their qualities vary, i.e. they are heterogeneous (Zeithaml, Parasuraman and Berry 1985). Adding the fact that a service can only be produced after the customer's decision to purchase it, that varying quality cannot be anticipated by the customer (Lovelock 1983). Lovelock (1983) points out that "*customers may be uneasy concerning the prior lack of certainty about the outcome*" (p. 16). If a failure occurs in the production process of a service, then that error often cannot be corrected, at least not within that same service provision act. As a consequence, the customer has to trust the service provider's ability to deliver an adequate quality of service. This ought to be more important where the individual service entity is very valuable to the customer and where the customer does not purchase a repeating series of service provisions. Professional services such as legal advice are good examples. Logistics service packages are typically, e.g. in outsourcing relationships, comprised of numerous quasi-atomic elements, i.e. individual acts of transportation, storage etc. For most of them, the quality of individual service provisions is of lower importance. In fact, if there are relatively large numbers of service provisions, the law of large numbers applies, so that the *average* service level can be planned relatively exactly.[54] Hence, logistics services have a more standardized character which in turn explains the high share of simple and standardized execution tasks (Langley et al. 2006).

The last of the service characteristics distinguished by Zeithaml, Parasuraman and Berry (1985) is perishability. With respect to logistical services, perishability appears to be less important than elsewhere, again because the service provision manifests itself in the goods it is provided to. In fact, not letting the goods perish is a central aim of logistical services. Without further intervention, the effect of logistical services remains, so that they can be classified as permanent services (Hill 1977), albeit as reversible services (Hill 1977). Immediate consequences of the latter two features are not visible.

2.3.3 Typical Features of LSPs

The previously discussed environment and LSPs' service characteristics materialize in four features that are typical for them (also cp. Figure 2-1 on page 21). By that, reference shall be

[54] A recent example of service agreements can be found in Caggiano et al. (2007).

made to innovation management contingency factors of the industry's average. Obviously, individual LSPs can deviate at specific points.

LSPs are typically characterized by de-centralized structures (Andersson and Norrman 2002; Carbone and Stone 2005; Lieb and Randall 1996; Sauvage 2003). Not only are transportation, warehousing and handling activities often provided de-centrally and distributed across relatively many sites, but LSPs also rely on de-centralized decision making. Therefore, a fraction of operative responsibility is often handed over to de-central units which are controlled by a profit centre structure. De-centralization can be explained by the need for geographic coverage and location expertise, as well as by the interface position of logistical services which are often provided on behalf of the LSPs' customers, possibly even at their customers' customers. Thus, de-centralization is likely affiliated with relatively high proximity to individual customers.

A focus on certain customer industries (Langley et al. 2005; Lieb 2005), close interlocking with the main business processes of LSPs' customers (Andersson and Norrman 2002; Selviaridis and Spring 2007) and LSPs' subcontractor role in outsourcing (Langley et al. 2006) also generate the same effect, that in the logistics industry, individual customers are particularly important (Carbone and Stone 2005; Flint et al. 2005; Flint, Larsson and Gammelgaard 2008; Sauvage 2003). Straube et al. (2005) found out that 70% of all LSPs make individualized offers to their customers and only 30% make standardized offers. Such a situation is likely to lead to dependency of the LSPs on their customers (Arbaugh and Sexton 1997; Hewitt-Dundas and Roper 1999).

Various features of logistical services cause relatively low skill requirements of LSPs' operative workforce which actual qualification levels are likely to follow (Ellinger, Ellinger and Keller 2002; Evangelista and Sweeney 2006; Lai, Ngai and Cheng 2005; Lin 2006). Those features are the large share of simple execution activities respectively the services' standardized character, the non-professional and non-personal nature, as well as logistics services' relatively high tangibility (cp. Chapter 2.3.2).

Not only anecdotal evidence, but also the extant literature suggests that the staff and company cultures of logistics organizations in general (Esper, Fugate and Davis-Sramek 2007) and of LSPs, in specific (Sauvage 2003; Straube et al. 2005; Wagner 2008) are relatively "*down-to-earth*" and reactive. Wagner (2007) speaks of a *"dominance of the operational focus"* (p. 583; translation by the author). Similarly, according to Straube et al. (2005), LSPs are characterized by *"short term reasoning"* (p. 23; translation by the author). That feature can be explained by the non-professional and non-personal character of logistics services, by the high share of standardized and easy execution tasks, and by the danger of merely reacting to explicated customer wishes that outsourcing poses (Sauvage 2003; van Hoek 2000).

The typical features were also challenged and confirmed by a group discussion conducted with 13 logistics researchers.[55] Afterwards, they were confirmed again by seven experts with

[55] Those were two professors of logistics management, one assistant professor of logistics management and ten Ph.D. students of logistics management.

operational experience in the management of LSPs.[56] Later chapters will present further empirical data (cp. Chapters 4.2 and 5.2).

2.3.4 Assessment with Respect to Research Question 1

LSPs' innovation management background is first that of a service organization. That background leads to a higher level of abstraction, to decreased predictability and decreased openness to tests, as well as to lower openness to legal protection (Bruhn 2006; Zeithaml, Parasuraman and Berry 1985). Beside missing or additional context factors for services, effects that are known from goods innovation contexts can work differently within the field of services (Nijssen et al. 2006). For example, customer closeness is traditionally associated with "listening to what the market wants". That notion may stem from a goods context, though, were it is very easy to avoid parallel developments and where a product is likely to find multiple users. For LSPs, there is likely also a downside effect which is amplified by the fact that their organizations are often de-centralized, so that central awareness of what is going on, i.e. what is being developed, is more difficult to establish and so that abstraction from individual customers' wishes is difficult to achieve. Accordingly, the service background alone makes it impossible to utilise large areas of innovation research related to goods (Hill 1977; Johne and Storey 1998; Thomas 1978). Besides, the identified speciality of the context (cp. Chapters 2.3.1, 2.3.2 and 2.3.3) is likely to pose an influential special background on LSPs' innovation management respectively their innovations, even with respect to innovation management within service contexts. This shall be discussed in the remainder of this chapter. It serves as an ex-ante deliberation that will later be explored further with empirical data (cp. Chapters 4.2 and 5.2) and be tested inference-statistically (cp. Chapter 6.2.1). An overview of the reasoning is depicted in Figure 2-1.

[56] The experts mostly belonged to the second hierarchical level of a LSPs' headquarter respectively its Germany-wide organization. In functional terms, responsibilities covered product development, product management, corporate development, key account management and operations.

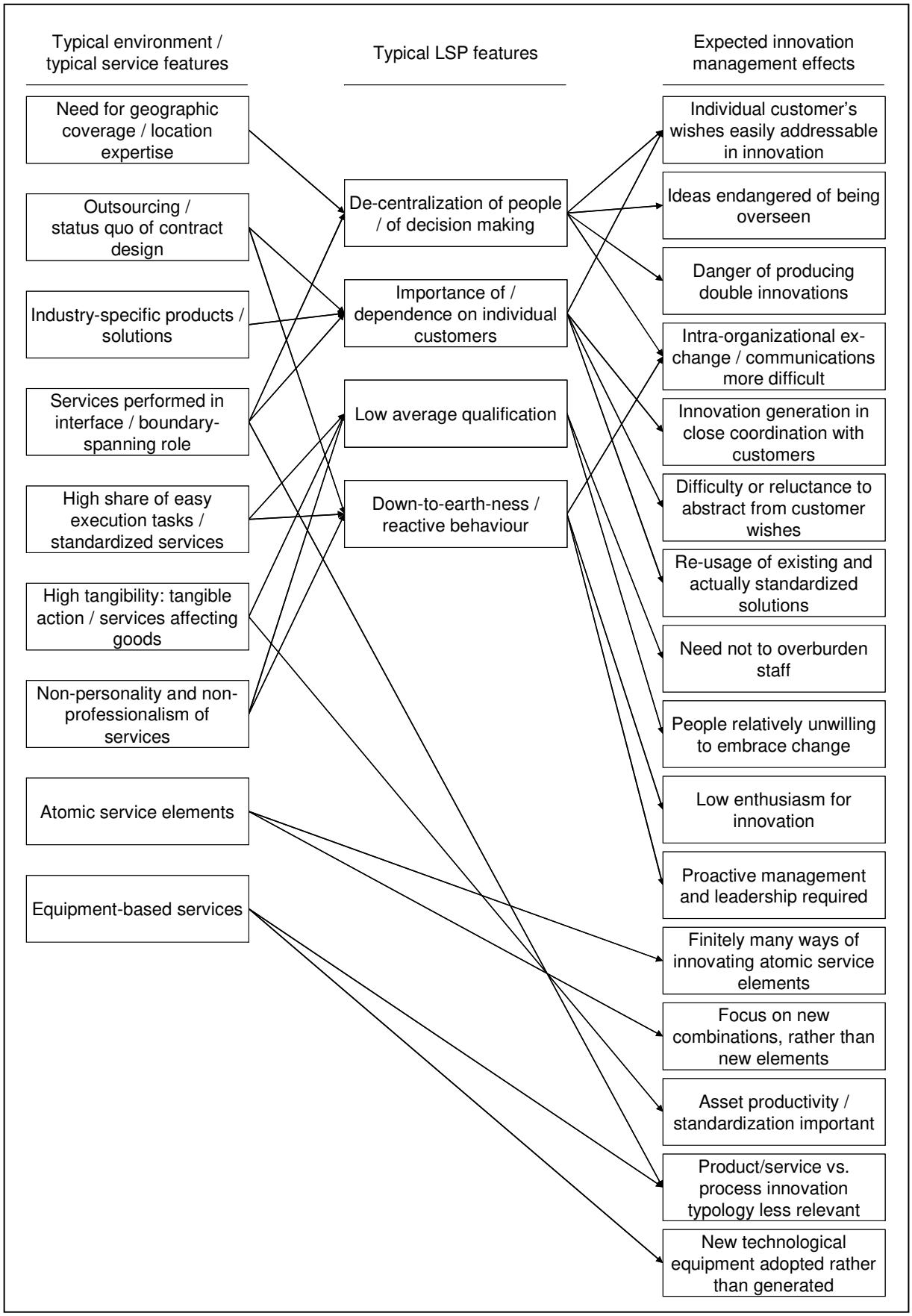

Figure 2-1: LSPs' Innovation Management Context

Each of the four typical features could already be linked to environmental trends, as well as to typical service features. The following innovation management influences can be expected:

- De-centralization of an organization is likely to allow LSPs customer proximity, so that for LSPs, it should be relatively easy to identify individual customer's wishes and needs and to address them through their innovations. De-centralization likely also incorporates a higher danger that innovative ideas generated by the staff are not noticed by a central unit with innovation management responsibility than in a centralized organization. On the other hand, in a de-centralized structure within a service context, the same innovation could – unperceived by central management – be generated multiple times. In addition, combined with down-to-earth-ness, de-centralization can pose communication barriers for generation or roll-out of innovations.
- High importance of individual customers makes it a near necessity to undertake innovation generation in close coordination with customers. Important individual customers can also be used as sources of creative ideas (Brockhoff 2003; Ernst 2001; Ernst 2005; Gruner 1997; Herstatt and Lüthje 2005). Adding LSPs' integration into their customer's business processes and the likelihood of knowing even the customer's customers well (Andersson and Norrman 2002), LSPs should be able to generate plenty novel ideas concerning innovations for their existing customers. At the same time, it poses dangers that LSPs have difficulty to abstract from immediate customer wishes or are reluctant to do so, due to (perceived) dependence on their existing customer base. Differentiation potential can arise from the re-usage of existing and actually standardized solutions as supposedly customer-specific novelties.
- On average low qualification of LSPs' staff results in a need not to overburden staff in innovation processes. For example, the roll-out of a highly complicated innovation management instrument throughout a LSPs' organization would not be adequate to the context. A LSPs' workforce can not only participate in innovation projects, but also be affected by them. It is likely, that a relatively low educational level affects people's willingness to embrace change negatively.
- Down-to-earth-ness explains why most LSPs do not inherit a tradition of innovation and why proactive innovation management and leadership are relevant to the industry irrespective of its peculiarities. Down-to-earth-ness is likely to affect enthusiasm for innovation negatively, so that it poses a cultural challenge for and a leadership challenge in innovation processes. Suitable incentives and formal procedures are thus likely more important for LSPs than for other companies. Down-to-earth-ness can also be expressed in terms of risk aversion.

LSPs' service features can also be expected to have a direct influence on LSPs' innovations and on their innovation management:

- Logistical services are comprised of quasi-atomic elements, i.e. individual acts of transportation, storage, handling etc. Adding constraints such as effectiveness and efficiency (cp. Chapter 2.3.2), there are finitely many ways of innovating them. Thus, LSPs' innovation management can be expected to (have to) focus on ways of

combining those atomic elements, rather than re-inventing them. Typical examples would be new process workflows or new networks designs.

- Logistical services are equipment-based services, so that asset productivity is a relatively more important aim for LSPs than for providers of people-based services. As a consequence, standardization of service bundles can be expected to grant relatively high yields, so that it should be an important aim. Besides, relatively incremental innovations directed at higher operational capacity utilizations, can be expected to have relatively high impacts. The importance of asset productivity together with the difficulty to innovate atomic service element let a bias of LSPs' innovations towards process innovations appear likely. High impacts of incremental innovations within set-up systems together with the need to innovate whole logistical systems rather than individual service elements suggest that LSPs' innovations could be relatively biased against average degrees of novelty to the firm.
- Because logistical services are services affecting goods, the outcome of service provision is much more important than the act of service provision. Therefore, the distinction between product/service innovation and process innovation is less relevant from the customers' perspective. In addition, for LSPs with their central supply chain positions, confusion can arise from differing perspectives between customers and suppliers. If, for example, innovative equipment such as a new handling device is produced by a mechanical engineering company, then from that company's point of view this device is to be regarded a product innovation. When used it can lead to process innovations at the LSP, for example to save warehousing costs. Opposed to that, product innovations by the LSP can be based on prior process innovations and can also lead to improved processes at the LSPs' customers. Hence, the classification of product and process innovations depends on the usage context and on the relative positioning in the supply chain. Apparently, for service providers the distinction is more difficult to establish, but less necessary than for goods producers.
- As service providers, LSPs are unlikely to generate radically new technologies such as barcode, RFID, EDI, CPFR, VMI, JIT, JIS etc. if they focus on their core competency, the provision of logistical services. Thus, (radically) new technological innovation by LSPs will be achieved through *adoption* rather than through *generation*.[57]

The above reasoning served to answer research question 1. While it cannot be judged from this analysis if LSPs' innovation context is unique, it can certainly be proposed that it is specific in numerous features. This fact further justifies independent studies focusing on LSPs' innovation management, such as the remainder of this work.

[57] This reasoning applies to all service providers, not only to LSPs. It is emphasized nevertheless, as it highlights the often neglected need to differentiate between the study of LSP innovations and logistical innovations.

3 Literature Review of LSPs' Innovation Management

It was concluded in Chapter 2.3 that LSPs' environments, their services and their own typical features pose a sufficiently special research context to justify LSP-specific innovation management studies. Therefore, it is appropriate to formulate research question 2: "*What is the state of knowledge on LSPs' innovation management? Can it be explained from that why LSPs are not particularly innovative? If so: How?"* Research question 2 is targeted through means of a literature review. It incorporates all findings on LSPs' innovation management activities, instruments, actors, antecedents and consequences. Expecting that LSP specificity influences the state of LSPs' innovation management (cp. Chapter 2.3.4), this text[58] focuses only on LSP-related findings from previous works. Thus, even if there are gaps in the LSP-specific literature (as is nearly certain), they will not be closed with the general literature, because it is possible that LSPs' context could alter the related content from what it is generally like. It is also probable that some findings from LSP-related investigations are not specific, at all. Those will also be reported, because the lack of a context effect is in itself noteworthy. The central aim is hence to present a summary of all findings on LSPs' innovation management. Another purpose of this text which is not directly related to the research-motivating question is to derive an agenda for future research.

In the next section, the review methodology is delineated. The subsequent results section is organized according to the applied categorization framework. It also includes suggestions for future research. A conclusion is drawn in the end.

3.1 Methodology

The methodology chapter contains two parts: In the first, sampling is described. The second explains the framework used for the categorization of the data.

3.1.1 Sampling

To ensure traceability and quality, this review focuses on publications written in the English language and published in academic journals. Due to the "*transformation of the TPL industry during the last years*" (Marasco 2008, p. 134), a focus on current research results was appropriate. Therefore, only literature published from 1999 onwards was investigated. The database EBSCO was used for the identification of articles.

Three groups of journals were distinguished: first renowned logistics journals, second leading technology and innovation management journals, and third other journals. The allocation of a journal to either of the first two groups was based on established journal rankings. As those tend to differ to some extent, multiple rankings were consulted to avoid missing an important

[58] The text was used in the article Busse and Wallenburg (2010a) which is to be revised and resubmitted to *International Journal of Physical Distribution & Logistics Management*.

journal (ERIM 2009; Gibson, Hanna and Menachof 2004; Linton and Embrechts 2007; Linton and Thongpapanl 2004; VHB 2005; VHB 2008; Zsidisin et al. 2007).[59] For each group of journals, potentially relevant articles were identified by means of a broad keyword search. Journal groups and initial search terms are depicted in Table 3-1.[60] The wide search resulted in more than five hundred publications as a starting point. Top logistics journals were the dominant group. A handful of articles were added to the preliminary sample by means of cross-checking referenced literature.[61]

	Leading logistics journals	**Leading Technology and Innovation Management journals**	**Other journals**
Journals	*International Journal of Logistics Management, International Journal of Physical Distribution & Logistics Management, Journal of Business Logistics, Journal of Supply Chain Management, Supply Chain Management: An International Journal, Transportation Research: Part E* and *Transportation Journal*	*IEEE Transactions on Engineering Management, International Journal of Technology Management, Journal of Business Venturing, Journal of Engineering & Technology Management, Journal of Product Innovation Management, R&D Management, Research Policy, Research Technology Management, Technology Analysis & Strategic Management* and *Technovation*	Any
Search terms	*"Innovation", "Improvement", "Change", "Development", "NPD" or "NSD" in Title, Abstract or Keywords*	*"Logistics", "Supply Chain Management", "Transport", "Warehouse", "SCM", "LSP", "3PL", "TPL", "LLP", "4PL", "Carrier", "Forwarder", "Courier", "Express", "Parcel", "CEP" or "Freight" in Title, Abstract or Keywords*	*"Logistics", "LSP" or "3PL"* in Title, Abstract or Keywords and *"Innovation"* in Title, Abstract or Keywords

Table 3-1: Initial Paper Identification

The next step was to narrow the long list down to relevant papers. The first criterion was whether innovation-related content was incorporated in the paper. To safeguard completeness, papers which only broached the topic were integrated rather than not. Specifically, organizational learning papers (e.g. Panayides and So 2005), and continuous improvement papers (e.g. Hyland, Soosay and Sloan 2003) were incorporated. The second criterion was if

[59] Any erroneous overestimation of a journal's meaningfulness could not have negative effects.

[60] The search was deliberately wide in the first step to ensure that most relevant papers would be incorporated. It could be assumed that any article from a leading logistics journal would be related to logistics. Within that field, LSP-related research is not necessarily labelled as such (cp. Chapter 2.1), so that narrowing down had to occur manually, rather than directly through the search terms. Thus, only innovation-related and neighbouring search terms were used for that category. As regards the second category, it was assumed that any article from a leading technology and innovation management journal was about an innovation-related phenomenon. LSP-related references had to be added in that category. As before, those were deliberately chosen to be broad. For the third category, narrower search terms were used, as that category contained those journals which do not specialize on either of the two related disciplines.

[61] This proceeding was motivated primarily by the possibility that works which fit the search terms might erroneously not have been incorporated in the data base EBSCO. A secondary motivation was the possibility that works had titles, abstracts and keywords which did not match the keywords, although they were relevant to this literature review. At the outset of the search, all references quoted by the relatively recent literature review of Selviaridis and Spring (2007), as well as all the references quoting the relatively old literature review of Johne and Storey (1998) were investigated. Over the course of the search, all notes from works that were found relevant were also assessed for relevance to this review. The search was ended when no new papers could be added, any more.

LSPs had been investigated. Therefore, first of all works which were labelled to be about LSPs, their customer relationships or some sub-group of those were incorporated into the review. Articles referring to logistics departments of logistics organizations (cp. Johannessen and Solem 2002) were only included when having a strong emphasis on their acting like independent firms (e.g., most works of *Soosay* were incorporated).[62]

The subsequent proceeding was to first check each title and exclude apparently irrelevant papers, next to examine the abstracts and again exclude the irrelevant ones and, finally, to read all papers and again exclude the irrelevant ones. At each step, where any doubt remained, papers were included to safeguard against the potential of excluding relevant papers. In total, 30 papers were included in the following review of which 18 focus on the innovation management of LSPs and a further twelve at least broach the topic (cp. Table A-1 to Table A-5 on pages 163 to 167 for an overview of reviewed papers).[63]

3.1.2 Categorization

The analysis of innovation-related research streams in Chapter 2.2.3 made it clear that both systemic innovativeness and process-theory research are important for innovation management at LSPs, so that the categorization should encompass both views. As no integrated concept of innovation management exists, two well-established categorizations were combined.

To structure all relevant elements of innovation management systems, Adams, Bessant and Phelps (2006) developed a systemic framework that stems from an in-depth categorization of innovation management research topics. It is comprised of seven categories: inputs management, knowledge management, innovation strategy, work environment[64], portfolio management, project management and commercialization. For each of the categories, two to four sub-categories exist (cp. Figure 3-1). The framework integrates the prior structures of Burgelman, Christensen and Wheelwright (2004), Chiesa, Coughian and Voss (1996), Cooper and Kleinschmidt (1995), Cormican and O´Sullivan (2004), Goffin and Pfeiffer (1999) and Verhaeghe and Kfir (2002), so that it covers all relevant aspects of previous systemic innovation management research. The framework's elements were assessed to be mutually exclusive[65] and collectively exhaustive[66] so that the Adams, Bessant and Phelps (2006) framework was used as a first categorization dimension.

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[62] A smooth transition exists between logistics departments and LSPs, as the example of a legally independent LSP with a single customer, its former mother organization and current single owner, highlights anecdotally. Therefore, a conflict of targets existed between an easily delineated, but narrow focus on the one hand and a focus that was more difficult to delineate, but wider on the other hand. Due to the smooth transition, no approach is objectively better than the other. In this particular case of a relatively novel research stream, it was decided to include the works on sufficiently independently acting logistics departments, as Flint et al. (2005) did, as well.

[63] Where it is deemed helpful, the review also refers to works which are clearly not innovation-related, as long as their findings are LSP-related.

[64] Labelled „*organization and culture*" by Adams, Bessant and Phelps (2006)

[65] This is highlighted by means of pairwise comparisons of the most critical appearing sub-categories: The inputs sub-categories "*people*" and "*physical and financial resources*" are far apart, so that no data can be allocated to both. However, as human resources also cause costs, any cost data must be assigned carefully. The inputs management sub-category "*tools*" appears similar to the project management sub-category "*instruments*". Inputs management tools cover "*tools and techniques for promoting creativity*", as well as "*systems of quality control*" (Adams, Bessant and Phelps 2006, p. 28), whereas project management "*instruments*" refer to "*methodologies*

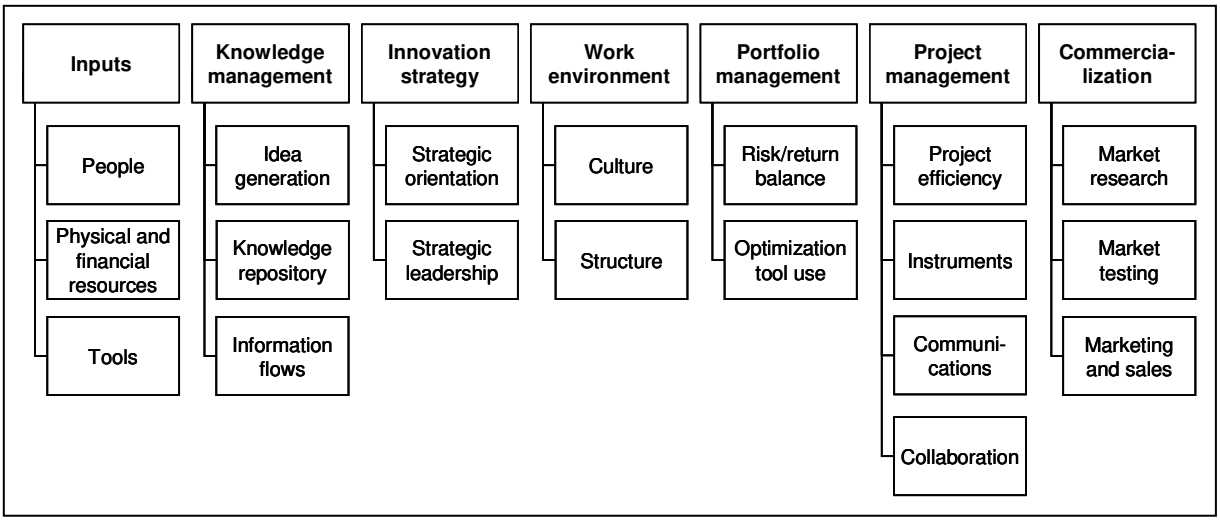

Figure 3-1: Systemic Innovation Management Framework
(adapted from Adams, Bessant and Phelps (2006), p. 26)

Regarding innovation processes, many different phase categorizations exist. Damanpour and Wischnevsky (2006) point out that innovation generation can analytically be separated from innovation adoption. Generation is characterized as a creative process, whereas adoption is seen as a problem-solving process. Damanpour and Schneider (2006) distinguish "*three widely recognized phases of innovation adoption – initiation, adoption decision and implementation*" (p. 216). Concerning innovation generation, the standard distinction differentiates development activities and realization/commercialization activities. Occasionally, the intellectually demanding Fuzzy Front End, i.e. "*all time and activity spent on an idea prior to the first official group meeting to discuss it*" (Reid and de Brentani 2004), is further separated from other development activities and regarded as an individual phase (e.g. Damanpour and Wischnevsky 2006; Stevens, Burley and Divine 1999). However, previous research on LSPs' innovation management has not truly distinguished individual phases of adoption or generation processes. The few works make it not necessary to apply the above distinctions within the categorization, so that only a distinction between types of process research, i.e. adoption versus generation, will be used.

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for innovation project management" (p. 36). Those clearly differ. Next, the knowledge management sub-category "*information flows*" appears similar to the project management sub-category "*communications*". Those are separated by their purpose and their points of occurrence outside respectively within an innovation project: "*[I]nformation flows into and within the firm are important in sparking ideas and in allowing the development of innovative concepts*" (p. 30), while project-internal "*communication facilitates the dispersion of ideas within an organization, increases the diversity and also contributes to the team 'climate'*" (p. 36). The project management sub-category "*communications*" also refers to external communications. Last, the commercialization sub-category "*marketing and sales"* might be defined so that it includes the other elements "*market research*" and "*market testing*". As Adams, Bessant and Phelps (2006) do not elaborate on this aspect, "*marketing and sales*" is understood as a residual sub-category of all commercialization activities except "*market research*" and "*market testing*". Hence, the frameworks' sub-categories appear sufficiently exclusive to allow for applying it.

[66] Exhaustiveness follows right from the literature review process which Adams, Bessant and Phelps (2006) used. Any theoretically missing elements would necessarily also be amiss throughout all of the innovation management literature at the firm level which Adams, Bessant and Phelps (2006) reviewed. However, Adams, Bessant and Phelps (2006) aimed at structuring the measurement of innovation management activities. Therefore, any (supposed) antecedents and consequences are allocated to those activities, instead of into different categories. As this work also primarily treats innovation management activities, that structure fits well.

3.2 Results

In this section, a macroscopic assessment is given at the outset. Thereafter, the categorized integrated body of knowledge is resented. Finally, suggestions for future research are proposed.

3.2.1 Macroscopic Assessment

In line with the newly increased importance of innovation management for LSPs (cp. Chapter 1.1), growth in publication numbers was obvious[67] (compare Figure 3-2).

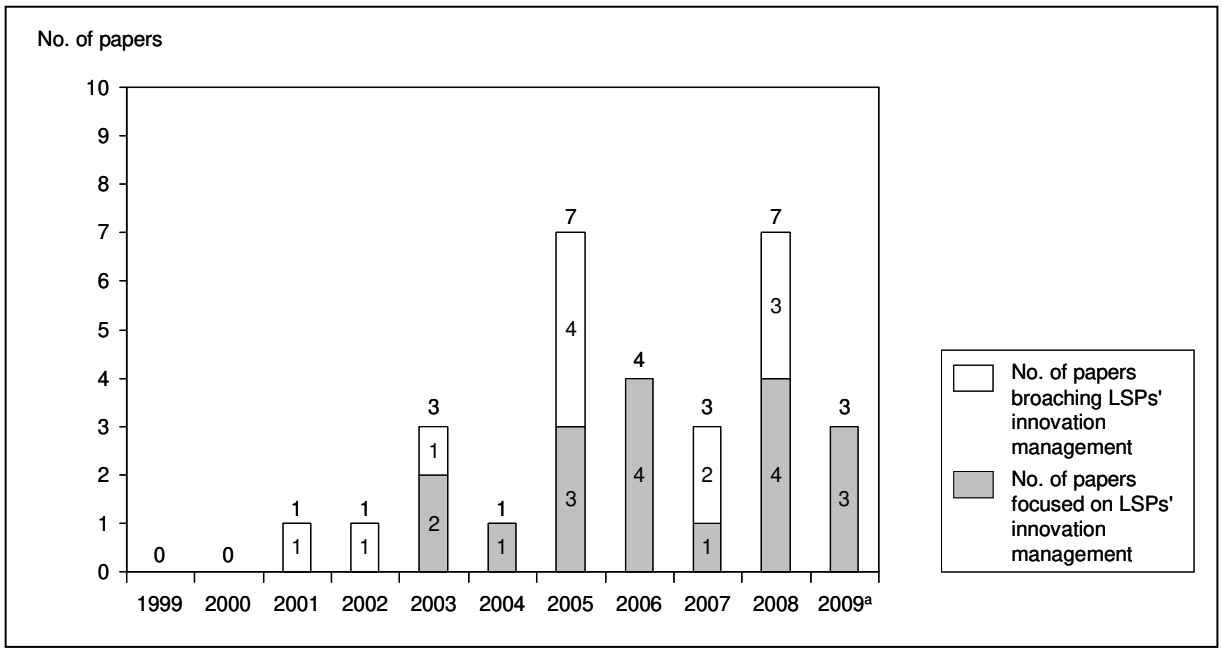

Figure 3-2: Number of Papers Published per Year
(a: The figures for 2009 are preliminary)

The degree of awareness within the scientific community was tested by means of citation analysis. Papers were examined for citations of earlier papers from the sample. The results show that little cross-referencing exists within the reviewed literature. This can be attributed to two reasons: first the non-existence of well-established research streams within innovation management research on LSPs and second the fact that many articles are very recent (more than half of the articles were published 2006 and after). Both reasons emphasize the usefulness of now integrating the existing knowledge base.

Concerning publications per journal and per journal category, leading logistics journals were found to be the most important group, within which *Journal of Business Logistics*, *Journal of*

[67] A simple linear regression model applying the year as independent and the number of papers as dependent variables has a coefficient of determination of r^2=50.9 %, meaning that more than half of the variance can be explained by the year as explanatory variable. It also delivers a slope of β=0.536, indicating a publication growth of approximately half a publication per year. With only eleven pairs of values, the meaningfulness is limited, but even if the two years with seven publications are deleted as outliers, growth is apparent (β=0.365) and even more strongly visible (r^2=68.3 %).

Supply Chain Management, *International Journal of Physical Distribution & Logistics Management* and *Transportation Journal* had published at least two papers on the topic. Leading Technology and Innovation Management journals did not focus on LSPs' specific innovation management. The only exception that published an article is *International Journal of Technology Management*. The higher interest of leading logistics journals is plausible, given that from a general innovation management perspective the phenomenon under investigation is a special case, whereas from a logistics point of view the topic of this research is at the core of the discipline. Within the group of other journals, *Creativity & Innovation Management* and *Journal of Technology Management & Innovation* had two papers each that dealt with the topic. Figure 3-3 provides an overview on publication numbers per journal category. In addition, Table A-1 to Table A-5 (on pages 163 to 167) in the appendix list research topics, methodological approaches, as well as recommended further research for all 30 reviewed articles.

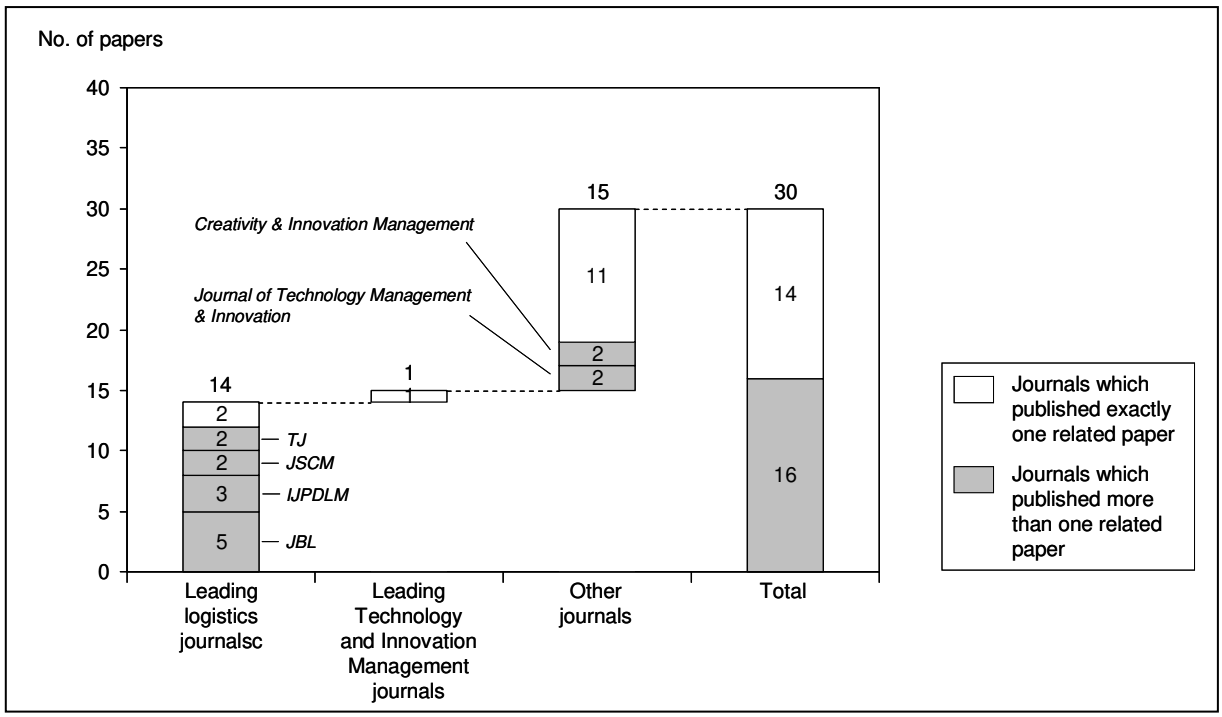

Figure 3-3: Publication Sources

Within the sample, a dominance of certain types of innovation[68] in the discussion could be identified, while classical distinctions did not play a major role (cp. Chapter 2.2.1): Only one work (Wagner 2008) distinguished between product/service innovations and process innovations. This can be explained by a relatively low applicability of this distinction for LSPs (cp. Chapter 2.3.4). As regards organizational/administrative vs. technological innovations, one part of the reviewed literature focused quite heavily on technological innovation (e.g. Evangelista and Sweeney 2006; Lai, Ngai and Cheng 2005; Sauvage 2003; Stapleton and Hanna 2002; Wu 2006), which for LSPs means technology adoption (cp. Chapter 2.3.4), while the other did not differentiate between these two types of innovation. Last, with respect to the degree of novelty, incremental innovations were referred to much

[68] Types of innovation will also be investigated in Chapter 6.

more often than radical innovations (e.g. Deepen et al. 2008; Hyland, Soosay and Sloan 2003; Soosay and Chapman 2006; Soosay and Hyland 2005; Wallenburg 2009). An explanation is that much LSP innovation research views existing customer relationships and continuous innovation. It is clear that continuous innovation cannot continuously produce radical innovations and that established relationships are subjected to lower degrees of novelty than new client-relationships would be.

3.2.2 Innovation Management (Sub-) Systems

Each sub-system of the systemic part of the categorization framework is presented on its own. The order is inputs management, then knowledge management, followed by innovation strategy, and then work environment. A note on portfolio management follows, before project management and finally commercialization are presented.

3.2.2.1 Inputs Management

Once a decision to strive for innovation is made, inputs must be managed. The first sub-system in the framework of Adams, Bessant and Phelps (2006) therefore refers to the management of innovation-related inputs such as human, financial and physical resources, as well as tools.

A first relevant class of inputs is people and their skills. Skill requirements for innovation projects are at least as high as for regular work, as could be shown for the adoption of technology where employee's skill profiles pose the highest barrier (Evangelista and Sweeney 2006; Lai, Ngai and Cheng 2005). Similarly, a significant positive relationship between quality of human resources and technology adoption was identified (Lin 2006). Individual competencies that are effective for innovative behaviours were explored by Soosay (2005), who identified creativity, effective communication, learning, teamwork and empowerment, skill flexibility, and adaptiveness to change. Individual competencies are closely related to individual learning behaviours (cp. Hyland, Soosay and Sloan 2003 and the sub-sequent section). Two instruments can be used to achieve the high skill requirements of innovation, namely training and staff selection. While staff selection has not been addressed, the importance of training has been confirmed in the LSP literature (Lu and Dinwoodie 2002; Panayides 2007a). Work induction programs, on-the-job training, external computer skills training and individual development plans can be appropriate instruments (Soosay 2005). LSPs seem not to have fully recognized the importance of training, though (Lu and Dinwoodie 2002). The latter fits to the general observation that logistics organizations have a tendency to neglect the importance of the "human side" (Ellinger, Ellinger and Keller 2002).

The second relevant class of inputs is physical and financial resources. Only if the right qualification and attitude is complemented with free resources such as slack time and slack resources to experiment, search for innovative solutions will occur (Hyland, Soosay and Sloan 2003). Physical resources have not been investigated at all, possibly because the creation of innovation in services does not require special physical resources. However, investment in equipment can be a means of innovation adoption (Wagner 2008), and logistical services were classified as equipment-based services (2.3.2). Regarding financial resources, Sauvage (2003) suggests the existence of under-capitalized LSPs which lack the financial resources to

undertake innovative efforts. He shows that technological efforts are higher in larger firms, which often possess more financial resources. A classification of financial innovation investments was provided by Wagner (2008), who differentiates internal and external research and development, investment in infrastructure and capital goods, acquisition of knowledge, and training and further education. He points out that most LSPs have hardly any research and development expenditures, whereas some LSPs, e.g. UPS, invest heavily in infrastructure. Innovation intensity, i.e. the share of revenue which is used as innovation expenditure (ZEW 2010f), is reported at 2.1% for the average LSP in Germany (Wagner 2008). Approximately 70% of those spending are investment expenses and 30% are current expenses (Wagner 2008).[69]

The last class of resources is tools used for managing inputs. Flint et al. (2005) provide a list of tools found at innovative LSPs which mostly aim at idea generation – in particular jointly with customers: customer groups/retreats, formal depth interviews, joint strategy meetings, outside expertise, trade journals, industry conferences, analysis of customer data, performance metrics, monitoring of technological changes and monitoring of competitor changes. Soosay (2005) points out the fact that tools can foster creativity and that quality control circles and work improvement teams have been used successfully.

3.2.2.2 Knowledge Management

In the (not LSP-specific) logistics literature, it was emphasized that "*[l]ogistics knowledge is about complex processes, not about discrete tasks. […] [F]or complex processes to be improved requires much more change and learning effort. Logistics knowledge is also strategic and operational at the same time and functional as well as cross functional*" (Carlsson and Sarv 1997, pp. 45-46). Chapman, Soosay and Kandampully (2003) describe knowledge as a resource that can "*enhance the firm's core competency*" (p. 640) and show the development of suitable knowledge-management processes to be a prerequisite of innovation.

The systemic framework distinguishes three elements of knowledge management: idea generation[70], knowledge repository, and information flows (Adams, Bessant and Phelps 2006). For LSPs, their customers are a very important source of ideas (Flint et al. 2005; Flint, Larsson and Gammelgaard 2008). Novel ideas with regard to existing customer relationships can stem from direct customer interaction, from monitoring of the LSPs' environment, from appraisals or complaints, as well as from "*the extent of customer buying and secondary data analysis*" (Flint, Larsson and Gammelgaard 2008, p. 261). In the interaction with existing customers, LSPs do not have to restrict themselves to reacting to their customers' ideas, but can also generate ideas proactively (Deepen et al. 2008; Wallenburg 2009).

Flint et al. (2005, p. 129) state, "*that it was found important to create systems for capturing [..] the right kinds of data*". They also provide an example of a firm which planned to install a repository of information gained in customer interaction in order to explicit that knowledge and to be able to retrieve it for later decision making. According to Hyland, Soosay and Sloan (2003), explication and storage of knowledge is realized through individuals who incorporate

[69] Also cp. the later Chapter 6

[70] Idea generation can alternatively be investigated procedurally, i.e. as one of the first activities within the Fuzzy Front End of innovation generation (cp. Chapter 3.2.3.1).

it in reports, databases and in standards on product and process which suggests that knowledge repositories have not only a technological side, but also an ergonomic side.

The most extensively studied element of knowledge management is information flows. Particular in the case of LSPs knowledge exchange processes often cross organizational boundaries (Carlsson and Sarv 1997; Panayides 2007a; Sauvage 2003). Therefore, LSPs should consider the exchange of knowledge in collaboration with their supply chain partners. Effectiveness and efficiency of knowledge diffusion are affected by the existing communication channels and instruments, namely "*emails, databases, reports, newsletters, bulletin boards, […] and [..] new process standards*" on the formal side, and "*social events, gatherings, meetings and training programmes, or […] activities where employees interacted with one another*" on the less formal side (Soosay 2005; p. 303). Today, information exchange is much more easily realized with the help of technology than it used to be (Sauvage 2003). On the other hand, fast information exchange has become a necessity, as well (Sauvage 2003). Chapman, Soosay and Kandampully (2003) advocate a holistic approach incorporating intra-organizational and cross-organizational knowledge sharing, as well as focusing on the people aspect no less than on the technology aspect. They explicit a multitude of benefits, but no costs or disadvantages, of sharing knowledge: efficiency, customer satisfaction, quality of strategic planning, flexibility and adaptability, decision making quality and supply-chain management processes.

Successful knowledge management can be expected to influence the quality of knowledge creation, i.e. learning. The latter is apparently an important prerequisite to innovation, given the novelty feature of innovation. Hence, findings on learning shall be subjected to this section, as well. Hyland, Soosay and Sloan (2003) report that strategic objectives are used to prioritize individual learning activities. They found individuals and groups to develop knowledge in innovation processes, to integrate knowledge across organizational units, and to transfer it from one process to another. Individuals assimilate knowledge and extract it from sources outside of their organization. Multiple works point out the importance and occurrence of process-related learning with feedback loops (Flint et al. 2005; Panayides 2007a; Soosay 2005). With respect to organizational learning, Panayides and So (2005) argue: "*Organisational learning orientation was found to influence firm innovativeness particularly in terms of adopting innovative technologies and processes […]. Openness to new ideas […] will culminate in an improvement of the LSP's effectiveness in the supply chain*" (Panayides and So 2005, pp. 183-184). Flint et al. (2005) point out a contingency of organizational learning upon "*the unique structures, organizational cultures, national cultures, and situations of the organizations in question […] Thus, logistics service providers may learn differently depending upon the nature of the organizations, the specific situations in which learning is taking place, and the national cultures in which the organizations are imbedded*" (p. 119).

3.2.2.3 Innovation Strategy

The Adams, Bessant and Phelps (2006) framework distinguishes strategic orientation and strategic leadership.[71] Within strategic orientation, four fields emerged from the reviewed literature:[72] growth and differentiation approaches, innovation management contingencies, knowledge protection, and importance of technology.

Articles on LSP strategy, expansion, or growth exist that do not explicitly mention innovation (e.g. Carbone and Stone 2005; Persson and Virum 2001; Stone 2001; Sum and Teo 1999)[73]. Yet, van Hoek (2001) shows that innovation is a possible path for LSPs to achieve growth. More specifically, it can be achieved through use *"of integrated logistics measures"* and *"of production and customization measures"* (van Hoek 2001, p. 19), i.e. innovations to management control systems as they *"indicate growth areas in supplementary services"* (van Hoek 2001, p. 27). An important driver of LSPs' growth, which is at first sight not related to innovation, is outsourcing (e.g. Chapman, Soosay and Kandampully 2003). Numerous authors that investigate LSP-client relationships emphasize the importance of improvements[74] provided by the LSP of which the client is the primary beneficiary (e.g. Deepen et al. 2008; Flint et al. 2005; Flint, Larsson and Gammelgaard 2008; Panayides and So 2005; Wallenburg 2009). Deepen et al. (2008) argue that unsolicited investments into the LSPs' customer relationships can pay off also for the LSP in the long. However, exceeding customer expectations poses the danger to "raise the bar" to a point where increased expectations cannot be met any more (Deepen et al. 2008). Wallenburg (2009) disaggregates proactive improvement further into cost and performance related improvements. Their strategic importance is derived from moderation analyses: *"[P]roactive performance improvements gain in importance, while cost improvements lose relevance as complexity rises and contracts lengthen. Therefore, LSPs should put a stronger emphasis on proactive performance improvements in settings with complex services and long-term contracts, while the focus should be more on proactive cost improvements when services provided are simple and contract durations short"* (Wallenburg 2009, p. 87).

Soosay and Hyland (2005) identify five relevant contingency factors of innovation management: turnover, extent of globalization, number of inter-firm relationships, knowledge

[71] According to Adams, Bessant and Phelps 2006, innovation strategy *"is generally understood to describe an organization's innovation posture with regard to its competitive environment in terms of its new product and market development plans"* (p. 30). This techno-centric view is narrower and seemingly less far developed than the overall strategic management discipline would allow. For example, established typologies of strategy origin (Mintzberg and Waters 1985) or of strategy processes (Hutzschenreuter and Kleindienst 2006) are not reflected in the literature reviewed by Adams, Bessant and Phelps (2006). It is therefore no surprise that they are not discussed by the LSP-specific literature, either.

[72] Adams, Bessant and Phelps (2006) assume that each organization has a strategic orientation. Existence of strategic orientation was not discussed in the reviewed literature. The allocation of the four aspects hence follows the assumption that those aspects should be addressed by LSPs' strategic orientation, if they have one. In the later chapters that contain primary empirical data, i.e. in Chapters 4 and 5, only LSPs that have an innovation management are investigated, so that they can be assumed to have a strategic orientation, as well.

[73] In fact, the theoretical example of a not innovative LSP that experiences 2% growth in a market segment which grows at 3% highlights that LSPs can rightfully claim to be able to grow without innovation, at least in the very short term.

[74] The question suggests itself if there is a certain minimum degree of novelty below which the term innovation is not suitable anymore. This work follows the classification of Wallenburg (2009), according to which (proactive) improvements are types of (proactive) innovations.

accessibility, and firm function, while no influence was found for technological complexity, labour turnover, and trade unions. As a consequence, LSPs' strategic orientation must take a number of specific factors into account and is itself contingent upon them. Hence, there is no such thing as an optimal innovation strategy for LSPs. Sauvage (2003) suggests that large companies can benefit more from information systems than smaller ones. This finding indicates firm size as another possible contingency factor, at least with respect to innovation adoption.

LSPs' knowledge protection, in particular patenting, was analyzed by Wu (2006), who found patents to be relatively unimportant for LSP. In general, intellectual property protection through patents can be as difficult to achieve for LSPs as for other service providers (Sauvage 2003). Nevertheless, Wu (2006) recommends patent data analysis as the associated costs have fallen considerably over the last years.

For LSPs, new technologies that emerge in their environment are a source of potential innovations. Technology-induced changes of the logistics function or of supply chains have been discussed for more than ten years (e.g. Abrahamsson and Brege 1997). LSPs' strategic orientations have to incorporate a general element of dealing with technology beyond the individual technology (Chapman, Soosay and Kandampully 2003; Sauvage 2003; Soosay and Hyland 2005) Evangelista and Sweeney (2006, p. 56) regard the technology approach as a very fundamental choice: *"The scenario that might arise could present small 3PLs with two different alternatives: survive in a low-cost world […] or pursue the […] path of becoming value adding providers through innovation in technology"*. The suggestion of self-enforcing path dependency is confirmed by the theory of absorptive capacity according to which the capacity to absorb new technologies is determined by cumulative prior related knowledge (Cohen and Levinthal 1990). Likewise, Sauvage (2003, p. 238) suggests that *"the dynamic of the growth of logistics service providers is contingent on the strategic trajectory adopted"*. He points out that *"in a highly competitive environment, characterized by 'time compression'"* (Sauvage 2003, p. 236), the speed of diffusion of technological innovations could have risen. Such an environment is suggested to even out the benefits received from innovation generation. At the same time high competitiveness likely retains the pressure to adopt innovations. The result would be an industry where few innovations appear, but are quickly used by a large fraction of LSPs, in accordance with the assessment in Chapter 2.3.

Lai et al. (2008) found a LSPs' managerial involvement to drive IT capability, which in turn is a strong predictor of *"service variety advantage"*, the *"ability to provide and customize a variety of 3PL services and products and meet the special requirements of its customers"* (Lai et al. 2008, p. 28; similarly Liu et al. 2008). Evangelista and Sweeney (2006) also suggested that service customization can be facilitated by information and communication technology tools. The recent technological developments can hence partially explain the *"trend towards modular production"* (Sauvage 2003, p. 250; similarly Shen et al. 2009).

The second facet of strategy, strategic leadership, describes behaviour and attitudes of senior management with respect to innovation management. Flint et al. (2005) emphasize the need of innovation commitment from various levels of management, particularly already during the Fuzzy Front End of innovation generation. Soosay (2005) points out management's obligation to translate strategy into innovative activities as well as to develop and diffuse knowledge for

innovations. The implementation of strategy can be fostered by annual quality improvement plans as well as by de-centralization of decision making and planning activities (Soosay 2005). Concerning the development and diffusion of knowledge, training, empowerment, recognition and rewards schemes, social activities and formal meetings are deemed helpful (Soosay 2005).

3.2.2.4 Work Environment

LSPs' strategic leadership should also imprint their cultures, the first facet of their work environment. This facet covers the innovation attitude incorporated in the organization, its willingness to change, incentives and empowerment to pursue ideas (Adams, Bessant and Phelps 2006).

From a general logistics context, it is known that logistics managers' work environments are not advantageous regarding learning (Ellinger, Ellinger and Keller 2002). Culture is important to learning in LSPs, though: *"A culture whereby people can openly express their opinions […] will assist in individual learning behaviors that promote organizational learning. […] However, instilling an organizational learning culture requires the investment of resources, especially managerial time, whereas the outcomes may not be readily apparent"* (Panayides 2007a, p. 146).

Change is required wherever an old procedure is replaced by an innovative one. Thus, change management is very closely related to innovation management and deals with getting people to cope with changes. The only work that investigates change is Soosay and Sloan (2005). They present basic change-related concepts from the literature and present empirical findings from case studies. *"Drivers for change"* (p. 1) were found to differ between countries in the study, e.g. innovation can be seen as a means to an end in Australia, while it can be an end in itself in Singapore. Patterns of resistance to change differed between countries, as well. Overall, *"change management is considered a crucial capability for innovation to occur"* (Soosay and Sloan 2005, p. 16).

Because of the decision-making character of adoption processes, it is no surprise that Lin (2006) found a significant positive relationship between organizational encouragement[75] and technology adoption. The effect between a suitable culture and creativity has also been identified empirically (Soosay 2005). Staff adaptiveness to change can supposedly be influenced by applying a participative approach: conducting discussions, allowing feedback and suggestions, setting up focus groups etc. (Soosay 2005).

The second facet of work environment is organizational structure, which has been very little researched. Chapman, Soosay and Kandampully (2003) point out that organizational structure can impede or foster innovativeness. Many LSPs are characterized by relatively de-centralized organizational structures (Carbone and Stone 2005; Lieb and Randall 1996). This feature can be a challenge as regards information exchange and coordination (Sauvage 2003).

[75] Lin (2006) does not explicitly define organizational encouragement, nor does he explain its measurement. The organizational encouragement construct used by Verbeke et al. (2008) is comprised of six items: "*In this organization there is a lively and active flow of ideas.*", "*New ideas are encouraged in this organization.*", "*Performance evaluation in this organization is fair.*", "*People are recognized for creative work in this organization.*", "*Failure is acceptable in this organization if the effort on the project was good.*" and "*People are encouraged to take risks in this organization.*" (p. 130).

On the other hand, the importance of listening to the voice of their customers has been emphasized (Flint et al. 2005; Flint, Larsson and Gammelgaard 2008). Lin (2006) reports a 35% share of LSPs that made use of a research and development department, a figure which seems high when contrasted with Wagner (2008), according to whom LSPs have basically no research and development expenditures and with Chapman, Soosay and Kandampully (2003) who point out that for the non-technical developments of service providers, formal R&D is not necessarily required.[76]

3.2.2.5 Portfolio Management

The Adams, Bessant and Phelps (2006) framework distinguishes two facets of portfolio management: portfolio balancing and optimization tool usage. The former covers aspects such as aiming for certain product-process innovation mixtures, striving for determined project size mixtures or establishing risk mixtures. The second concerns evaluation and choice of projects, for example because of resource limitations. The reviewed literature does not pertain to either of those facets, but does not point out why they should be irrelevant, either. LSPs' portfolio management is hence a particularly pronounced research gap.

3.2.2.6 Project Management

The dominant understanding of project management – managing projects from phase to phase as they develop – belongs to process theory research and is hence referred to the later sections on innovation generation and innovation adoption. From a systemic point of view, Adams, Bessant and Phelps (2006) identify four facets of project management: project efficiency, communications, collaboration, and project management instruments.

The only consideration on project efficiency that is based on quantitative data stems from Wagner (2008). Comparing LSPs' innovation outputs to those of other industries he concludes that "*insufficient innovation management at LSP's' is [..] likely"* (Wagner 2008, p. 224). As pointed out in the introductory section, other authors share this view.

LSP-related innovation management literature has not yet investigated intra-organizational project-related communication or collaboration. The only work which acknowledges a LSP-internal division of labour and therefore makes the study of those aspects possible is Flint et al. (2005). Their process model is related to the Fuzzy Front End, though, i.e. to precisely those activities which occur before a formal project structure can exist. As regards inter-organizational communication or collaboration, the literature remains vague as to which takes place within innovation projects and which not. It seems plausible that due to the boundary spanning-role of logistics and due to their central supply-chain positions, LSPs are engaged in much communication and collaboration with external parties. Beginning with communication, three works present results, all of which appear to apply at least also to communication within innovation projects: Panayides (2007a) points out the importance of communication for organizational learning and hence for innovation management and further emphasizes the role technology plays in enabling communication. Likewise, Sauvage (2003) stresses the need to adopt electronic data transfer technology to foster communications. Communication at the

[76] R&D usage will be discussed in Chapter 6.

individual level is apparently facilitated by means of open-office concepts, by keeping bureaucracy and hierarchy levels low and by encouragement (Soosay 2005).

For collaboration, the situation is identical, i.e. previous research has not differentiated between project-specific and project-unspecific collaboration, but findings give the impression to at least also be applicable within projects: Relationship networks, i.e. a type of institutional collaboration setting, are labelled an important prerequisite to LSPs' innovativeness by Chapman, Soosay and Kandampully (2003). They further suggest that LSPs' overall innovative capacity rises through repeated collaboration, and that supply chain collaboration will lead to process innovations, in particular. Sauvage (2003) argues that compressed cycle times lead to more collaborative behaviours and, in a second step, to decreased innovation costs in supply-chain relationships. He identifies efforts for technological advancement as a prerequisite for longevity of customer relationships. Customers are the most important collaboration partners for LSPs, as compared to suppliers or other LSPs, (Chapman, Soosay and Kandampully 2003; Flint et al. 2005; Flint, Larsson and Gammelgaard 2008; Sauvage 2003). In this respect, Chapman, Soosay and Kandampully (2003) advocate "*thinking for the customer*" (p. 640). Sauvage (2003, p. 251) sees a trend towards closer partnerships with customers, even though *"subordination exerts an inhibiting effect on development of technological potential*". If LSPs' relationships were to become less dedicated, the future role of LSPs might become one of key interface in the supply chain (Sauvage 2003). A very important relational variable in that context is trust. Trust was analyzed by Verwaal, Verdú and Recter (2008) in existing outsourcing relationships between LSPs and their clients and was found to lead to less knowledge protection from partners. The latter suggests that LSPs can achieve more innovation in long-term outsourcing relationships than in short-lived ones and that they should try to build up relationship capital as a prerequisite to innovation. Deepen et al. (2008) found cooperation to affect both proactive improvement and outsourcing performance positively.

Concerning applicable instruments, Chapman, Soosay and Kandampully (2003) name benchmarking within the supply chain as a means towards incremental process innovations. Performance measurement tools can identify problem areas as well as good practices (Soosay and Chapman (2006). Soosay and Chapman (2006) conclude that an approach integrating cost and non-cost measures as well as qualitative and quantitative measures can be tailored to serve as an appropriate overall measurement system for establishing links from capabilities, competence and performance towards innovation. With respect to the current state of implementation they emphasize *"that logistics firms are very much aware of the importance of performance measurement for continuous innovation, but the actual implementation […] is at a more advanced state in Singaporean-based firms than in Australian firms"* (Soosay and Chapman 2006, p. 204). Soosay and Chapman (2006) argue that those international differences in the innovation management of LSPs' could be caused by sample differences regarding organisational type, organizational structure or market position.

3.2.2.7 Commercialization

Three facets of commercialization were identified by Adams, Bessant and Phelps (2006): market research, market testing, as well as marketing and sales. Flint et al. (2005) report on market research which does hardly pertain to an anonymous market, but focuses on individual

customers, instead: "*The customer clue gathering activities […] seem to be consistent with activities suggested by the innovation literature, but with a strong emphasis towards customer knowledge over technology, or competitors. We found less emphasis on […] technology, and competitor analysis and a wider variety of customer-specific information gathering techniques than the innovation literature might suggest*" (Flint et al. 2005, p. 137). Compared to various other industries, LSPs have the lowest intensity in observing their market environment (Flint, Larsson and Gammelgaard 2008).

Market testing is not referred to in the reviewed literature. This can be attributed to the fact that market testing is hardly used in service industries (Thomas 1978) or only integrated into innovation efforts undertaken jointly with the customer. Marketing and sales are not mentioned explicitly either. It seems possible that these activities are embedded into innovation generation activities focused on individual customers.

The commercialization sub-system is the only one which deals with finished innovations. It is thus the right dimension to discuss innovations as outputs.[77] Wagner (2008) reports statistical data on the LSP sector as a whole, according to which only 30% of all LSPs had finished an innovation project successfully and produced at least one innovation in the three years prior to the survey. Kimura (2005) analyzed the innovation output of the Japanese logistics industry based on macro-economic data. He found that deregulation in the early 1990s had increased competition. That in turn made LSPs increase their efforts to innovate and thus made them more innovative (similarly Stapleton and Hanna 2002).

3.2.3 Innovation Management Processes

The procedural categorization dimension distinguishes findings by type of innovation process: generation and adoption.

3.2.3.1 Innovation Generation

The only works which focused on innovation generation and investigated it from a process perspective are Flint et al. (2005) and Flint, Larsson and Gammelgaard (2008). Both emphasize early activities. Flint et al. (2005) investigate logistics innovation that adds value to external customers. They describe four groups of activities that are suggested to be embodiments of *"being innovative"* (p. 127). A feedback loop exists to ensure learning. First, setting the stage activities are supposed to establish a creative environment in which logistics managers can concentrate on and understand their customers' wishes, equated with a customer-oriented and innovative culture. Those activities include planning, training and resource acquisition tasks. Second, customer clue gathering activities ought to lead to customer closeness and to deep insights on (changes of) customer wishes. Third, negotiating, clarifying, and reflecting serve the purpose of reflecting *"the voice of the customer"* (p.134). Last, inter-organizational learning *"refers to the new insights and understandings that emerge jointly for managers from the logistics service provider and customer organizations. These insights about industry opportunities, technological advancements, and process improvement possibilities, emerged in part because an adequate stage had been set for learning to occur"*

[77] Those will be discussed in more detail in Chapter 6.

(Flint et al. 2005, p. 135). Flint et al. (2005) further mention the fact that they observed procedural learning with regard to the workflow of innovation processes themselves.

Flint, Larsson and Gammelgaard (2008) strongly builds upon the earlier analyses of Flint et al. (2005). The concept of inter-organizational learning is refined to supply chain learning, which deals with *"supply chain and product problems and potential solutions jointly across organizations within a supply chain"* (Flint, Larsson and Gammelgaard 2008, p. 258). Accordingly, this article also belongs to the new supply chain innovation research. Customer clue gathering activities are differentiated further into *"customer interactions"*, *"customer monitoring"*, *"customer satisfaction measurement"*, *"customer buying and secondary data analysis"*. Negotiating, clarifying, and reflecting activities are mirrored by *"customer insight discussions"* (p. 263). Structural equation modelling confirmed the relationships proposed between the above concepts and company performance. In their review of Flint et al.'s (2005) procedural model which Flint, Larsson and Gammelgaard (2008) use, as well, Flint, Larsson and Gammelgaard (2008) concede that the model's coverage is confined, as *"innovations do not need to emerge out of such a process"* (p. 265). Consequently, the discussed model is just one possible path towards innovation.

3.2.3.2 Innovation Adoption

Previous LSP-related works have mostly dealt with innovation adoption as a binary coded variable: adopt or not. Technology adoption has been dominant in adoption studies. It can enable LSPs *"to implement innovative methods and gain superior competitive advantage"* (Chapman, Soosay and Kandampully 2003, p. 641), and the *"adoption of new systems and processes is likely to improve effectiveness in the delivery of the logistics service"* (Panayides 2007b, pp. 71-72). The adoption of information and communication technology in particular can allow LSPs to offer new services, to incorporate new functions and to commit themselves to new alliances (Evangelista and Sweeney 2006). It is further suggested that it can help LSPs to *"add benefit to customers and other stakeholders"* (Chapman, Soosay and Kandampully 2003, p. 642).

Lin differentiated various kinds of technologies in a number of closely related works and found the most frequently adopted new technologies to be information technologies. The importance of data acquisition technologies, transportation technologies and warehousing technologies varied between China and Taiwan (Lin 2006; Lin 2007; Lin 2008). Apparently, at the time of adoption and in the specific context, information technology was more important than technology related to physical logistics processes, a phenomenon that can be explained by differences between technological development speeds. *Lin* (Lin 2006; Lin 2007; Lin 2008; Lin and Ho 2008; Lin 2009) further investigates factors explaining technology adoption and identified six variables with significant influence: explicitness / transferability of technology, organizational encouragement / support for innovation, quality of human resources, government support (samples stemming from emerging economies), existence of an R&D department (investigated only once) and capital size. The results were ambiguous for accumulation of technology which describes the degree of fit with an organizations' existing technology base, for environmental uncertainty and for company size / number of employees. Lai, Ngai and Cheng (2005) also investigate information technology adoption and report on twelve benefits of adopting IT, most of which are related to

operational improvements in terms of cost and quality. Improvements in customer service and competitiveness were also perceived as very beneficial. As regards implementation barriers, Lai, Ngai and Cheng (2005) reported only two to be significant and more severe than the neutral value of their scale: lack of information technology expertise and lack of implementation expertise. One factor, lack of top management commitment, was significantly less than neutrally important. Apparently, within their LSP sample, hard factors such as operational issues and questions of know-how and ability were more important for adoption than soft factors such as willingness (Lai, Ngai and Cheng 2005). Finally, Evangelista and Sweeney (2006) also highlight criteria influencing the decision to adopt new information and communication technology. Medium importance scores were achieved for cost reduction[78] and competitiveness improvements, while the most important inhibiting factors are related to costs and to staff qualifications.[79]

By means of transaction cost analysis, Stapleton and Hanna (2002) analyze the effect of the adoption of stack train technology. From this specific research three general conclusions can be drawn: First, innovation adoption can initiate further change beyond the amount accompanying the implementation phase. Second, even though one can assume performance considerations to be much more important for innovation than costs, transaction cost theory can occasionally be applied. Third, for LSPs with operations in multiple sites, technology adoption is not necessarily a decision which affects the whole organization at once. For material handling technology in particular, the decision to use the same technology can have to be taken multiple times. According to the definition of innovation, only the first adoption would be regarded as an innovation, though, if indeed comparable decision contexts exist.

3.2.4 Suggestions for Future Research

Based on this review, multiple suggestions for future research on LSPs' innovation management can be concluded. The ones recurring to methodology are presented first, the content-related ones thereafter.

3.2.4.1 Methodological Suggestions

Future research should more explicitly detail its research subject and place it unambiguously in a research stream. It should be clearer if it deals with innovations generated or adopted by an LSP, with logistical innovation, with innovation that happens to occur in supply chain relationships, with supply chain innovations etc. Fuzziness impacts subsequent research negatively.

The distinction between innovation generation and innovation adoption (Damanpour and Schneider 2006; Damanpour and Wischnevsky 2006) is useful to increase transparency. Also

[78] The cost reduction factor had not been identified by Lai, Ngai and Cheng (2005). That might be casued by higher average costs within the Italian sample used by Evangelista and Sweeney (2006) than in the Hong Kong sample which Lai, Ngai and Cheng (2005) used.

[79] Again, contrasting these findings with the previously reported ones is insightful: Lai, Ngai and Cheng (2005) had found costs only averagely strong barriers. As regards running costs, those will mostly be personnel costs and hence probably actually be smaller in Hong Kong than in Italy. As concerns investment costs, that is not intuitively explainable because no reason is apparent why LSPs in Hong Kong should feel those to be a smaller barrier than Italian LSPs.

the classification of organizational innovation research into the four streams diffusion of innovation, systemic innovativeness, process-theory research and network innovation as a further development of Wolfe's (1994) classification proved to be valuable. It helps to understand how one piece of work relates to another, and it allows checking the consistency between research question and unit of analysis. It is hence suggested that future research in the field of organizational innovation make use of the classification and clearly place their work therein. The framework removes a lot of fuzziness from innovation research.

The holistic perspective applied here that took both innovation management system design and process workflows into account, was found very potent. It covers the innovation phenomenon in its entirety better than either of the perspectives can do on its own. Further, the framework of Adams, Bessant and Phelps (2006) proved to be effective in disaggregating innovation management systems into clearly distinguishable categories.

As regards empirical research methodology within the reviewed sample, both surveys and case studies have been undertaken. There was descriptive, explorative and confirmatory work. It seems as if confirmatory work was dominant precisely where innovation management in the understanding of this article was only a side issue. Future research can make use of both qualitative and quantitative approaches. Especially case studies seem promising for deeper penetration of the subject in a field which is still at an early stage (Benbasat, Goldstein and Mead 1987; Eisenhardt 1989).

3.2.4.2 Suggestions on Future Research Directions

There is currently a lot of emphasis on innovation as a final result. Scholars should place more emphasis on how it emerges (Knight 1967). Two points of views have been offered: On the one hand, innovation is a phenomenon produced by an innovation management system. An innovation management system has a number of sub-systems all of which can also be studied individually and linked to managing for innovation. On the other hand, innovation is the result of an innovation process which consists of various phases.

Second, the theoretical considerations on logistics service characteristics, on the service environment, and on LSPs' features (cp. Chapter 2.3) should be further developed. In particular, it should be researched how obstructing factors can be taken into account by the LSPs' innovation management.

Third, a number of recommendations on individual sub-systems can be made. Inputs management research will have to investigate the people who bring innovation about, how they are elected, which qualifications and attitudes they do and should possess, and how they behave. Research on inputs management will also have to explain why most LSPs invest so little into innovation respectively why some LSPs do not consciously invest any resources at all. Within knowledge management, the most pressing question will be how LSPs should better manage the high level of de-centralization which many of their organizations have. In addition, the concepts of learning logistics organization and that of a logistics learning capability can be tested with regard to LSPs' innovation management (Ellinger, Ellinger and Keller 2002; Esper, Fugate and Davis-Sramek 2007). Next, comprehensive innovation strategies have not yet been described. Particularly interesting would be the question which contingency factors affect the content of innovation strategies, and how. The former question

can be posed with respect to each of the sub-systems, but if innovation strategy is understood to be at least a *primus inter pares* (cp. Chandler 1962) or even if strategic choice is taken into account (e.g. Child 1972), then it is particularly relevant there. Concerning work environment, structures used for innovation have so far been disregarded. Here, relevant questions are how projects are and should be structured and how to combine permanent and non-permanent architectures. Portfolio management has also been ignored, which leaves the question whether this aspect is not relevant to LSPs and if so, why. The most interesting question concerning project management from a systemic point of view is whether project efficiency is indeed particularly low for LSPs. If that was the case, it would largely explain the fundamental question why LSPs are not more innovative than they currently are. Another project-management related question concerns collaboration, in particular with customers. Is collaboration always positive? General research on New Product Development suggests that there can be unsolicited customer input (Brockhoff 2003), which leads to the question whether this is always welcome. Commercialization, the final sub-system, lacks research on market testing (presumably due to the conceptual nature of innovations in services, cp. Thomas 1978), as well as on marketing and sales, in general. Here key question are how LSPs intend to get payback from their novelties and how a potential conflict between customer orientation and market orientation can be solved.

Fourth, specific recommendations shall be made with respect to process-theory research. While there are some process-oriented works on innovation generation, they focus rather heavily on the fulfilment of customer wishes and on the front end of innovation generation. Additional models could be useful. In particular, no procedural model was reviewed here which can be used as a management instrument at an LSP. Innovation adoption, the second type of process, has been investigated relatively often, though mostly as an undivided phenomenon, instead of in a truly procedural way. There was also strong emphasis on technology adoption which implies that the adoption of organizational novelties had deliberately been excluded.

Fifth, it was argued that differentiations between types of innovation may be less important for LSPs than for other industries. Obviously, that does not mean that it will be possible to ignore them in the long run. Overall it is clear, that future research also will benefit from combining and integrating the different streams and perspectives from the extant literature

3.3 Conclusion

The first sub-chapter in this conclusion focuses on the answer to research questions 2. Afterwards, managerial implications are presented, and limitations are discussed.

3.3.1 Summary with Respect to Research Question 2

Given the novelty of the research topic, it was possible to compile a relatively large amount of knowledge pertaining to most of the facets of LSPs' innovation management in partial answer to research question 2. However, there is a clear lack of comprehensive studies of the topic, in fact from both a procedural and a systemic perspective.

Previous works did not aim at explaining LSPs' low innovation achievements. From the integration of knowledge in this review it is not possible to explain those low achievements, either. The unfortunate short answer to the second aspect of research question 2 is therefore that previous works on LSPs' innovation management do clearly not explain why LSPs are not particularly innovative.

3.3.2 Managerial Implications

This text was mainly written for academic purposes, but it also allows concluding some managerial implications. First, it has becomes apparent that a holistic understanding of innovation management must include both a systemic and a procedural perspective. Therefore, companies should not only apply a proactive attitude, but also design concepts of innovation management systems and processes consciously. The design needs to be tailored to the organizational and environmental circumstances.

Second, specific management challenges lie in the Fuzzy Front End of innovation generation, as well as in adapting the current, still relatively general findings of previous research to the specific LSP context that had been identified in the previous chapter.

3.3.3 Limitations and Research Implications

This research is limited first through the sampling applied. While the focus on LSP-specific works was a necessity, other sampling decisions could have been taken differently. For example, due to the restriction on academic journal articles in the English language, articles from edited books such as Pfohl (2007) or Wagner and Busse (2008b) could not be taken into account. In temporal terms, it is imaginable that articles published before the timeframe of this review were not taken into account, even though they may not be obsolete, yet.

Another limitation arises from the categorization framework used. Even if the used framework does not influence the author's or the readers level of attention, it still impacts the presentation of the body of knowledge, for example which findings are contrasted most with others. Having said that, the central implication of this text is clear: Comprehensive studies on LSPs' innovation management should be undertaken.

4 Procedural Model of Innovation Generation, Implementation and Roll-out for a Typical LSP

The review of existing literature on LSPs' innovation management showed that there is sparse knowledge in the literature with respect to the evolvement of innovation (cp. Chapter 3.2.3). Two complementary approaches to remedy that were offered: to study the make-up of LSPs' innovation management systems or to study LSPs' innovation processes. Both perspectives were shown to be necessary to cover innovation management in its entirety, but only one can be adopted at a time (cp. Chapters 2.2.2 and 2.2.3). This text[80] will take a procedural point of view.

It is theoretically possible to analyze innovation processes without ex ante having specific models (e.g. Krallmann, Frank and Gronau 1999; Kühne 2005) or mental models (Senge 1990) thereof. A simple two- or three-activity general model could be applied to this aim. For three reasons, pursuing that path is not advisable here:

- First, Evan and Black (1967) stated more than forty years ago that "*we can only speculate about the generalizability of elements in the innovation process*" (Evan and Black 1967, p. 520), an observation that still holds true. Ten years ago Gerpott (1999) confirmed that there are "*significant sectoral differences regarding the development of innovation processes*" (Gerpott 1999, p. 54; translation by the author). Göpfert and Hillbrand (2005), Johne and Storey (1998) and Wolfe (1994) subscribe to that view, as well. The answer to research question 1 further supports this line of reasoning (cp. Chapter 2.3). Thus, a supposedly general model would possibly not even be valid for LSPs.
- Second, the superordinate purpose of this text is to shed light on the effects LSPs' characteristics have on their innovation processes. It can safely be assumed that those characteristics will be the more pronouncedly visible the more detailed the process model is (cp. Heinemann 2007). Shrouding them, as a general model would have to do, would thus foil the purpose to contribute to the understanding of LSPs' low innovation achievements.
- Finally, the specificity of the LSP context could make the usage of special, i.e. context-adapted, instruments necessary or at least beneficial. The application of mal-fitting concepts is an imaginable partial reason for LSPs' currently low innovation management achievements.

Accordingly, LSP-specific innovation process models are required. The literature review in the previous chapter unfortunately showed that there are virtually none. The single exception, Flint et al. (2005), covers only the Fuzzy Front End and is not suitable for procedural

[80] The text is a synthesis and further development of a major excerpt from the article Busse, Eitelwein and Wallenburg (2007) that was published by *Logistik Management*, and of the book chapter Busse and Wagner (2008a) that was printed in Wagner and Busse (2008b).

analyses, as it proposes merely a possible model of innovation generation (Flint, Larsson and Gammelgaard 2008). An LSP-specific innovation process model must hence be developed. It is important that such a model can be connected with previous ones, as this research is motivated by a cross-industry comparison. As a consequence of that need, a grounded theory approach was rejected (cp. Chapter 1.2). Action research was chosen instead as it allows the incorporation of previous results which can then be adapted to the LSP-specific context. Its modifying character ensures specificity while preserving connectivity. The action research approach is presented in the methodology section. However, due to the researcher's interaction with the research context, the validity of the findings can be questioned. It was thus deemed advisable to postpone the actual usage of the developed process model until its validity is confirmed by subsequent scholars. Hence, research question 3 is formulated as follows: "*Which explanations of LSPs' low innovation achievements can be proposed from the development of a LSP-specific model of an innovation process?*"

Among the possible objects of study, an innovation generation process with LSP-internal implementation and subsequent roll-out, i.e. LSP-wide implementation after the first implementation, was chosen (cp. Chapter 4.2.1.2). Thus, an archetypical model of such a process is to be developed. In accordance with the formulation of research question 3, the purpose of this model is purely analytical.

The remainder of this text begins with the methodology specific to this text, i.e. the action research approach, together with the expert round it was used in, and the general mode of operation in that work group. The model's development, however, is allocated to the subsequent results chapter, as it can impact the results themselves (Westbrook 1995). The final results follow. Therein, a link between innovation processes and the innovation management system is established first. Then, the process model is introduced in its entirety, before each of its four phases[81] (with a total of twelve activities) is presented on a stand-alone basis. The text is concluded in the usual three-phase way, i.e. by means of a scientific summary, an assessment of managerial implications and recognition of the text's limitations.

4.1 Methodology

In this section, the chosen action research approach is described first. After that, the expert round is depicted.

4.1.1 Action Research

Given the largely exploratory nature of this research and the complexity of the individual research subjects, it was reasonable to apply a flexible methodology on a small scale. For the following reasons, it was decided to use the action research approach:

1. Action research allows for the explicit incorporation and review of existing results.

[81] In the nomenclature of this text, a "phase" consists of at least one "activity" which in turn may be comprised of multiple "tasks".

2. It could be assumed that those previous – supposedly generally applicable – findings needed only refinement, but were not completely misleading. This fits the high need for connectivity with existing research (cp. the introduction to this text).
3. As none of the LSPs that participated in the work group was of the opinion that they already employed a very good process model, the purpose was concerted learning rather than purely observation. This confirmed the preference of action research to the best alternative approach, namely explorative case study work. It also lead to a half-descriptive, half normative character of the proposed model.

Action research is increasingly used within logistics research (cp. Bichou and Gray 2005; Boer et al. 2005; Cagliano et al. 2005; Craighead et al. 2007; Evangelista and Sweeney 2006; Koplin 2005; Middel et al. 2005; Müller 2005; Naslund 2002; Prockl 2005). According to Müller (2005), action research is characterized by its relation to practical problems, by taking action, by being discourse-oriented and embedded in practice, by a function of the researcher as an agent of change and by being dialectic. The aim of an action researcher is to get a holistic understanding of the situation and not only about a few variables. Through close interaction with managers in charge it is possible to develop a deep situational understanding which is especially helpful for establishing theories (Westbrook 1995). The action research procedure is hence iterative, heuristically and contains feedback loops (Westbrook 1995). In action research it is vital to document the proceeding in detail. Action research requires a proactive management of the research process itself. Westbrook (1995) provides specific advice on ensuring the quality of the research process, in particular its reliability. Table 4-1 contains his recommendations and their implementation in this research project.

Advice	**Coverage**
Mapping criterion	Open discussion about possible phases, gates, activities, responsibilities for assignments, tools and pitfalls
Incorporation of multiple viewpoints	Group discussion among six to eight experts
	As far as possible, two experts of each partner corporation
Usage of simple semi-standard record formats	Presentation of results in Microsoft PowerPoint
	Completion of figures and tables in Microsoft Excel by the experts
Cross-check of write-ups	Use of mailing list
	Discussion of the figures and graphs at the workshops
Preference of hard to soft data	Realization impossible, because of the competitive environment amongst the experts' companies
Treatment of opinions as valuable data	Documentation of process and discussion with detailed protocols
Usage of an assistant to do much writing-up	Documentation of discussion by currently inactive person
Choice of appropriate frequency of site visits	Agreement about the frequency and overall length, upfront

Table 4-1: Action Research Design Advice and Coverage

As regards the assessment of the methodology, its central advantage was that it fulfilled its scientific purpose as expressed by research question 3 and the introductory chapter to this text. According to the involved experts, the model is also useful in their corporate practice.

The major disadvantage of the methodology stems from the fact that the researcher went beyond the usual observatory role which impacts validity negatively (in more detail cp. the following sections). Specifically, topics were proposed, discussions were moderated, and analytical input was provided. This affected the model itself. Given the outset of this research where practitioners felt a lack of suitable process models, pure observation had not been an option. It is consequentially exactly the action research approach which allowed not only developing a descriptive model, but even a normative one.

4.1.2 Expert Round

An expert round consisting of executive managers from the logistics industry was chosen as medium of research. The first section depicts its set-up and structure, while the second points out its mode of operation.

4.1.2.1 Set-up and Structure

The motivation for setting up a work group emerged in the beginning of 2006, based on the research motivation of this work and on practitioners' interest in the superordinate topic of LSPs' innovation management. The scientific purpose of the work group as defined at its outset was to contribute to the answer of the research-motivating question. Its managerial aim was to develop application-oriented recommendations on LSPs' innovation management. LSPs were hence chosen as objects of study. To acquire participants, a brief description of the work group was distributed at the Campus for Supply Chain Management of WHU – Otto Beisheim School of Management. In total, 19 conversations with initially interested practitioners occurred. Nine LSPs decided not to take part in the work group due to financial[82] or temporal restrictions, in one case due to the participation of a competitor. Four large, internationally operating LSPs participated in the expert round, which took place in the second half of 2006. All of those LSPs were active in innovation, i.e. they invested resources for innovation-related efforts (cp. Aschhoff et al. 2009). They were convinced, however, that their innovation management processes were not "optimal", yet, so that they hoped to be able to learn from the work group. That setting fit the action research approach very well, because organizations were knowledgeable through their past innovation endeavours, while learning was desired and deemed possible. Asked to assess the usage frequency of certain innovation management approaches for their own organization and for LSPs in general, participants from the LSPs provided very similar answers for their own organizations and for LSPs, in general,[83] an indication of external validity of the results (Yin 2003). Each of the

[82] It had been necessary to charge the participating LSPs a fee to cover the costs of research.

[83] Respondents had been asked for two judgments: one with respect to their own organization, the other with respect to LSPs, in general. There were five complete answers from three organizations. The eight items referred to strategic specifications of innovation management (cp. Hauschildt 2004) which were used as measures of the LSPs' innovation management behaviours. The mean values of the empirical coefficient of variation between the respondent's own LSP and the LSP industry, calculated across all eight items, was between 2.50% and 10.24% for the five experts, with a mean value across experts of 6.55%. This indicates that the average difference between a LSP-related value and the mean value of the LSP-related value and the industry-related value did not exceed 10.24% of a standard deviation from the point of view of any of the experts. It compares to mean empirical coefficients of variation between the eight strategic specification items, calculated across the respondent's own LSP and the LSP industry, between 16.21% and 48.05% for the five experts, with a mean value across experts of 28.45%. This indicates that the average difference between a strategic specification value

organizations was characterized by LSPs' four typical features (cp. Chapter 2.3.3).[84] The model's outreach is therefore limited[85] to typical LSPs which are defined as LSPs with all typical features.

Seven experts participated whom the LSPs had nominated due to their knowledge concerning the topic and due to their interest in it. They belonged mainly to the second management levels of German-speaking organizations or the corporate headquarters of their companies and were involved in the LSPs' innovation management. Across all organizations, it was further desirable to incorporate differing functional perspectives. While the fulfilment of this criterion could not be planned, it was well met: Responsibilities covered product development[86], product management, corporate development, key account management and operations. Ideally, every single LSP should be represented by multiple participants in order to allow different perspectives within a company and in order to enable discussions outside the official meetings. Too many participants would likely have formalized the atmosphere which in turn might have impacted the openness of discussions negatively, so that the participating LSPs were allowed two participants per organization. The research team itself consisted of two people, as well: the author who held responsibility for content-related preparation, post-processing and who acted as moderator, as well as a second researcher acting as a co-moderator and critical counterpart during the discussions.

4.1.2.2 Mode of Operation

Four whole-day workshops were conducted.[87] Workshops were prepared in advance and summed up in detail afterwards. In each workshop, previous scientific findings, i.e. mostly findings from the LSP-unspecific innovation management literature, were presented and discussed. The time share of presentation vs. discussion decreased from workshop to workshop. Discussions of the involved experts with the purpose of creating chains of evidence and the review of previous results through the experts were supposed to affect both construct validity and internal validity positively (Yin 2003).

The decision on the topics of the workshops was dynamic, i.e. during each workshop, the experts decided on the topics of the following workshop. The key criterion for the decision on a subject was the accessibility of the results for direct implementation into practice. Out of this requirement, the workshops focused on the processes of innovation generation at LSPs

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and the mean of strategic specification values exceeded 16.21 % of a standard deviation for each of the experts. As for each item variation between the LSPs and the LSP industry was much lower than variation between the items pertaining to strategic specification, the LSPs are assessed to be good representatives of LSPs.

[84] A noteworthy side note was that – while all felt their individual customers to be highly important, there was some disagreement about the consequences of individual customer's importance and the perceived level of customer dependence. This resulted in different choices concerning the products vs. the solutions approach that will be discussed in a later chapter (cp. Chapter 5.2.3.3).

[85] As was pointed out before, the LSPs can be regarded as representatives of typical LSPs', and they seem to be characterized by typical innovation management behaviour. However, as the four organizations are replications of one another with respect to the four typical features, there are no variations stemming from low and high typical feature values, so that it is necessary to restrict the model's field of application (cp. Yin 2003).

[86] Many LSPs use that function denomination to refer to the generation and implementation of product innovations, i.e. typically new logistical services.

[87] The workshop language was mostly German and occasionally English. For six of the seven participants, as well as for the researchers, it was their native language. One participant was a native speaker of English, but fluent in German.

and on the development of the model at hand. The high interest of the practitioners in the model emphasizes its importance.

Seven previous LSP-unspecific process models were used as a point of departure for the development of the process model (cp. Chapter 4.2.1.1). Those were assessed by the expert group against criteria identified[88] from the literature and against the needs of typical LSPs (cp. Chapter 4.2.1.2). To this aim, it was necessary to discuss typical LSP features with the group. The factors discussed in Chapter 2.3.2 were confirmed by the experts.[89] Their effects are discussed throughout Chapter 4.2.

4.2 Results

In this section, the development of the process model from previous cornerstone models is explained first, based on twelve requirements. A framework linking innovation processes with the innovation management system will be described in a second section. Afterwards, the model as a whole is depicted. In the ultimate sections, the individual phases and activities are discussed and described in detail.

The presentation of the results is a direct consequence of their development: First, because of the involvement of the author in the research process, citations from the expert group could have been influenced by statements of the researcher, so that their validity could have been affected negatively. They are hence not used as argumentative support, but omitted from this text. Second, while the approximation to the results becomes visible through the discussion on requirements and on their fulfilment, the results must be presented in a quasi-normative way. However, the presentation aims at highlighting why the results are reasonable and adequate.

4.2.1 Development of the Process Model

This section includes a brief description of previous process models which formed the point of departure for the process model development. Requirements on the process model follow, together with the means they were addressed with.

4.2.1.1 Cornerstone Models of Innovation Generation

There are numerous phase models of innovation development in the literature. It is established practice for them to depict innovation generation in a quasi-linear manner despite the iterative nature and frequently existing backward loops of those processes (Garcia and Calantone 2002; Thom 1992). In addition, abortions of innovation processes are possible without being explicated. Seven of those models were chosen as cornerstone models. Each of them was presented to the practitioners and assessed with them.[90] An overview of their phase sequences is depicted in Figure 4-1. The depicted allocation of activities to the phases of the LSP-specific process model will be explained in a later chapter.

[88] This task was allocated to the author.
[89] Also cp. the following Chapter 5, where all of the contingency factors that typical features are formed of, reappear as contingency factors at the individual company level.
[90] Noteworthiness was a sufficient selection criterion for an individual model, as the action research approach made possible weaknesses transparent and leads to the development of remedies.

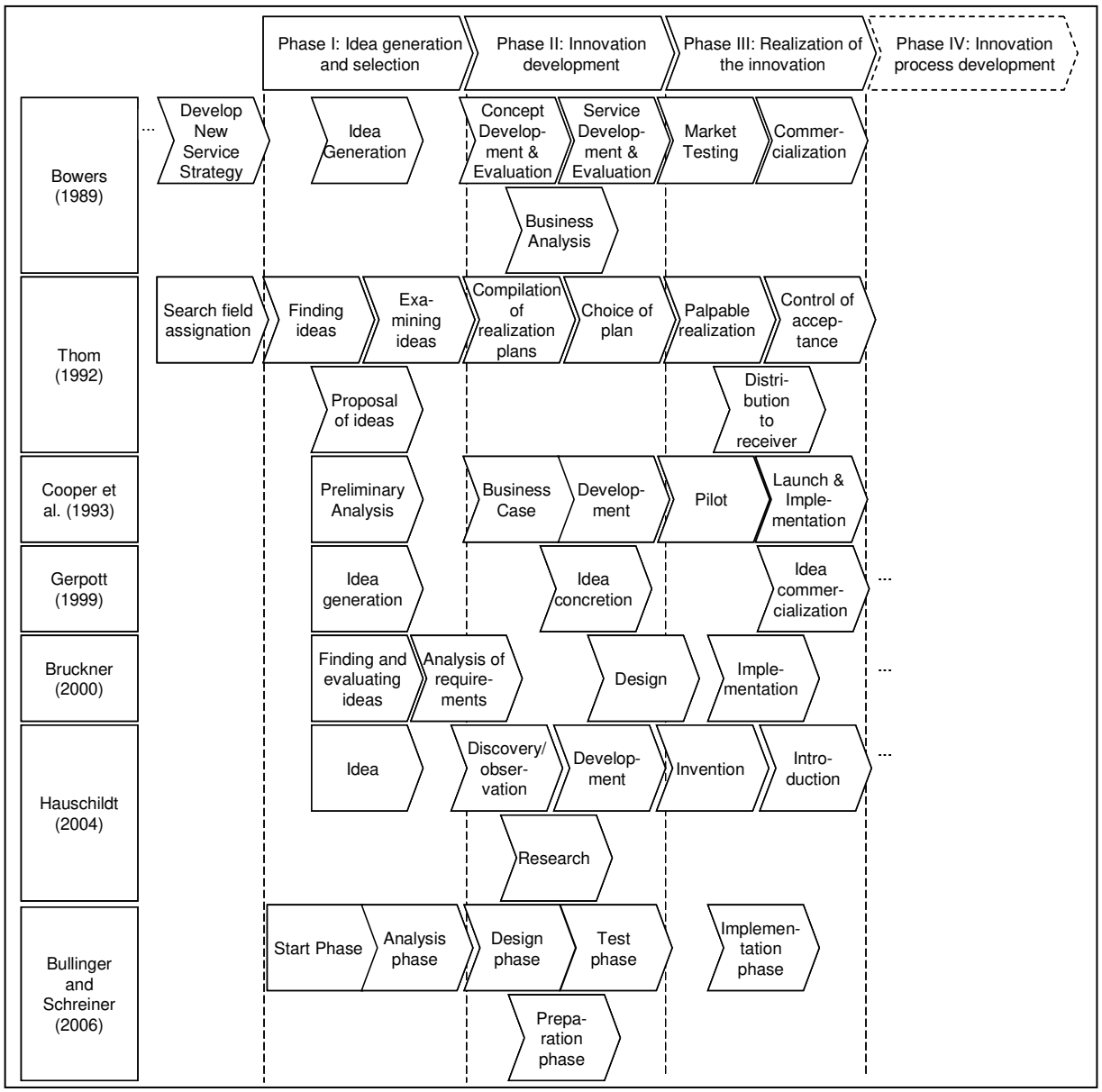

Figure 4-1: Evolvement of Cornerstone Models and Allocation to Phases of the LSP Model

The first model that was chosen is the one presented by Bowers (1989) who derived a normative procedural model for service contexts from models stemming from goods contexts. The model of Thom (1992) was also developed for a service context. It is very detailed and comprehensive. Of particular importance for both models is the integration into an encompassing innovation management framework which was foreshadowed by means of a "New service development strategy" activity (Bowers 1989) respectively a "Search field assignment" activity (Thom 1992). The model of Thom (1992) further comes forward as the only model with a distinct activity for the proposal of ideas. The stage-gate process model of Cooper and Kleinschmidt (1993) respectively its successor works (Cooper, Edgett and Kleinschmidt 2002a; Cooper, Edgett and Kleinschmidt 2002b) depict a particularly innovative model which introduced formalized kill-or-go decisions linked to milestones over the course of an innovation generation process. Gerpott (1999; 2005) can be seen as an agent of a particularly simple and straight-forward model consisting of only three phases which

processes across different industries supposedly have in common,[91] namely idea generation, idea concretion and idea commercialization. In his Ph.D. dissertation, Bruckner (2000) emphasizes the varying competencies that are relevant throughout the phases of innovation generation processes. His considerations formed the motivation for the model to be developed to analyze phase-specific success factors, as well. The model of Hauschildt (2004) was incorporated because his work integrated the innovation research tradition of the German-speaking area, where the work group took place. Finally, Bullinger and Schreiner (2006) describe a service-specific model which in itself is a synthesis of a review of various models. In addition, they provided the impetus to distinguish phase-specific management and IT instruments (labelled *methods* and *tools* by Bullinger and Schreiner 2006, p. 75; translation by the author).

4.2.1.2 Process Model Requirements and Consideration

Over the course of the discussions in the work group, twelve requirements were established which the model under development should fulfil.[92] The reasoning behind each of the requirements shall be presented in this section. For the sake of better readability it will also be highlighted within this section how those requirements were taken into count.

According to General Model Theory (Kühne 2005; Stachowiak 1973), any model is characterized by three central features. That is firstly the mapping feature: Models are maps of certain originals which likely have an abstract character themselves. The second characteristic is the reduction feature: Only relevant properties of the original are mapped into the model. Finally, there is the pragmatic feature: Models fulfil a surrogate function for their users. A model's users determine its purpose. These general features were used as guiding questions of the group's discussion and therefore as modelling criteria: It had to be decided as the first requirement which entity should be mapped in the model. Second, it had to be determined which aspects of that entity had to be modelled. Those could either be innovation-related, or they could stem from high interest of the work group. Simultaneously, it was decided which aspects could be omitted. The third requirement was that the model needed an unambiguous purpose.

As was highlighted in Chapter 2.2.1, innovation adoption processes are firstly decision-making processes and are begun with an external impetus, namely the existence of something which might possibly be adopted, while innovation generation processes are begun as creative processes and with an internal impetus. Those types of processes clearly evolve so differently that a single model cannot cover both simultaneously. Therefore, with respect to the mapping criterion, a decision had to be taken between a generation process and an adoption process.[93] The experts agreed that for typical LSPs, generation processes pose larger challenges than adoption processes so that the former should be modelled. There was further consensus that generated novelties would typically be exploited by means of internal implementation.

[91] Cp. the cited statement in the introduction to this text.
[92] Usually, the author proposed a criterion to the group from which a requirement could possibly be established. That was then assessed in a group discussion which the author and the second researcher tried to moderate, rather than to lead.
[93] This decision can also be related to the reduction feature, because disregard of type of innovation process was assessed as an invalid oversimplification, i.e. the type of innovation must be taken into account.

Besides, the discussion made it clear that another challenge exists which consists of the roll-out of the innovation. Therefore, the modelling was extended to include that, as well. With respect to the first requirement it was hence decided that the model should be a map of a typical LSPs' innovation generation, implementation and roll-out process (cp. Chapter 4.2.3).

As regards the reduction criterion, it was decided that activities to be undertaken were to be regarded as the most important aspect to be modelled. Decisions about responsible actors were also found relevant by the expert group, but could not be entirely generalized without knowledge of the individual organizational structure. The competitive setting between LSPs forbid discussing those, so that at least the allocation of tasks to central or de-central units should be analyzed. Further, the experts were interested in instruments that could be applied to help them in their innovation developments. It was found helpful to distinguish between IT instruments and management tools. Knowledge about success factors was assessed to be helpful in management practice, so that the work of Göpfert and Hillbrand (2005) should be extended towards success factors within each activity. Over the course of the discussion it was found that differentiations between the classical types of innovation (cp. Chapter 2.2.1) were relatively unimportant. In particular, at the level of abstraction of the model it was not necessary to distinguish between process innovations and product innovations, nor between technical and organizational novelties. As regards the newness to the firm of the innovation to be developed, it was decided to focus on innovations radical enough to be worth the effort associated with a formalized process model, i.e. the most incremental ones should be omitted. At the other end of the spectrum, there was consensus in the group that the most radical and disruptive ones were so infrequent and likely so difficult to map in a formalized model that they should also be omitted. All participants agreed that the previous mapping vs. reduction decisions which together make up the incorporation of the reduction criterion lead to a good compromise between the model's outreach and its specificity. Where it seems befitting, the presentation of the final model will incorporate case distinctions, however (cp. Chapters 4.2.4 to 4.2.7).

Concerning the deduction of the third requirement from the pragmatic criterion, the central purpose of the model was decided to be its applicability for analytical purposes. Accordingly, the model derived here is not intended to be used as a tool which can be rolled out through an LSP's organization (it would be too complex for that), but to allow for the analysis of innovation development. Such an analysis might have to be carried out not only by scholars, but also by, e. g., innovation managers looking for bottlenecks, or by management consultants reviewing a long-term business plan. As the incorporation of earlier phase models in the action research process ensures the model's connectivity with existing research, and as a transfer of the model into other contexts does not seem necessary, the argument that innovation process models should have few phases with few activities to make them compatible with other models (Heinemann 2007), does not apply here. In fact, from the analytical purpose of the model follows a preferably high level of disaggregation into individual activities (cp. Chapter 4.2.3). The resulting complexity (Krallmann, Frank and Gronau 1999) is accepted because of the expected additional usage. Last, the work group was of the opinion that the Fuzzy Front End was a particularly challenging phase which should receive special attention. Therefore, it was decided that it should be modelled as an individual phase and be relatively finely partitioned into individual activities (cp. Chapter 4.2.4).

The next requirements were gained from the assessment of the cornerstone models. It was deemed a positive feature to formally link the model to the embracing innovation system, as for example Bowers (1989) and Thom (1992) suggested, so that this became a fourth requirement. The reason is the opportunity to institutionalize the commencement of innovation processes, rather than to merely rely on their existence. However, an activity such as the development of a new service strategy or a search field assignment for the development of new ideas do not have to occur with every newly begun innovation process, so that it was preferred not to incorporate them directly into the model, but to construct an accompanying model of the interface between innovation processes and the innovation system (cp. Chapter 4.2.2).

Next, none of the models incorporates the possibility of or even methods for an ex-post assessment of the innovation development process. Merely the innovation itself is assessed as a result of the development process in some of the models (Bruckner 2000; Cooper and Kleinschmidt 1993; Thom 1992). By neglecting this step, it is made impossible to systematically develop the applied processes during the course of learning processes. The fifth requirement is hence to formally incorporate procedural learning. This was addressed by means of incorporating a distinct phase in the final model (cp. Chapter 4.2.7).

It was agreed upon by the group of experts that the service character of logistics services which is expressed in, e.g. immateriality und intangibility, makes it impossible to utilise large areas of innovation research related to goods, e.g., concerning the construction of prototypes (cp. Chapter 2.3.2). The service character in general further leads to a higher level of abstraction, to decreased predictability and decreased openness to tests, as well as to lower openness to legal protection (Bruhn 2006; Zeithaml, Parasuraman and Berry 1985). Therefore, the sixth requirement on the process model is that it should take that service character into account. This is firstly realized by omitting activities aimed only at goods producers, such as “construction of prototype”, and secondly by the embodiments of activities (especially activities II.1 and II.3, cp. Chapters 4.2.5.1 and 4.2.5.3).

The model under development should further be tailored to the needs of typical LSPs. Therefore, the recognition of LSPs’ often de-centralized organizational structures, their frequently high importance of individual customers, their usually comparatively low level of education of their staff, and their typical down-to-earth character make up the seventh to tenth requirements. Those features first of all had to be assessed with respect to possible effectiveness on LSPs’ innovation management (cp. Chapters 2.3.3 and 2.3.4). This assessment was based on LSPs’ previous experience, as well as on the group’s argumentation of expected effects. The proposed factors were found relevant by each of the practitioners and were deemed to be “complete” in such a way that no expert could name a missing factor. Overall, it was expected that the features would work as barriers, rather than as facilitating factors. This was confirmed and will be visible within the twelve activities of the final model.

As the first of the four typical LSP features, LSPs’ typically high level of de-centralization had to be taken into account. It is more likely in a dispersed organization that innovative ideas generated by the staff are not noticed by a central innovation management responsibility than in a centralized organization. Therefore, a distinct activity I.2, referring to the intra-organizational communication of ideas to prevent their non-observance (cp. Chapter 4.2.4.2),

is incorporated in the model. Together with the other typical feature down-to-earth-ness, de-centralization was assessed to make the roll-out of generated innovations more difficult. This is addressed by incorporating another distinct activity, namely activity III.4, to enable the conscious and proactive management of the transfer to day-to-day business (cp. Chapter 4.2.6.4). In line with the argumentation concerning the pragmatic criterion, in particular the general importance of the Fuzzy Front End, the typically high level of de-centralization was a second motivation to separate the idea generation and selection phase from the innovation development phase (cp. Chapter 4.2.3) and to finely separate activities within that phase (cp. Chapter 4.2.4). Specifically, the assessment and pre-selection of ideas should be designed as a deliberate step towards a higher level of formalization, as this characteristic reduces the danger of non-visibility of new ideas. Last, individual activities' specific embodiment was affected by de-centralization (all further activities in phase I and II, cp. Chapters 4.2.4 and 4.2.5).

Next, the high importance of individual customers has to be taken into account. Its immediate effect is that customer proximity can be used to receive external input (cp. the embodiments of the activities I.1 to II.3 in chapters 4.2.4 and 4.2.5). On the other hand, there is potential bias towards individual customers and away from an unspecific market which calls for a conscious management of the assessment and pre-selection of ideas. This should safeguard that not every customer wish is realized without further consideration, and that the usability of customer-specific solutions as future standards and vice versa are considered. This line of reasoning underpins again the need for separating assessment and pre-selection of ideas from neighbouring activities and for formalizing it to some extent (4.2.4.4).

The on average low educational level within the workforce of LSPs does not affect the workflow as depicted in the process model. However, this typical feature of LSPs can obstruct many activities and should hence be managed proactively (cp. especially activities I.1, I.2, II.1, II.2 and IV in Chapters 4.2.4.1, 4.2.4.2, 4.2.5.1, 4.2.5.2 and 4.2.7).

The last typical feature, down-to-earth-ness, also refers to the suitability of LSPs' staff respectively of their culture with respect to innovation. Like the previous factor, it does not impact the general design of innovation processes, but manifests itself as a barrier within individual activities (cp. especially activities I.1, I.2, II.2 and IV in Chapters 4.2.4.1, 4.2.4.2, 4.2.5.2 and 4.2.7).

Two final requirements stem from previous research on LSPs' innovation management. According to Göpfert and Hillbrand (2005), it is important that the model safeguards *process completeness* and that it ensures an "*authoritative workflow and decision making structure*" (Göpfert and Hillbrand 2005, p. 53; translation by the author).

The eleventh requirement, process completeness, was ensured with the help of the cornerstone models of innovation generation. To this aim, the LSP-specific model under development was compared against each of the seven cornerstone models to make sure that each activity from the cornerstone models was integrated (albeit possibly under a different name) into the LSP model and that activities were meaningfully ordered and sensibly allocated to the superordinate phases (cp. Figure 4-1 on page 51 and Chapter 4.2.3).

Finally, a suitable workflow and decision-making structure were already largely assessed at the activity level through the high level of disaggregation of the process and the conscious ordering of activities. At the level of phases, the sequence follows the usual separation in which development is separated from implementation and usage (cp. Chapter 3.1.2). For the already discussed reasons, the Fuzzy Front End was further separated from the development activities, and the innovation process development phase was added (cp. Chapter 4.2.3). An overview of all the recommendations and of their means of consideration is depicted in Table 4-2.

Requirement	**Consideration**
Mapping criterion	Mapping of innovation generation, implementation and roll-out processes at LSPs respectively of mental models thereof
Reduction criterion	Focusing on activities, allocation of actors, IT and management tools and on success factors
	No need to differ between administrative and technical innovations nor between product and process innovations
	More than incrementally new, but less than radically new innovations
Pragmatic criterion	Analytical purpose
	Relative focus on Fuzzy Front End
Connectivity with innovation management system	Integration into a procedural framework of innovation management
Enabling of procedural learning	Distinct activity IV.1: innovation process development
Service context	Absence of activities aiming at producers of physical goods
	Embodiment of individual activities (esp. activities II.1 and II.3)
LSPs' organizations often de-centralized	Distinct activity I.2: communicating ideas
	Distinct activity III.4: transfer to day-to-day business
	Separation of idea generation and selection from other activities
	Fine activity distinction within idea generation and selection phase
	Composition of individual activities (all activities in phases I and II)
Frequently high importance of individual customers	Separation of assessment and pre-selection of ideas from neighbouring activities
	Composition of individual activities (all activities in phases I and II)
Educational level of the employees often low	Composition of individual activities (esp. activities I.1, I.2, II.1, II.2 and IV)
LSPs often being down-to-earth	Composition of individual activities (esp. activities I.1, I.2, II.2 and IV)
Completeness of process	Mapping of all LSP-related activities of cornerstone models
Authoritative workflow and decision-making structure	High level of disaggregation of the process
	Conscious ordering of activities and phases

Table 4-2: Process Model Requirements and Consideration

4.2.2 Process-system Interaction Framework

In Chapter 2.2.2, it was shown that the management of innovation processes and the management of the innovation system are both necessary to cover the subject innovation management entirely. That raises the question of linking the related perspectives. From a systemic perspective, innovation processes can easily be understood as system elements

which are related to other system elements. From a procedural perspective, the link is more difficult to establish.

To understand the surrounding conditions for the sequence of events in innovation processes, the expert round set itself the target to create a framework in which innovation processes are embedded into a comprehensive innovation management system. A bottom-up approach was used, i.e. it was not tried to position elements from a systemic perspective[94] in the framework, but rather elements that had to be given from the point of view of the individual innovation process were collected and then logically connected. The proprietary framework that was set up includes a number of innovation management elements beyond the management of individual innovation processes which were also understood as processes by the work group (cp. Figure 4-2).

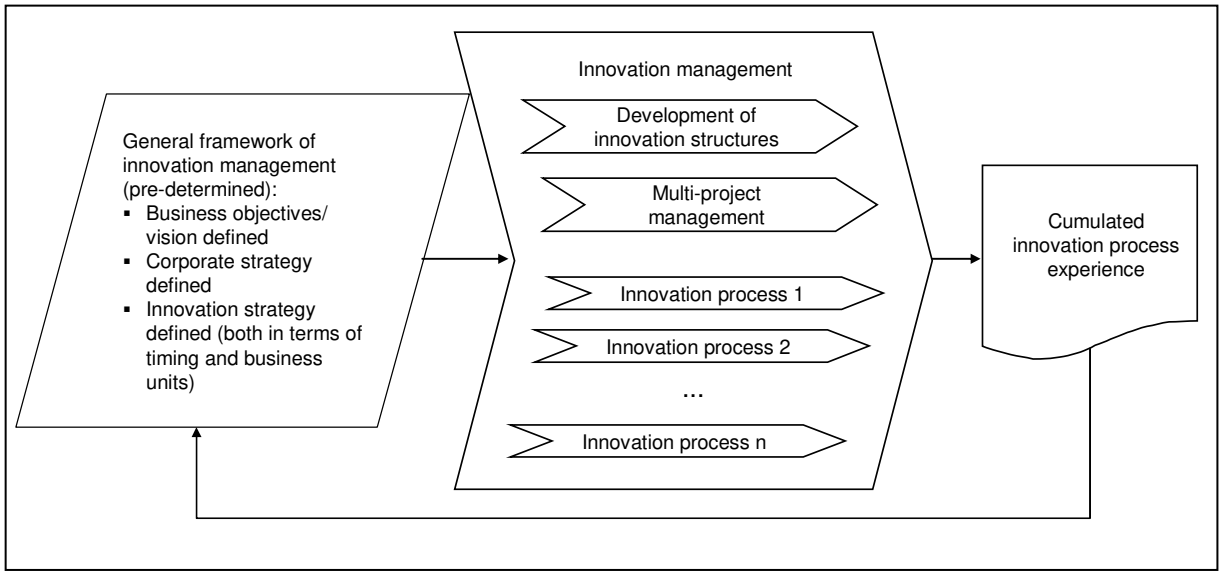

Figure 4-2: Process-system Interaction Framework Derived From Action Research

The illustration shows a balanced state, in which innovation management is basically implemented and established (cp. Busse and Wagner 2008b). Therefore, modifications can be made in an incremental way and presumably without the need for structural breaks. The modification of the elements of the framework is ensured through continuous learning which is enabled by *cumulated innovation process experience*, an element that collects the experience gained over time.

The *surrounding conditions of innovation management* are defined by *corporate strategy* and its determinants, as well as by the company's *goal or vision*. The *innovation strategy* derived from the enterprise's strategy determines the timing of innovation behaviour, the specific fields of search (e.g., concentration on certain business segments or exclusive search for innovations decreasing costs), as well as the priorities. *Development of innovation structures* includes the establishment and advancement of innovation management concepts within the operational und organizational structure. Thus, this function will be of low priority, once the

[94] Such as, e.g., the Adams, Bessant and Phelps (2006) framework that was introduced in Chapter 3.1.2 and applied in Chapters 3.2.2.1 to 3.2.2.7

balanced state is reached. It is however of much more importance for the establishment of the innovation management and for the accomplishment of structural changes (Busse and Wagner 2008b). *Multi-project management* aims at the central coordination and control of the innovation project portfolio. Besides deciding about beginning and termination of innovation processes, multi-project management is responsible for resolving resource conflicts, it should include mentoring and training of innovation project and program managers, and it should provide adequate instruments. Elements of innovation management which cannot directly be linked to a procedural understanding (such as an innovation culture of a company) are not shown in the framework.

According to the expert round, it seems imaginable that the functions of innovation structure development and multi-project management could be institutionally united in a single responsible actor, such as an administrative department close to the LSP's top management. Because of the high strategic importance of those activities, corporate top management ought to be involved not just in objectives and strategy definition, but also in the development of innovation structures and in multi-project management. For individual innovation processes top management is likely only involved as a promoter, backing up the plans of the managers in charge (cp. Witte 1973).

4.2.3 Holistic Process Model

In compliance with the process completeness criterion (cp. Chapter 4.2.1.2), the cornerstone models introduced in Chapter 4.2.1.1 were compared with respect to the process evolvement they depicted (cp. Figure 4-1 on page 51). The comparison shows that in each of those models there are activities which can be grouped to a phase *idea generation and selection*, other activities which can be grouped to a phase *innovation development* and yet others which can be grouped to a phase *realization of the innovation*.

On the other hand, there is no activity in any of the seven cornerstone models which cannot be related to either one of the three phases above, to ongoing usage of the generated innovation or to the linkage with the innovation management system. The process-system interaction framework exists already, and ongoing usage of a finished innovation is deliberately not modelled here. Thus, *idea generation and selection*, *innovation development* and *realization of the innovation* form the central phases. As a fourth major phase *innovation process development* is added which aims at the institutionalization of the process improvement. It is important to highlight again that this phase covers learning with respect to the workflow in a single idealized innovation process. Learning in regard to the design of the whole innovation management system was illustrated in the framework in a cumulated way. This reflects a conscious modelling decision: It is expected that changes concerning innovation management as a whole will be so rare and characterized by so much uncertainty that it would not be adequate to establish a standard review process.

The idealized procedural model of innovation generation, implementation and roll-out for a typical LSP follows a sub-division of its four main phases into twelve distinct activities (cp. Figure 4-3). For each of those main phases and activities the following sections present further details with respect to content, allocation to central respectively de-central actors, IT and management instruments and to success factors, as far as they are relevant.

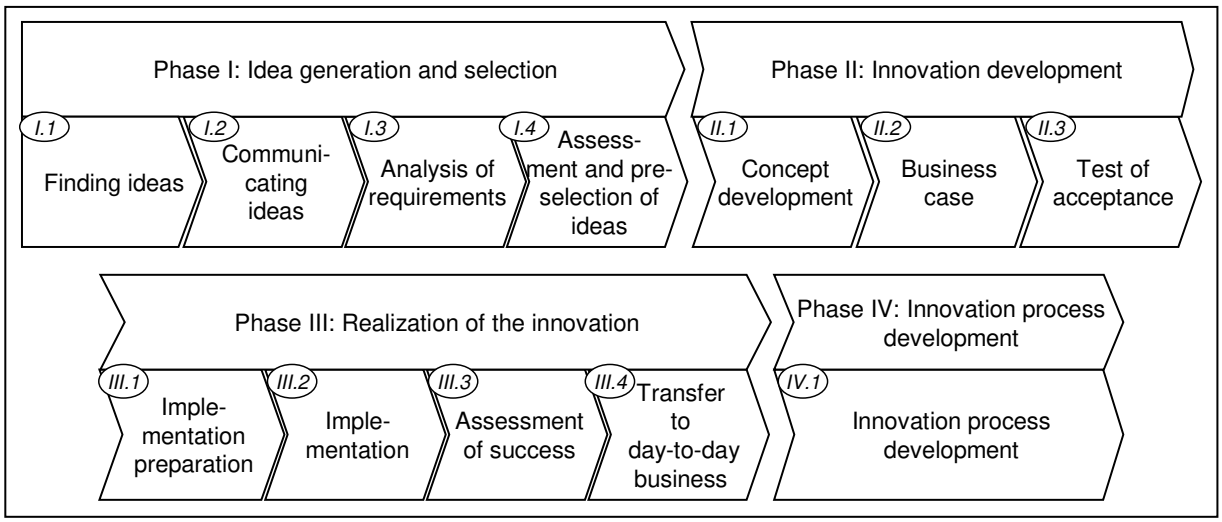

Figure 4-3: Idealized Procedural Model of Innovation Generation, Implementation and Roll-out for a Typical LSP

The experts agreed with Cooper's and Kleinschmidt's (1993) general assessment that the success of the modelled[95] innovation generation processes is relatively predictable and controllable. Thus, the entire process can and should be constructed as a stage-gate process. The concrete timing of gates can be adjusted to the existing workflows of the individual LSP such as, e.g. existing multi-project management review cycles. However, occasionally representative statements can be made.

Concerning success factors of innovation management at LSPs, the experts agreed with success factors postulated by Göpfert and Hillbrand (2005) and with their positive influence on success:[96] In respect to innovation strategy the following factors are of relevance:[97] *top management commitment*[98], *content-related focusing*[99], *pro-active search for ideas*[100] and *standardization*[101]. Relating to innovation structure the following factors are of importance: *central coordination unit*[102], *high hierarchical anchorage of innovation projects*[103] and *interdisciplinary team structure*[104]. Considering the innovation process itself, two further

[95] Those excluded merely incremental, as well as truly radical innovations (cp. Chapter 4.2.1.2).
[96] On a five-point scale from "1= not relevant" to "5 = very relevant", none of the factors received any value lower than "3 = somewhat relevant" from any of the six respondents to this question. While a T-test cannot be undertaken due to the lack of (approximately) Gaussian distribution, each of the success factors had mean values more than one standard distribution higher than the neutral value 3, so that the factors were regarded as supported (also cp. the following footnotes). The subsequent discussion in the work group provided further support.
[97] All translations by the author
[98] N = 6; estimated $\mu = 4{,}67$; estimated $\sigma = 0{,}52$
[99] N = 6; estimated $\mu = 4{,}33$; estimated $\sigma = 0{,}52$
[100] N = 6; estimated $\mu = 4{,}17$; estimated $\sigma = 0{,}75$
[101] N = 6; estimated $\mu = 3{,}67$; estimated $\sigma = 0{,}52$
[102] N = 6; estimated $\mu = 4{,}17$; estimated $\sigma = 0{,}75$
[103] N = 6; estimated $\mu = 4{,}00$; estimated $\sigma = 0{,}63$
[104] N = 6; estimated $\mu = 4{,}33$; estimated $\sigma = 0{,}82$

aspects; namely *completeness of process*[105] and *authoritative workflow and decision-making structure*[106] were already discussed and recognized.

In addition to the confirmation of the above factors, further success factors emerged, most of which relate to more than one activity: An *adequate HR policy* is regarded a success factor that reflects the meaningfulness of suitable participants of innovation projects, as well as of team structure (cp. Amabile 1998; Bantel and Jackson 1989). It thus emphasizes the importance of recruiting and training, in fact independent of phases. *Stimulation of creativity* is deemed a success factor within the phase of idea generation and selection because creativity is seen as source of innovation ideas (cp. Hirst, van Knippenberg and Zhou 2009; Oldham and Cummings 1996) which should therefore be fostered. The experts proposed using interdisciplinary working groups or allowing a certain degree of freedom to foster creativity. Different sources of inputs are existing or potential customers, i.e. the LSPs' market, as well as their competitors.[107] Therefore, *transparency of market and competition* is seen as a success factor within the phase of idea generation and selection. It is still relevant afterwards, i.e. during the innovation (concept) development phase. The reasons are that customer feedback can be used to re-align innovation development efforts, and that benchmarking against competing solutions can provide valuable information, as well. In fact, feedback from all business partners can be valuable not only for the generation of ideas, but also for their assessment against requirements, as well as for their selection. Thus, *gathering of feedback from business partners* was understood to be a success factor within the phase of idea generation and selection by the experts. In later phases, feedback information is required, as well, but rather as a means of control than planning. Therefore, *utilization of key performance indicators* e.g., concerning customer satisfaction, is regarded as a success factor relevant for the individual activities of assessment of success and transfer to day-to-day business (cp. Akroyd, Narayan and Sridharan 2009).

4.2.4 Phase I – Idea Generation and Selection

The aim of this phase is the creation and selection of innovation ideas. In line with findings from the general literature, emphasis should lie on the provision of methods (Boeddrich 2004) and on a cultural respectively leadership environment allowing freedom for new approaches (Tushman and Nadler 1986; van de Ven 1986). Tight guidelines or standardized process flows are considered to be contra-productive.

4.2.4.1 Activity I.1: Finding Ideas

The purpose of the activity *finding ideas* is the generation of new means or new ends (cp. Pfohl, Frunzke and Köhler 2007a). A new means is aimed at improving the efficiency of existing services by using new processes, tools or technologies, while a new end contains a new service aiming at the fulfilment of unsatisfied or latent customer needs. By definition of innovation, both approaches have to aim for commercial exploitation (cp. Chapter 2.2.1).

[105] N = 6; estimated $\mu = 3{,}67$; estimated $\sigma = 0{,}52$
[106] N = 6; estimated $\mu = 3{,}83$; estimated $\sigma = 0{,}75$
[107] The latter refers to innovation adoption more strongly than to innovation generation.

As *finding ideas* is directed at a novelty, the search for ideas is highly unpredictable and demands a large portion of creativity (cp. e.g. Tushman and Nadler 1986 without special reference to LSPs). Therefore, this activity cannot be structured nor divided further. A new function includes a completely new service.

There was agreement in the work group that in a de-centralized LSP with highly important customers, the search for ideas mostly takes place de-centrally and mostly on request of those customers. Thus, all de-centrally employed staff could theoretically be actors. The cultural barrier of the LSPs generally being down-to-earth could however result in a reduced willingness of individual employees to search for new ideas. Their comparatively low educational level could lead to a limited capability of doing so. It seems that the relatively low innovation capability of LSPs, compared to other industries, is already inherent in the beginning of innovation processes. It follows that for effective innovation process management LSPs should pursue an adequate staffing policy (cp. the aforementioned comprehensive success factors) which should consider especially choice and qualification of staff (ability dimension), as well as motivation and incentives (willingness dimension)[108].

Propositions for new ideas are frequently made by LSPs' highly important customers. This often happens when the customer is searching a solution for a specific operational problem (generally a new instrument for a known function). Usually the customer does not come up with a ready solution but gives an impulse to the LSP to find one. From there on, the client takes on the roll as judge, deciding on the propositions and solutions made by the LSP. Therefore, it is of advantage to involve the client in the evaluation of ideas for potential solutions in an early stage.

A proactive attitude towards finding new ideas is rarely found within this industry. Such an attitude however can be supported by appropriate tools and techniques. Potentially successful techniques include creativity techniques (Hauschildt 2004), the lead customer concept (Pfohl, Frunzke and Köhler 2007b; von Hippel 1986), prospection respectively technology prognosis (Reger 2006), market and competitive observation, as well as the classical intra-corporate suggestion system. When specific instruments were discussed, the experts acknowledged that creativity-fostering instruments were uncommon to them. They further argued that those would likely not be accepted by their down-to-earth staff. Motivation of employees and an adequate incentive system account to the short term and the selection and training of staff to the long term success factors.

4.2.4.2 Activity I.2: Communicating Ideas

A distinct activity concerning the communication of ideas is not usually found in established models of innovation development, the only exception being Thom (1992) (cp. Chapter 4.2.1.1 and Figure 4-1 on page 51). It was included in the model for a typical LSP in order to counter innovation barriers and to constitute an active management of forwarding ideas: The most important barrier for typical LSPs is the fact that management and operations are de-centrally organized; the large physical distance of the units makes it difficult to exchange ideas. Thereby it is irrelevant whether the idea is supposed to be shared between two de-

[108] Cp. e.g. Weber and Schäffer (2006) for a detailed discussion of the relevancy of those two dimensions for the analysis of human actions from a behavioural perspective.

centrally located employees or between a de-central employee and a central one, e.g., an innovation manager. Customer-related search for ideas (high importance of individual customers poses a second typical barrier) generally leads to the development of ideas which only aim at solving a specific local problem (of a de-central unit). If communication of ideas is neglected, synergies are wasted. In the most extreme case the employees would reinvent an earlier innovation within a single organization. It becomes clear that an active promotion of communicating ideas is essential. This necessity is reflected by incorporating a distinct activity in this model.

The actual embodiment of communicating ideas is influenced by two other limitations: Typical LSPs being down-to-earth makes it unlikely that the search for information will follow a pull-principle. This could be encountered by distributing information according to the push-principle. To this aim, an innovation newsletter could be used as means of communication of new ideas. Employees should be sensitized to the importance of promotion of (push) and active search for (pull) ideas, which could be facilitated by putting incentives in place. For example, explicitly mentioning individual employees in an innovation newsletter can have a large motivational effect without binding any financial resources. Therein it is important to consider the typically low educational level of employees. Accordingly, news should be self-explanatory and communication should use basic terms and be easy to comprehend. Adjusting to these requirements can be facilitated by, e.g., employing central communication experts. The use of an intra-net application could help with the search for existing solutions (pull-principle). Such a knowledge management system was strongly promoted by the expert round. An innovation newsletter could be used as an instrument allowing push-communication. Alternatively, an official form could be used similar to those used for an intra-company suggestion system.

In regard to success factors, both the ability dimension and the willingness dimension have to be considered. Concerning the ability dimension, it is important to inform all employees about the instruments existing within the company. Likewise, willingness is fostered by a pleasant, informal atmosphere for the exchange of ideas which is therefore a key to success. An informal setting is important because many people perceive too much formalization as unpleasant. Given that communicating ideas, in most cases, leads to more work for the employees, a relaxed environment might increase their willingness to do so. Thus, formalized exchange of opinions and experiences should be restricted to the level of the experts.

Detached from individual innovation activities of LSPs, the creation of competitive, marketable products through the combination of modules and components which were originally created as customer-specific solutions is a major success factor (Franklin 2008). The identification and selection of components that are capable of being transferred or can even become a standard, is rather challenging. It follows that the communication of ideas has to be organized in a way that allows an easy identification of the potential of components to be re-used in a different context.

4.2.4.3 Activity I.3: Analysis of Requirements

A systematic analysis of requirements ensures a well-founded basis for the following step, the assessment and pre-selection of ideas. Motives behind (formalized) requirements analysis can

be cost-related, e.g. that costs associated with relatively early changes are much lower than costs of relatively late changes (Boness, Finkelstein and Harrison 2008), or the can be achievement-related, e.g. that a requirements analysis enables personalization and adaptation of the solution (Höver and Steiner 2009). The relative importance of those motives depends largely on the degree of customer specificity of the solution under development.

The actual analysis usually starts off with a brainstorming about possible requirements of the solution. This can theoretically happen centrally or de-centrally. However, with rising customer specificity it becomes increasingly important to include the client into the process of defining the specifications. Therein, it is important to carefully acknowledge varying importance of customer requirements (Kwong and Bai 2003). According to the expert group, customers tend to assign every pleasant option to a must-do list, without being prepared to pay extra for it. Hence, not every suggestion of the client should be considered, in order to encounter this pitfall. It can thus be advisable only to present a final documentation of requirements to the customers to have them cross-check it. Further requirements exist besides customer requirements. For example, the potential for standardization, the risk affiliated with the potential innovation or its costs can play additional roles. If the analysis of requirements relies on a market or competitive analysis (for example for the development of non-specific products) the expert group was of the opinion that it can be helpful to include external consultants in the process. Otherwise the analysis should typically be assigned to employees from the operational areas of the company. Centralization of these activities is generally of no advantage, in particular in the typical cases of de-central structures and high importance of individual customers.

After the actual analysis of requirements has supposedly been finished, it has to be ensured that the data is complete. Completeness of documentation of requirements can be ensured by formalizing the workflow and by putting output guidelines in place. There is hence an increase of formalization within this phase, i.e. some first restrictions on the participants of innovation processes are put into place. Controlling and monitoring activities such as the development of output targets, the examination of the content of the documentation and the checking for completeness should be carried out centrally. The owner of the process should ideally belong to a controlling or innovation management unit.

The central finding concerning tools and methods is that processes, review cycles, formats of reports etc. have to be formalized in order to ensure completeness of the analysis of requirements and to guarantee the quality of data. Correct interpretation of the customers' demands respectively the market needs, as well as industry and method-related know-how of employees, determining the accuracy of the analysis, are keys to success.

4.2.4.4 Activity I.4: Assessment and Pre-selection of Ideas

Based on the assessment that the success of innovation processes is predictable, controllable and thus manageable (Cooper and Kleinschmidt 1993), a LSPs' management should define milestones with kill-or-go-decisions according to the stage-gate process model at various phase transitions (cp. Cooper and Kleinschmidt 1993; Cooper, Edgett and Kleinschmidt 2002a; Cooper, Edgett and Kleinschmidt 2002b). As an abstract guideline, the correct time to take such a decision was identified as right before the input of resources is about to rise

substantially. Such a rise occurs each time the innovation development phase is entered. Thus, is seems reasonable to assess and approve or reject ideas before concept development is begun.

A first screening of ideas by internal experts can be conducted either centrally or de-centrally. In case of a high project importance, the work group found it advisable that the innovation proposition be presented to the executive board (for internal innovation projects of LSPs) or to the customer. Concerning customer-specific ideas, the preferred alternative of the customer will usually be followed down. The only criterion which has to be regarded by the LSP is the transferability of the solution to different contexts and therefore customers. In the case of customer-unspecific ideas, several distinct alternatives should be evaluated and compared with each other.

In a de-centralized LSP with highly important individual customers, information advantages of de-central units are likely even more pronounced than in absence of the typical features. This emphasizes the need for a formal kill-or-go-decision in advance of a substantial rise in resources. However, it does not influence the content of such a decision.

Cost-benefit analyses as well as scenario techniques are among the classical tools and methods which – according to the expert group's analysis – best suit the assessment and pre-selection of ideas. The accuracy of the benefits evaluation of a solution for customers beyond the existing base as well as the challenge to gain acceptance of all involved parties were identified as keys to success for this activity.[109]

4.2.5 Phase II – Innovation Development

The following activities, assigned to the innovation development phase, aim to conceptually further develop the ideas chosen in the previous phase, to refine those concepts and to evaluate the feasibility and economical validity of those concepts rigidly in order to ensure commercial success.

4.2.5.1 Activity II.1: Concept Development

The development of a concept is the first activity of innovation development. According to Bowers (1989), concept development of services can be compared to the construction of a prototype for physical goods: First of all, "*policies, procedures and standards of performance*" (Bowers 1989, p. 19) are to be developed, together with a description of the services' functionality. A compatible view is adopted by Bullinger and Schreiner (2006) who call for individual specifications of potential, process, result and market dimension, which should subsequently be added to an overall specification. The work group came to the same conclusion that the refinement of content of the drafted and pre-checked ideas should be the nucleus of concept development.

Thus, concept development firstly includes the task of checking the general set-up and the evaluation of resources needed for provision of the service. Due to knowledge asymmetries, it is advisable to perform this task de-centrally. Afterwards, during the refinement of the idea,

[109] As an alternative order to the one developed by the work group, Klement (2007) proposes to assess and pre-select ideas before the analysis of requirements.

models of possible solution modules can be constructed and tested with respect to their performance and their likelihood of success. The main advantage of such testing is the feedback, allowing a fast modification of the concept. However, the resulting concept should be fixed at a certain time through means of a (centrally communicated) design freeze. This serves to avoid costly requests for modifications at a later point. Thus, at the design freeze, all involved parties must agree on the specifications proposed. In the case of a customer-specific solution it is advisable that the actual customer acts as a "final authority". The solution under development should precisely meet customer expectations, because negative discrepancies are hard to correct and could potentially have a negative effect on the relationship with the customer, whereas positive divergence is hardly honoured nor paid for.

The typical features of LSPs are of relatively little concern for the development of concepts. It should however be mentioned, that de-centralisation and high importance of individual customers result in the responsibilities being installed locally, and that tests which are more abstract anyway for services than for goods, become even more difficult in presence of a low educational level.

IT models and simulations that support the evaluation of solutions and allow for the identification of weaknesses are appropriate tools within concept development. Key success factors are the acceptance of the design freeze by all participants (including the customer), as well as the right degree of detail of the original idea. Furthermore, industry and methodological know-how of the employees are of relevance.

4.2.5.2 Activity II.2: Business Case

A business case "*defines the product and verifies the attractiveness of the project*" (Cooper and Kleinschmidt 1993, p. 26). It is hence a formalized examination of the commercial potential of a developed concept.[110]

The scope of this examination depends on the importance of the innovation project and varies from basic financial considerations to sophisticated business plans stating targets, strategy and so on. The expert group came to a differentiated evaluation: Accordingly, development efforts independent of any specific customer request should include a business case regarding the market potential beyond the single customer's demand. On the other hand there are project efforts for which a suitable return is ensured by a single large customer's high demand, already. In this latter case the business case is reduced to a simple calculation of the tender.

Again, it is the de-central unit which has to use its advantage of relatively more complete and up-to-date data. Thus, it is advisable that the de-central unit should generate and compile the

[110] At this point, it is worth emphasizing that among the cornerstone models there was no agreement about the order of concept development and business case (or similar) activities (cp. Figure 4-1 on p. 51). Assuming that the concept development activity requires more resources than the business case activity, it could be argued that an "upstream" business case could help saving resources by possibly verifying a lack of attractiveness before a concept is developed. However, the actual realization of the innovation occurs at a later point, and that is likely to require even more resources than either of the two activities in question. Hence, the expert group took the standpoint that the expected value of precision of business case – achieved by means of being based on concept development – in the case of subsequent continuation of the innovation process overcompensates an unused savings potential in the case of innovation processes terminated no earlier than after an unpromising business case. Accordingly, the recommended order of activities is the one reported. Klement (2007) agrees with calculating the business case after the development of the concept.

planning data. A central unit takes up the role of a supervisor, ensuring the completeness and plausibility of the information provided. The process owners of a business case within a de-central unit would typically be the same operational managers who are in charge of the implementation of the innovation. Centrally responsible actors would hold controlling or innovation management positions, possibly in an administrative department. The low educational level of typical LSPs and their down-to-earth-ness also play an influential role: Both are likely to affect people's tolerance of standardized calculations negatively. Hence, due to possible resistance the business case guidelines must either incorporate the management of the human factor, or there must be additional enforcement policies.

Comprehensive market reports were described by the experts to be among the less useful tools. Simple tools like spreadsheet analyses are used more intensively. Key to success within this phase is the appropriateness of the assumptions in the business case. To safeguard that the calculations are realistic, management accountants might act as critical counterparts of the managers conducting the assessment (Weber and Schäffer 2006). However, they must be careful not to demand information that is inadequate for an innovation concept (similarly Pfohl, Frunzke and Köhler 2007b; Weber and Schäffer 2006).

4.2.5.3 Activity II.3: Test of Acceptance

In advance of the realization of an innovation, it is necessary to test the acceptance of the affected party, usually the client. That is of particular importance in cases where there is only one client who is co-responsible for making the following kill-or-go-decision. The acceptance of the actual solution by the customer should ideally be pre-determined by the requirements analyzed earlier and can hence be understood as a vulnerability or weakness test (Bullinger and Schreiner 2006). If concept and business case do not aim at a specific customer, it is still advisable to test the concept's acceptance through a pilot implementation or to involve customers by means of confidential feedback respectively pre-test discussions (similarly Klement 2007). This activity is thus characterized by an iterative approach of discussions with the participants and of subsequent modifications of the concept. That loop should be run through until the degree of customer satisfaction has reached a satisfactory level.

Market tests are particularly difficult to undertake due to the immateriality of (logistical) services (Johne and Storey 1998). Thus, acceptance of an innovation recurs to the acceptance of the planned concept, rather than to the acceptance of a testable prototype (Thomas 1978). De-centrality and importance of individual customers as typical features again result in the usage of de-central process owners, as those are particularly close to the customer respectively to a lead customer (cp. the non LSP-related works Athanassopoulou and Johne 2004; Morrison, Roberts and Midgley 2004; von Hippel 1986). Responsible actors could be staff with customer contact, employees within operations or the innovation project manager.

According to the participating experts, the only tool to be used for this activity is an adequate IT-testing environment such as, e.g., a simulation tool. The key success factor is the embedding of all project stakeholders to ensure that all arguments and positions are taken into account.

4.2.6 Phase III – Realization of the Innovation

Planning and implementation of the innovation as well as its transfer into routine operations is accomplished in the third phase, *realization of the innovation*. This phase can in itself be structured as a project, as it complies with the general definition of a project, because of its time restriction, its non-recurring execution and its continuous evolution (Project Management Institute 2004). Accordingly, the innovation realization can and should be managed rather formally.

4.2.6.1 Activity III.1: Implementation Preparation

In other contexts, it was found that usage willingness was directly influenced by beforehand occurring preparation and training activities (Peslak, Subramanian and Clayton 2007). To facilitate acceptance of the innovation, the actual implementation should thus at least formally be preceded by an implementation preparation activity. It includes any preparation tasks such as the creation of an implementation road map or any necessary preparation of the implementation site which is often located at the customer's. Relevant stakeholders, especially clients, should be involved in this. In addition, users and possibly support staff may have to be trained. Another motivation for those activities is that late adaptations are particularly costly (cp. e.g. Coenenberg, Fischer and Günther 2007) and likely affiliated with some double executions, so that it should be aimed at anticipating execution activities in a high level of detail.

A collective kick-off meeting – labelled from the user's point of view – should be undertaken. The individual design of implementation preparation strongly depends on content and scope of the innovation to be implemented. All substantial activities ought to be executed locally and therefore typically de-centrally.

Planning can be accomplished by adequate project management software or by standard forms. The key success factors identified are: orientation along project management standards, staff management and training, as well as a detailed preparation. In the case of unspecific products, it is additionally important to have a well-functioning communication channel to the market.

4.2.6.2 Activity III.2: Implementation

Implementation had been defined as "*realization of solutions which exist in conceptual form and have to be transferred into concrete corporate action*" (Daniel 2001, p. 15; translation by the author; cp. Chapter 2.1). As that process of transfer must be managed as well, implementation activities include not only the actual execution tasks, but also the management of the implementation process and an accompanying project controlling.

During the implementation it is important that targets agreed upon in earlier activities are constantly reviewed to be able to apply corrective measures in case of deviations. Special attention has to be paid to all transition points of responsibility across company borders. Those occur where responsibility for a process is transferred from the LSP to the client and vice versa. Not only are faults likely to occur at interfaces, but even conflict can arise

(Barclay 1991).[111] Overall, implementation management and project controlling should be characterized by coordination, rather than by planning.

The work group agreed that standard tools of project management and reporting are the instruments to be used for these tasks. Concerning the transition of responsibilities, pre-determined procedures should take place. Key to success at this stage is a high quality of the project management.

4.2.6.3 Activity III.3: Assessment of Success

The final activity concerning the innovation in its character as a novelty is an assessment of its success which includes a formal acceptance of the output of the innovation project. Upon completion of these activities, the innovation has to be realized in accordance to its specifications. Other central factors in assessing success could be customer surveys as well as analyses concerning customer satisfaction. Again, most steps would normally be conducted de-centrally. However, for innovations realized centrally, the experts emphasized that the – possibly relatively distant – customer should have access to formal process reviews in order to receive his feedback in near real time. In case modifications are needed, these could be done right away.

Help desk support and remote diagnostics tools belong to the tool set of this activity, as well as operational and financial controlling instruments. Key factors to success are a high level of quality of the preparation and the effectiveness of the review processes and tools.

4.2.6.4 Activity III.4: Transfer to Day-to-day Business

The implementation project ends with the accomplishment of the innovation transfer into day-to-day business. In practice, a (first) implementation often exists at this point. In this case, a distinct transfer in terms of a pre-planned handover to standard operations is obsolete. Transfer can then be characterized as a rollout: As soon as a solution is implemented at a first customer's or at the LSP's first site, it ought to be examined if it can be made available to other customers or other LSP sites, too, and if any modifications would be required for that. Apart from centrally organized coordination, all activities are accomplished de-centrally.

The expert group recommended that a highly successful product innovation be used as a case study in marketing. Instruments that can be used in this phase are reporting tools to collect customer feedback and to facilitate future improvements.

Factors eminent for success include the quality of modifications after an assessment of success, the quality of management after the implementation and the customer's acceptance. In the case of a transfer by roll-out there are different success factors: modularity and the potential of the innovation to be standardized, as well as internal transparency of accomplished innovations.

[111] A detailed review of interface research, in particular with respect to interdepartmental interfaces, is provided by Knollmann (2007).

4.2.7 Phase IV – Innovation Process Development

The concept of organizational learning is nowadays generally accepted in management science (Argyris and Schön 1978; Easterby-Smith 1997; Visser 2007). Of particular importance to this research is that the usefulness of post-project reviews has been demonstrated with regard to R&D projects (von Zedtwitz 2002). As the expert group agreed with the potential of post-project reviews, the aim of the final phase is the evaluation and improvement of the innovation process workflow and of the tools and instruments used therein. It includes formal aspects such as process documentation and assessment of applicability as "Best Practice", as well as creative elements such as the creation of specific improvement recommendations.

The explicit consideration of the *innovation process development* phase in the process model ensures that all participants of an innovation process are given the opportunity to incorporate their experiences on how to improve the process flow. This is of particular importance for typical LSPs who due to their de-centralized organizations are in a relatively high danger of letting experience pass unnoticed. In addition, standardization of reviews helps to handle potential barrier effects of their being down-to-earth and of their staff often having a low educational level. Naturally, passing on experience only helps if it is used as an input for following processes. Hence, it is advisable to let project managers participate in the reviews of projects beside their own (von Zedtwitz 2002).

The following procedure was recommended in the expert round: At the beginning, the innovation process should be described verbally. This task serves first an internal purpose, i.e. as an inspiration for future innovations. The second purpose would be external marketing. Additionally, it is advisable to include distinct project participants into the debriefing and to write a report about the content of the meeting. The outcome (improvement proposition) can be used for future innovation development processes. At this point it is to be recalled that learning related to innovation management, but beyond the scope of innovation process workflows, is incorporated in the process-system interaction framework in a cumulative form.

As to when post-project reviews take place, it is recommended that they are undertaken at a pre-defined point of time at the very end of an innovation process. Only then is it possible to give it dedicated attention and time. For processes terminated before a transfer to day-to-day business post-project reviews are worth their effort if significant amounts of resources had been invested and if there had been a division of labour. That should be the case every time the innovation development phase had been entered.

With respect to methods, there are two reasonable instruments in place: formal processes for gathering feedback and improvement proposals, as well as standards to take them into account. Further, a comparative analysis of target and actual process performance indicators could prove to be effective. Key success factors in Phase IV are a pronounced feedback culture and the existence of sufficient dedicated time and resources.

4.3 Conclusion

The development of a LSP-specific innovation process model was undertaken to contribute to the understanding of the root causes of LSPs' low innovation achievements. Hence, from the scientific point of view, its development was conceptually motivated, while the model can be used instrumentally by managers and possibly by future scholars (cp. Weber and Schäffer 2006). Accordingly, the summary to this text which this conclusion is begun with contains a summary of most important findings with respect to research question 3. The process model itself is discussed in the second subchapter on managerial implications. The ultimate subchapter contains considerations on limitations and future research.

4.3.1 Summary with Respect to Research Question 3

The development of a LSP-specific model of an innovation process was undertaken to contribute to the understanding of the root causes of LSPs' low innovation achievements. With respect to that purpose and in answer to research question 3 the analysis provided the following insights:

- In addition to the fact that LSPs offer (specific) services, four factors that had previously been discussed on a conceptual basis and had been anchored in the literature (cp. Chapter 2.3, in particular Chapter 2.3.2) were empirically validated as typical of LSPs by the work group. De-centralization respectively dispersion was the most impact-full factor, then the importance of individual customers which can lead to dependence, down-to-earth-ness, and finally the typically low educational level of LSPs' staff.
- The effect of the four typical LSP features was mostly hindering LSPs' innovation management, and not facilitating it. It can hence be postulated that for LSPs, it is indeed inherently more difficult to generate innovations than for the average of organizations from other industries.
- Last, at the outset of this research, the participating LSPs had lacked an adequate process model of innovation generation. This lack exemplifies the need for scientific concepts tailored to the LSPs' circumstances. As a consequence of the lack of such a tool, the LSPs' procedural management for innovation as applied at the outset of this research lacked the quality it could have had, so that it can secondly be postulated that lack of specific concepts is another reason for LSPs' relatively low innovation achievements.

4.3.2 Managerial Implications

The procedural model of innovation generation, implementation and roll-out that was developed can be used for analytical purposes, i.e. as an audit tool. Accordingly, innovation managers or management consultants at LSPs are offered an instrument which allows for analyzing bottlenecks within the LSPs and for deducing improvement measures. Besides, the tool fulfils the frequent postulation from research to undertake industry-specific examinations, and it enables further scholarly analyses.

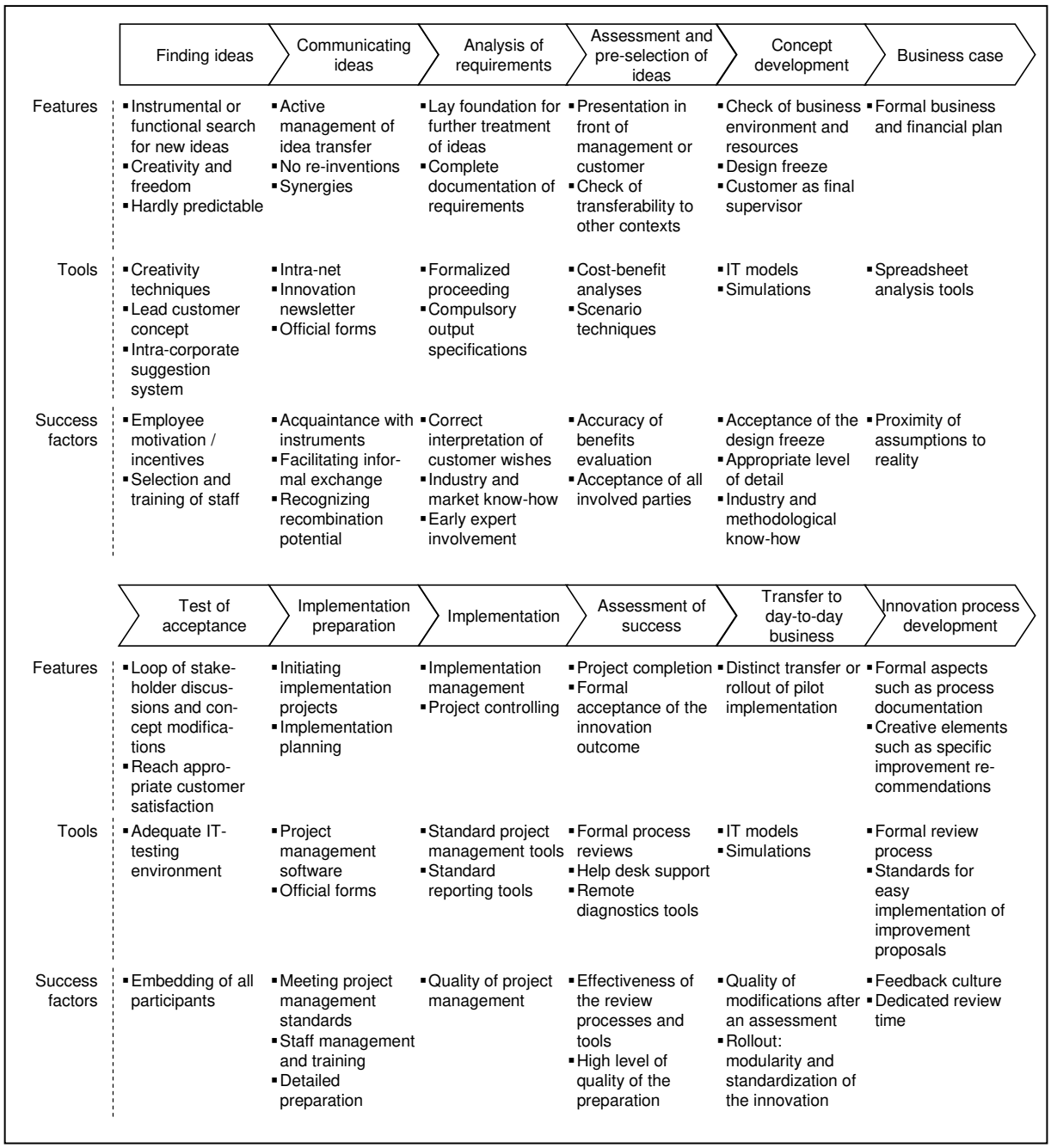

Figure 4-4: Audit Tool

The audit tool consists of four phases comprised of twelve activities. Each of those activities is characterized by certain features. Specific recommendations on applicable tools and instruments were derived, and phase-specific success factors were identified. An aggregated overview is presented in Figure 4-4. Concerning the allocation of tasks which was also analyzed, but is not depicted in Figure 4-4, it can be stated that the vast majority of these is handled de-centrally. Some of the central tasks are more supportive in character such as, e.g. the ones in the activities *finding ideas* and *communicating ideas*, whereas others are more of a supervising kind such as, e.g. the ones in the activities *analysis of requirements* and *business case*.

At a typical LSP, the audit tool can immediately be applied in their corporate practice. LSPs that are characterized by some, but not all the features of typical LSPs, can still use the process model as an instrument which is tailored more to their needs than an unspecific one is and can adjust it depending on their circumstance.

Another managerial implication concerns the focus of LSPs' management's attention: It became obvious throughout the discussion of the distinct activities in the work group that in the later phases and activities, innovation process management can be handled well with existing project management concepts and instruments. This is not the case for relatively early activities. As most LSPs tend to handle project management very well, another managerial implication is that LSPs should place a focus of their management effort on the early activities of innovation development.

4.3.3 Limitations and Research Implications

This research is first and foremost limited through its action research methodology. While the methodology led to very detailed findings, its results are needier of further validation than those of other, purely observational, approaches. That is particularly the case because action research contains a normative component. As the context remains complex and the state of research remains early, it might be appropriate to undertake case studies as an intermediate next step, before confirmatory survey work is targeted.

As regards the content of this research, starting off from some established knowledge on innovation management at service providers (cp. Johne and Storey 1998), in particular in dissociation from goods producers (cp. Nijssen et al. 2006; Zeithaml, Parasuraman and Berry 1985), a procedure of decreasing abstraction called for a consideration of LSPs as a supposedly homogenous group as the next step after typical service providers. To this aim and in answer to calls for industry-specific approaches, an archetypical LSP had to be defined. A number of next steps could be taken from here:

- First, the typical features must be tested in confirmatory and preferably quantitative studies.
- Second, the scope of the model could be widened significantly by developing it further into a contingency model of innovation generation at (any kind of) service providers. As was pointed out before, the purpose of the model derived here is only to be applicable for a typical LSP. Hence, not all identifiable contingency factors of LSPs had to be taken into account, but merely those which have typical values.[112] Further factors could be relevant at the level of the individual firm. Chapter 5 provides an example of that.
- Third, after this research which emphasized commonalities among LSPs, it could be appropriate subsequent research endeavours to differentiate LSPs further, for example based on differing business models or service spectres: Klaus and Kille (2006) differentiate 16 distinct market segments for LSPs in Germany, and Wallenburg (2004) classifies LSPs into carriers, forwarders, courier, express and parcel service

[112] Precisely those factors should be typical of the LSP industry in which LSPs differ significantly from other service providers.

providers, third-party logistics service providers and – at least as theoretical models – fourth party logistics providers.

- Fourth, in a confirmatory analysis, factors which did not appear as significant in this study, but are known from previous research, could be tested for their relevance with respect to LSPs' innovation management. Factors could, for example, stem from organizational theory (e.g. Child 1973; Pugh et al. 1968; Pugh et al. 1969).
- Finally, it would be interesting to supplement this text with a process model of innovation adoption at LSPs. A systemic perspective on LSPs' innovation management is necessary, as well. It will be adopted in the subsequent chapter.

5 State and Contingencies of LSPs' Innovation Management Systems

This text[113] complements the previous chapter's procedural perspective with a systemic one. Both perspectives together were shown to enable a holistic understanding of innovation management (cp. Chapter 2.2.2). It serves to answer research question 4: "*Which explanations of LSPs' low innovation achievements can be proposed from the study of LSPs' innovation management systems?*" Accordingly, the text investigates LSPs' innovation management systems.

A case study research design was chosen which is described in the following methodology section. Due to the complete lack of comprehensive studies on LSPs' innovation management systems (cp. Chapter 3.2.4.2), the current status of a number of cases of LSPs' innovation management systems is firstly explored. Thereafter, the text follows the general approach of continuous refinements of the topic under investigation that was described in Chapter 1.3. Accordingly, after the study of innovation management of typical LSPs in the previous chapter, LSPs' innovation management is now studied in dependence of certain contingency factors. The reason is that innovation research emphasizes that no single best way exists to manage for innovation, but that it is rather contingent upon external factors (Burns and Stalker 1961; Lawrence and Lorsch 1967). Hence, after briefly depicting the descriptive results, six relevant context factors are identified in the second sub-chapter of the results section. Last, 39 propositions are derived on how those contextual factors affect the innovation systems of LSPs. The procedure how those propositions were formed is also described in the following methodology section. As usual, the text is concluded by a summary with respect to the answer of research question 4 – the contingency analysis is only auxiliary in that respect, by a synthesis of managerial implications and by considerations on the limitations of this text.

5.1 Methodology

In line with a general opening-up of logistics research to utilize more qualitative research (e.g., Aastrup and Halldórsson 2008; Craighead et al. 2007; Ellram 1996; Naslund 2002; Sachan and Datta 2005; Spens and Kovács 2006), a descriptive and explorative multiple case study design was chosen. It enabled the generation of a deep understanding of the research context in a situation where analytical penetration is difficult (Benbasat, Goldstein and Mead 1987). The fact that research on innovation management systems of LSPs is still in its early stages is another reason why case studies are particularly appropriate (Yin 2003). The choice of cases is explained in detail in the first section below. Thereafter, mechanisms to safeguard data quality are highlighted. A third section depicts the choice of a framework used for directing the study and for categorizing the data. Last, the proposition formulation procedure is presented.

[113] The text is currently under review with the *Journal of Business Logistics* as Busse and Wallenburg (2010b).

5.1.1 Choice of Cases

The purpose of the case studies is to generate theory (Eisenhardt 1989; Eisenhardt and Graebner 2007) on LSPs' innovation management respectively its specificity. The literature is ambiguous about when theory development should be begun. Eisenhardt (1989) advocates beginning "*as close as possible to the ideal of no theory under consideration*" (p. 536). For Yin (2003) on the other hand, "*theory development as part of the design phase is essential*". Either way, researchers agree (Eisenhardt 1989; Lamnek 1995a; Strauss and Corbin 1990; Yin 2003) that it is practically impossible to start theory-building research with "*a clean theoretical slate*" (Eisenhardt 1989, p. 536). Previous (theoretical) knowledge must hence generate some ex-ante expectations which – even if they stayed undiscovered – are most likely to affect data analysis, at least in the form of the researcher's mental models (Lamnek 1995a; Senge 1990).

The broader effort aiming at a medium-range theory on (the specificity) of LSPs' innovation management is not actually *begun* by this text. It had been pointed out before that the theory under generation requires both analyses at the level of the project, as well as the level of the firm (cp. Chapters 2.2.2 and 2.2.3). The study of LSPs' innovation management systems covers only the second facet, but it is integrated into previous related work belonging to the same theory-generation effort (cp. especially Chapters 2.3 and 4). Prior knowledge from that effort can hence be used for the design of the case study examination, specifically for choosing cases. Cases should be sampled theoretically (Eisenhardt 1989; Eisenhardt and Graebner 2007; Glaser and Strauss 1967; Yin 2003), aiming "*to replicate previous cases or extend emergent theory, or […] to fill theoretical categories and provide examples of polar types*" (Eisenhardt 1989, p. 537). It should thus be aimed at including variation of all factors that might influence the design of innovation management systems and at controlling all others that cannot be varied. Specifically, before the beginning of data collection, the following considerations on the internal and external context were taken with respect to the selection of cases:

- It was shown in Chapters 2.3 and 4 that de-centralization, customer importance, the qualification level of the staff, as well as the attitude concerning innovation respectively corporate culture, affect typical LSPs' innovation generation processes. It seemed plausible that the degree to which those factors were present affects an LSP's innovation management system, as well. Those factors should hence be varied in the LSP sample.
- It was further assumed that organizational size would play a role as a context factor (cp. Sauvage 2003; Soosay and Hyland 2005), and that relatively large LSPs would be more likely to apply consciously designed, as well as relatively complex innovation management systems. It was thus regarded reasonable to aim mostly at medium-sized or large LSPs, but to contrast those with a small or very small one, as well.
- LSPs should only be investigated within one country to control for the legal and cultural environment in the study. Germany was chosen. This also allowed keeping the costs of research low.

- An earlier work (Soosay and Hyland 2005)[114] had varied LSPs' service spectres, in particular their widths, so that variation in that respect was also regarded as desirable.
- Soosay and Hyland (2005) had further differentiated by ownership (albeit without identifying any effect of it); so that it was regarded as desirable to incorporate both privately owned and listed LSPs, as well as to distinguish privately managed LSPs from LSPs lead by external managers.
- The fact that LSPs' services are equipment-based (cp. Chapter 2.3.2), suggested capital intensity as a further factor.
- Last, the potentially smooth transition between LSPs and logistics departments (cp. Chapter 3.1.1) indicated the integration of some "borderline cases" between LSPs and logistics departments as possibly informative with respect to the appropriateness to include them in the investigation.

Faced with nine factors that ideally ought to be varied in the sample, it was impossible to include cases with all possible factor variations, even with a very large sample.[115] Literature suggests to view only four to ten cases, due to the complexity of handling large amounts of data (Eisenhardt 1989). Therefore, the intention to replicate cases could only aim at (literal or theoretical replication) of the most relevant factor(s) for an ongoing analysis (cp. the following section). Another challenge at the outset was that some of the potentially relevant factors, for example customer importance and attitude respectively culture, could not be assessed from the outside point of view at the time of initial case study design. From both issues, it follows that the choice of cases could not occur in an entirely deterministic way, but had to contain an element of serendipity.[116] As replication logic is essential, it follows again that in this investigation an overlap of case selection and data analysis was not only possible (Eisenhardt 1989) or recommended (Glaser and Strauss 1967), but even a necessity.

[114] The work of Soosay and Hyland (2005) had already been read at the time when the case study design was conceived.

[115] The issue is not discussed by any of the constitutional works on case study research, but is actually a very basic problem: Given n potential explanatory factors with m possible discrete values for each of the factors, precisely m^n cases would be necessary to include all possible factor combinations exactly once in the sample, if all cases exist and are chosen fittingly. Assuming n = 9 as discussed above and setting m = 3 to allow only for high, medium or low values, at least $3^9 = 19.683$ cases would be required. In practice; it cannot even be assumed that all imaginable cases exist. Also cp. footnote no. 118 on page 79.

[116] Again, this appears to be a general problem which is underexposed in the literature: Supposedly theoretical sampling can be limited by the impossibility to measure factors from the outside, as well as by a lack of ex ante knowledge about which variables influence each other.

Organization	Description
Organization A	Organization A is a business unit of an LSP with further business units. Organization A is a medium-sized organization that manages warehouses respectively processes therein.
Organization B	Organization B leads a centralized global network. It is a large organization.
Organization C	Organization C is a centralized network operator which is active mostly in Germany.
Organization D	Organization D is a business unit of an LSP with further business units. Organization D is a large organization that manages warehouses respectively processes therein.
Organization E	Organization E is a medium-sized site operator with dedicated equipment. It is a spin-off of a non-logistics company.
Organization F	Organization F is a medium-sized site operator with dedicated equipment.
Organization G	Organization G is a large network operator. It is the national organization of a multinational network operator with further (super-) national units.
Organization H	Organization H is a large network operator. It is the national organization of a multinational network operator with further (super-) national units.
Organization I	Organization I was taken over after participating in this research. The organization was medium-sized at the time the study was undertaken. It was a provider of land transport and warehousing services, but mostly active as a forwarder.
Organization J	Organization J was taken over after participating in this research. The organization was medium-sized at the time the study was undertaken. It was a provider of land transport and warehousing services, but mostly active as a forwarder.
Organization K	Organization K is a very small carrier managed by its founder and single owner.
Organization L	Organization L is a large organization, which concentrates on warehouse management and inbound logistics of its mother organization, a consumer-goods organization.
Organization M	Organization L is a large organization, which concentrates on outbound logistics, but also on warehouse management, for its mother organization, a consumer-goods organization.

Table 5-1: Case Sample

Sampling according to the selection criteria presented above rested initially strongly on the logistics market and firm descriptions by Klaus and Kille (2006). To avoid any confirmations of ex-ante expectations in precisely those firms which could have caused those expectations, neither a firm from the action research sample (cp. Chapter 4.1.2) nor any that the author had worked with before were chosen. Over the course of data collection and case analysis, it was found that some of the selection criteria were not influential. On one occasion criteria could be aggregated. Two other context factors emerged which had not been foreseen (cp. Chapter 5.2.2). As the sample contained sufficient variance on those two when they emerged, it was not necessary to add further cases because of those additional factors. It is advised that "*the iteration process stops when the incremental improvement to the theory is minimal*" (Eisenhardt 1989, p. 545) respectively when theoretical saturation is reached. In accordance

with those directives, 13 cases had been studied in the end,[117] a number that exceeds the recommendation of Eisenhardt (1989). This was due to the relatively high number of identified contingency factors.[118] It also served the (secondary) aim to gain a very broad understanding of the current state of LSPs' innovation management. Table 5-1 provides an overview of the case sample.[119] Without having designed the sample to that aim, there were two dyads in the sample, i.e. there were two occasions where one LSP was subcontractor of another.

5.1.2 Data Quality

Data collection made use of data triangulation, as proposed by, e.g., Craighead et al. (2007), to safeguard high data quality. Various kinds of interviews (open interviews, half-structured interviews and problem-centred interviews) were combined with an explorative questionnaire, annual reports, and service descriptions, as well as with internet-based profiles of the LSPs. For each context-dependent variable, the composition of its measurement is briefly described in Table A-6 to Table A-11 (on pages 168 to 173). This combination of quantitative and qualitative data[120] is consistent with Eisenhardt (1989) who points out that this *„can be highly synergistic. Quantitative evidence can indicate relationships which may not be salient to the researcher. It also can keep researchers from being carried away by vivid, but false impressions in qualitative data, and it can bolster findings when it corroborates those findings from qualitative evidence" (p. 538).*

Further, most personal conversations were audio-recorded to ensure *data reliability*. Some interviews that occurred on the spot, however, had to be journalized. *Construct validity* is guaranteed through triangulation of data, researchers[121], and methods. Multiple respondents were used, in fact, for both interviews and questionnaires. Earlier results derived from a workshop series with another four LSPs (cp. Chapter 4.1.2) were discussed with informants. Requests concerning *internal validity* were acknowledged by means of a search for patterns and by taking into account competing explanations (where applicable). The research design, i.e. the deliberations concerning choice of cases and replication of results, assesses *external validity*. Finally, literature recommendations on interview techniques, data handling and analysis were taken into account (Eisenhardt 1989; Yin 2003).

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[117] Organization M had been contacted relatively early to replicate imaginable peculiarities of the spin-off feature of Organizations E and L, but that feature had shown not to pose an issue in itself. As there already was a saturated picture when Organization M participated, it was not actually required anymore and only studied very briefly.

[118] It will be shown in Chapter 5.2.3 that on average, no more than 1.5 context factors are required to postulate a proposition, because what the context-dependent variables depend on, varies relatively strongly. This meant that the sample was, in fact, large enough to provide sufficient levels of contrast within its data.

[119] Participating organizations were promised anonymity, so that case descriptions have to be very brief. Most organizations were engaged in more than one line of business. The nominated type of LSP reflects their focus.

[120] Variable measurement is described in Chapter 5.1.4.

[121] The work was supervised by a professor of logistics management. He was not active in the field, but incorporated a role as critical counterpart who was unaffected by field impressions (cp. Sutton and Callahan 1987).

5.1.3 Framework

To direct the study and to structure its findings, the Adams, Bessant and Phelps (2006) framework was employed again. There are four reasons why this decision is deemed possible:

- The framework does not list specific variables to be studied, but contains a structure of innovation management categories and sub-categories (cp. Figure 3-1 on page 28). Its general receptiveness does not hinder from being open to new ideas and inputs at any time in the research process.
- It evolved out of a systemic review of the literature on innovation management measurement, and it is a synthesis of five previous frameworks (cp. Chapter 3.1.2), so that – unless there are dimensions to LSPs' innovation management which do not exist elsewhere – it could be expected to cover innovation management at the level of the firm very well.
- The framework could already be used in Chapter 3 to categorize previous findings on LSPs' innovation management systems, so that its usability with previous LSP-specific findings was shown.
- The decision to use the framework could be revoked if it proved inadequate for reasons not yet foreseen.

The key advantages associated with the framework's usage are both derived from its origin as a literature review:

- It can provide guidance to the research in its quest to not overlook any important category.
- It ensures connectivity with previous research.

Data analysis showed that the framework can be used as a general structure determining the make-up of innovation management systems out of individual elements.[122] Only the actual variables identified within its sub-categories are subjected to the influence of contingency factors. The framework was already depicted in Figure 3-1 on page 28. Its sub-categories will be repeated throughout Chapters 5.2.1.1 to 5.2.1.7.

5.1.4 Development of Propositions

It has been argued that natural and/or managerial selection mechanisms exist which let only those organizations survive which are adapted to their context (DiMaggio and Powell 1983; Drazin and van De Ven 1985), so that there is a fit (Drazin and van De Ven 1985; Sousa and Voss 2008; Venkatraman 1989) between them and their context. Fit or congruence has previously been discussed between various factors (Tosi and Slocum 1984), of which at least one is a high inertia variable and hence regarded as a given, while the other is of low inertia and hence adaptable to the other (Burns and Stalker 1961; Chandler 1962; Lawrence and Lorsch 1967; Sousa and Voss 2008). Accordingly, the concept of fit or congruence can be

[122] This supports the earlier deliberation that, while the evolvement, i.e. the "structure", of innovation processes is subjected to the influence of context factors (cp. the previous Chapter 4), the structure of innovation management systems is likely universal.

applied not only to external, but also to internal contexts (Duncan 1972). Various contingency approaches make use of the congruence concept. In particular, in line with the selection approach as described by Drazin and van de Ven (1985), fit in this context could be understood as an assumed congruence between context and innovation management design (similarly cp. Sousa and Voss 2008; Venkatraman 1989). Previous discussions of contingency theory and contingency approaches such as Tosi and Slocum (1984), Drazin and van De Ven (1985), Venkatraman (1989) and Sousa and Voss (2008) do not specify criteria when a contingency approach as such is justified. The distinction of variables into high inertia and low inertia variables suggests a dynamic view. The key question is then if it is valid to assume that there is a sufficiently steady state of LSPs' innovation management systems, at least within the sample, to justify the fit assumption. At the outset of this research, application of a contingency approach had actually not been planned. The aim was merely to explore and describe their innovation management systems. In fact, an ex-ante expectation based on previous literature had been to assume a bad quality of LSPs' innovation management. It was found that – while there was a high variance across cases – the LSPs had consciously designed their innovation management systems and had adapted them to their contexts. There seemed to be (an internal, systemic) fit between their innovation management system elements, and the reasons for management decisions could be made plausible (cp. Chapter 5.2). Replication efforts across cases were successful. Therefore, a selection approach was chosen according to which a LSPs' design of innovation management fits its context.[123] Propositions could therefore be formulated with respect to the influence of contingency factors on variables pertaining to the innovation management system.

The analysis of case study evidence has been labelled *"one of the least developed and most difficult aspects of doing case studies"* (Yin 2003, p. 109), in which the researcher's thinking and his "*playing with the data*" (Yin 2003, p. 111) are critical success factors. It is also "*the least codified part of the process*" (Eisenhardt 1989), so that it becomes very difficult to communicate. The general proceeding was the following: It was first aimed to understand cases on their own and to grasp the explicated or seemingly obvious reasons for the appearance of innovation management systems.[124] The closest thing to a tool that could be used was the Adams, Bessant and Phelps (2006) framework. It allowed sorting the data into categories, as suggested by Yin (2003). The sorted data could then be investigated for commonalities and variance. Variance was assessed by means of the case selection criteria (cp. Chapter 5.1.1) and based on the initial understanding of the cases. These procedures lead to a preliminary theory about contingency factors, context-dependent variables, and the relationships between those. In an iterative, largely heuristic and feedback-oriented procedure, the preliminary theory was continuously refined until 25 context-dependent variables emerged from the data as context-dependent variables[125] which could be explained in a stable manner by six contingency factors (cp. Chapter 5.2.2) in 39 relationships (cp. Chapter 5.2.3).

[123] The decision's practical usefulness is underpinned by the avoided methodological challenges of success measurement in innovation management studies (cp. e.g. Ernst 2002; Wolfe 1994).

[124] In line with the recommendation of Eisenhardt and Graebner (2007), narratives are omitted from the presentation of results, but replaced by summary tables and particularly rich evidence (cp. Chapter 5.2).

[125] Their measurement is described in Table A-6 to Table A-11 in the appendix, together with descriptive statistics of questionnaire items.

A very specific challenge was related to the measurement of variables. While aggregating various kinds of data is recommended (cp. Chapter 5.1.2), in the methodological literature no suggestions at all are given pertaining to the procedure of doing so. Examples of published case studies also left this issue unaddressed. Therefore, a self-developed heuristic procedure was applied: Quantitative and qualitative data are first discussed separately. For quantitative data from the explorative questionnaire, organizational answers pertaining to individual items[126] were aggregated to factors in the specific manner described for each variable in Table A-6 to Table A-11 (depicted on pages 168 to 173), usually by means of averaging across individual items.[127] The factors were then ranked.[128] Those ranks were mapped to a 5-point scale from very low to very high. The lowest rank was mapped to "very low", and the highest to "very high". In between those extreme values, the ranks served the purpose of maintaining the order of factors. The allocation to the five-point scale also reflected the pair-wise differences between the ordered factors. The procedure for qualitative data was simpler. It was assessed directly against its relative positioning in the sample, as perceived by the researcher. That assessment took all available qualitative data simultaneously into account. It was also mapped to a 5-point-scale[129]. Last, where both qualitative and quantitative data was available, the respective factors had to be aggregated. The relative importance given to either reflected the relative importance of the respective type of data within data collection.

The idea behind the phrasing of propositions followed survey logic, i.e. propositions were formulated in order to maximize the explanatory effect of linking contingency factor variance with dependent variable variance, while using preferably few contingency factors. However, this procedure was limited by the number of cases, by measurement accuracy, by the lack of a defined estimate function, by correlations between contingency factors[130], as well as by the visibility of weak effects.[131]

The achieved fit between the data and the proposed relationships was assessed in two ways: First, the numbers of cases for which the contingency factors explain the dependent variable values well, fairly well or did not fit, were qualitatively assessed for each case and then aggregated for each dependent variable, depending on the frequencies of fit values. A second assessment of the fit of cases measures the level of additional backward support of the proposition: This rests on comparisons of the contingency factor values of high dependent-variable organizations with those of low dependent-variable organizations.

[126] The method of deriving those from individual questionnaires is explained in the notes to Table A-6 on page 168.
[127] Lacking a large sample size, factor analysis had not been an option.
[128] This procedure aimed at mapping the (possibly only partial) usage of the scales of the explorative questionnaire items to a fully used scale, thus emphasizing the variance between organizations.
[129] However, in most cases only the extreme values and the neutral value within that scale were used, due to restricted accuracy of measurement
[130] As a consequence, all alternative explanations which could explain the data and are reasonable will be mentioned, as well.
[131] The stronger the effect of a contingency factor, the more likely it will become visible. It is therefore possible that weak effects are shrouded.

5.2 Results

The results section is divided into three sub-chapters: In the first, descriptive results are presented (also cp. Table A-6 to Table A-11 on pages 168 to 173). The second contains the derivation of six contingency factors. In the ultimate section, propositions on the effects of those contingency factors on context-dependent variables are derived.

5.2.1 Descriptive Results

The interviews showed that the practitioners' understanding of innovation is generally compatible with the academic understanding as introduced in Chapter 2.2.1. It was difficult for the experts to describe or even define innovation management. When asked to denominate the key components of innovation management, no respondent was able to label more than fragments, while on the other hand, the structure of Adams, Bessant and Phelps (2006) was found adequate when it was explicitly introduced. Regarding the type of innovations (cp. Chapters 2.2.1 and 3.2.1) which LSPs produce at the moment, the interviews suggested that innovations with relatively low degrees of novelty are currently dominant. Besides, process innovations appear to be more frequent than product innovations.[132] Within process innovations, administrative innovations seem to appear more often than technological innovations.[133] Generation processes appear to be more frequent than adoption processes.[134]

5.2.1.1 Inputs Management

With respect to input factors that determine innovation inputs (cp. Chapter 3.2.2.1), Adams, Bessant and Phelps (2006) recommend a disaggregated analysis of financial, human resource and physical inputs. In practice, an intuitive understanding exists that views the allocation of human resources as current expenses and the allocation of financial resources, e.g. for the purchase of technology, as investment expenses. Interestingly, the endowment with financial resources was on average regarded more generous than the endowment with human resources, while both resources showed a high degree of variation across the sample.[135] Physical resources did not matter, at all, presumably due to the service context.

Another type of input is „*formal systems and tools in support of innovation*", which can be further differentiated into quality management instruments and creativity instruments (Adams, Bessant and Phelps 2006, p. 28). The data indicates that currently, creativity instruments are used relatively rarely compared to quality management instruments.[136] While in general a lack in creativity in the early and intellectuality demanding process phases of innovation generation is observable, this can be attributed more to personnel's unwillingness to use such instruments than their lacking existence.[137]

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[132] Throughout Chapter 5.2.1, footnotes referring to the explorative questionnaire are used where results are mostly derived from that easily traceable source of information. In this case cp. items no. 103 and 104 vs. items no. 98 and 99 in Table A-11 (on page 173)
[133] Cp. item no. 23 vs. item no. 22 in the questionnaire (Table A-7 on page 169)
[134] Cp. items no. 98 and 103 vs. items no. 99 and 104 in the questionnaire (Table A-11 on page 173)
[135] Cp. the questionnaire items no. 1 and 2 vs. items no. 3 and 4 (Table A-6 on page 168)
[136] Cp. questionnaire item no. 6 vs. item no. 7 (Table A-6 on page 168)
[137] Cp. questionnaire items no. 5 and 8 (Table A-6 on page 168), as well as Chapter 4.2.4.1

5.2.1.2 Knowledge Management

Adams, Bessant and Phelps (2006) disaggregate knowledge management into idea generation, knowledge repository and information flows.

The average LSP is not proactive in its idea generation.[138] In addition, LSPs rarely measure the number of new ideas generated by their staff and only rarely steer accordingly. They hardly recruit because of candidates' specific knowledge, nor do they deliberately hire experts from competitors. Further, idea generation is only rarely supported by instruments. Analysis of patent data is hardly undertaken at all which can be explained by the immateriality of logistics services. However, it seems likely that those LSPs that utilize a technology-driven physical transportation network[139] could make more use of that kind of information (cp. Wu 2006).

Knowledge storage and formal information flows were found to be closely linked by knowledge management technology. The interviewees only advocated the use of instruments and technology where those foster knowledge exchange and communication between people. Email newsletters, display cabinets, project leader meetings, and management trainee meetings were named multiple times as favoured tools. Verbal – and possibly informal – communication is consistently regarded the most important exchange mechanism, though. Organizational abilities are clearly understood as collective abilities of employees, and organizational knowledge is understood as collective knowledge of staff. Accordingly, technological knowledge repositories such as databases and document management systems are somewhat incompatible with the way these people like to work and are only tolerated because they also foster knowledge exchange between people.

5.2.1.3 Innovation Strategy

Two components of innovation strategy are distinguished by Adams, Bessant and Phelps (2006): strategic orientation and strategic leadership. The first encompasses existence and effectivity of innovation strategies as behavioural guidelines. The second refers to the behaviour of top-managers, namely their change-related behaviour, their attitudes, expectations, as well as their verbal and practical support.

The companies tend to have behavioural guidelines, which are believed to be aligned with the overall strategies.[140] Common innovation strategy elements are a conscious choice of risks and accepted risk levels, the existence of a change and/or innovation vision, and – where applicable – differentiation between business units. Conscious timing of innovations compared to competitors was less standard than the previous strategy elements. Innovation benchmarking seems to be quite rare. Planning of future services and processes in advance is certainly not standard, either. The term innovation strategy is usually not used, as three exemplary views point out: *"There is a strategy on competitive differentiation. And there is a small facet which might be called innovation strategy, but does not have that name."* Another respondent also stated: *"I would not necessarily call it innovation strategy. We do not yet*

[138] Cp. questionnaire items no. 9 to 14 (Table A-6 on page 168)
[139] Cp. Table 5-1 on page 78
[140] Cp. questionnaire items no. 24 to 37 (Table A-7 on page 169 and Table A-8 on page 170)

meet the claim such a label brings about". A third expert described the components of their innovation strategy as, first, adapting to market and business needs and, second, to speak of innovation in front of customers. Further elements would not exist. This statement helps to explain some of the lack of innovation achievements LSPs' customers do perceive.

Strategic leadership was said to be "*strongly influenced by top management, by means of personal examples, directives, odour marks […]. An atmosphere of departure can easily be produced by a board member.*" Employees are encouraged to pursue new paths, the LSPs' management seem generally committed and open-minded towards change, and the organizations were described as able to cope with failure.

5.2.1.4 Work Environment

This category on LSPs' work environment is the most encompassing of the seven framework categories. It includes structural and organizational features as well as cultural elements (Adams, Bessant and Phelps 2006). The differences between the LSPs' work environments appear to be larger than between the previously discussed categories.

The most important organizational decision to be taken with respect to LSPs' permanent structure is if or if not a unit specialized on innovation management tasks should exist.[141] The key advantage of such a – necessarily central – innovation management unit would be specialization. In addition, central units can have an innovation-favourable niche culture: "*In staff units and in specialist headquarter departments which are mostly occupied with younger academics, you tend to have people who are keener to experiment*". There was a high variety of answers concerning the existence of central units dedicated to innovation efforts. Coordination, planning and steering responsibilities are more likely centralized and specialized than the actual innovation processes. On average, a high fraction of innovation processes appear to be undertaken de-centrally. No LSP spoken to has a unit labelled "*Innovation Management*" or "*R&D*". A number of units can carry out innovation management tasks, though. A high variance was observed, as the other end of the spectrum existed, as well. „*We have got no staff positions*", was a statement from a company where managers carried out innovation-related activities together with their operational work. The central responsibility in that example was to coordinate multiple de-centrally undertaken innovation projects. The opposite extreme was an organization which has specialized central units for product development, corporate development, market and competitor observation plus another two units with innovation management tasks in the course of formation.

The leaders of innovation projects have a large influence on their projects' results. Project leaders' were described to be highly committed, to possess the right knowledge and to have adequate personal authority. Their accountability and decision competence received medium scores in the questionnaire.[142] The strongest strain on project leaders stems from limited temporal resources. The project leader profiles gave the impression that LSPs were not special in this respect (cp. e.g. Meredith and Mantel 2003).

[141] Cp. items no. 38 to 41 (Table A-8 on page 170)
[142] Cp. items no. 42 to 43 (Table A-8 on page 170)

LSPs' overall cultures were noticeably down-to-earth. That was reflected in their rejection of overly "playful" tools, e.g. to foster creativity, in their strong problem-solving attitudes and in their lack of innovation enthusiasm. There is hence an area of conflict between top management's strategic leadership which fostered innovation and the LSPs' general organizational culture.

Culture and work ethics are largely influenced by financial incentives. Incentives to foster innovation were not found to be a standard concept used by LSPs.[143] The relatively highest usage of incentives for individuals is related to team success in innovation, followed by incentives linked to corporate success. Incentives linked to individual innovation achievements were used least often. Some experts mentioned that their companies employ suggestion schemes. The unit responsible for those can be an operational unit, the HR department or a special innovation management unit.

Another important cultural aspect is innovation-friendliness:[144] *"You have to give people some decision rights […], enable them to be innovative […], give them breathing space and allow them to make mistakes."* A potential conflict between freedom, which can also facilitate slack, and control, which can also choke off creativity, is imaginable, but LSPs seem to be able to create good equilibriums, as people appreciated sufficient freedom while they found efficiency ensured by means of control.

5.2.1.5 Portfolio Management

Portfolio management is an instrument to prioritize competing innovation projects and to optimize the aggregate of innovation projects. Some part of the evaluation of an ongoing single innovation process often occurs during the review of a company's overall (innovation) project portfolio by some kind of steering committee. Accordingly, there are aspects in portfolio management which might as well have been allocated to project management by Adams, Bessant and Phelps (2006).

Instruments which pertain to the evaluation of individual projects are much more strongly implemented in LSPs' practice than those that refer to the entire project portfolio.[145] In particular, usage of milestones and some form of financial success planning appear to be near standard. The planning of financial and human resource requirements seems to be pretty well established, as well, whereas the planning of a project's duration occurs less commonly. The technical success probability for an individual project is hardly planned. That comes as a surprise given the high rate of project failures known from other industries (Aschhoff et al. 2009).

The actual optimization potential of portfolio management is not yet reflected in practice. Portfolios are generally not assessed as a whole, e.g. to understand their overall opportunity-risk-profile. Portfolio management is not even used to get a general view of innovation projects going on. Consequentially, no optimization regarding mix of project sizes, durations, risks or radicalness is carried out.

[143] Cp. questionnaire items no. 44 to 46 (Table A-8 on page 170)
[144] Cp. questionnaire items no. 47 to 53 (Table A-9 on page 171)
[145] Cp. questionnaire items no. 54 to 61 vs. items no. 62 to 69 (Table A-9 on page 171)

5.2.1.6 Project Management

The systemic view on project management focuses on measures of project efficiency, usage of project management instruments, as well as external communication and collaboration. Project efficiency measurements concerning benefits, costs and duration seem to be nearly standard and show little variation across the cases,[146] while the originally planned results are tendentiously only achieved as regards intended benefits. The interpretation is that projects which can be finished successfully are only terminated once the planned-for benefits were achieved, even though cost plans and schedules might have to be given up. From other contexts it is known that this behaviour can reflect various rationality deficits (Mahlendorf 2008), albeit none special for LSPs.

Concerning project management instruments,[147] formalized project reviews at the end of projects are quite common. The majority of LSPs do not apply company- or industry-specific process models for innovation generation or adoption, though. More specifically, the evolvement of innovation projects does not follow stage-gate patterns as recommended in the literature (Cooper and Kleinschmidt 1993).

On average, there is relatively much external communication.[148] The questionnaire highlighted a preferred order of external parties who LSPs interacted with in their innovation efforts: Exchange with customers and direct observation of competitors are nearly standard. Service benchmarking, trade fair visits and customer interviews on competitors follow. Cooperation with research institutions and with management consultants has least importance. Major differences between the companies in the study exist with respect to collaboration with customers[149] and to customer involvement in innovation processes.

The experts and their companies are competent or even very competent regarding the technical side of project management: *„When it reaches the degree of maturity Project and Approval, well then the resources are ramped up […] till the implementation into controlled operation"*. Someone else was calling innovation project management *"classical project management"*, leaving no doubt that he regarded it to be a "basic". A third expert described a standard procedure which was also unspecific: *"We have got a standard […] I shall concentrate on product innovations, now. So: Calculating market potential […]. How much does it cost? […] Creating a business plan and so on […]. Approval […]. That is always a very similar process"*. It seems as if innovation project management for LSPs is quite innovation-unspecific, probably because many LSPs are very used to project work due to their involvement in outsourcing projects. The interviews provided the impression that LSPs feel comfortable with the complexity of their innovation projects. This can be explained first by their apparent technical project management skills, and secondly be features of their innovation projects, such as relatively low degrees of novelty of their innovation projects.[150] It indicates that for LSPs, project management is only a minor challenge.

[146] Cp. questionnaire items no. 70 to 72 (Table A-10 on page 172)
[147] Cp. questionnaire items no. 73 to 80 (Table A-10 on page 172)
[148] Cp. questionnaire items no. 81 to 88 (Table A-10 on page 172)
[149] Cp. questionnaire items no. 89 to 92 (Table A-10 on page 172)
[150] The second explanation is supported by quantitative data on LSPs' innovation outputs (cp. Chapter 6).

5.2.1.7 Commercialization

The last category in Adams, Bessant and Phelps (2006) framework addresses commercialization activities. It is the only category which also deals with innovations as finished outputs.

While some variance could be noted, the respondents mostly agreed that it is reasonable for LSPs to undertake market research – most did so themselves, and that market research pays off, financially.[151] Market tests, on the other hand, are regarded as much less reasonable. The latter can be explained with the immateriality of logistics services, as well as with a dominance of incremental innovations (also cp. 4.2.5.3). Some LSPs orient their marketing and sales activities rather towards individual customers, while others focus on offerings to the market as a whole.

The respondents agreed that the number of finished innovations is rather small.[152] That is the case for both product and process innovations. Taking into account that services are much more difficult to protect intellectually than physical goods are, it seems likely that LSPs should make use of innovation adoptions more often than innovation generations. That is not the case, as adoptions are relatively scarcer than generations. This facts confirms the existence of general bias towards own developments (Lichtenthaler and Ernst 2006).

5.2.2 Contingency Factors

The subsequent discussions include references to previous works to facilitate the connectivity of this text with the literature. Previous researchers' results were deliberately investigated and added *after* the completion of the analyses. Because of this order, tempting connections that were not actually observed could be avoided, while any actually observed peculiarities are not shrouded by dominant established concepts.

5.2.2.1 Organizational Size

The size of the organization showed to be the most important contingency factor as it will be the contextual factor for 10 of the 39 propositions derived. Size is a predictor of specialization and formalization (Bryman et al. 1983; Pugh et al. 1969). Aspects of size that are emphasized in the literature are physical capacity of an organization, personnel available, organizational inputs or outputs, or discretionary resources available (Kimberly 1976). As LSPs vary in terms of revenues per employee, it was decided to take both an organization's number of full-time-equivalent employees and their revenues into account to create an aggregated size measure. That procedure is compatible with Agarwal's (1979) recommendation to collect data on multiple measures of size. The data was derived from annual reports, internet presentations, and market reports (notably Klaus and Kille 2006).

[151] Cp. questionnaire items no. 93 to 95 (Table A-11 on page 173)
[152] Cp. questionnaire items no. 98, 99, 103 and 104 (Table A-11 on page 173)

5.2.2.2 Level of Dispersion

What can be labelled dispersion is another structural variable which serves as a contingency. Dispersion as understood in this text covers both an organization's level of de-centralization, and the spatial distribution of its staff. Centralization is defined as "*the locus of authority to make decisions affecting the organization*" (Pugh et al. 1968, p. 76). The spatial distribution of staff has been captured before in an innovation context by team member proximity (Högl and Proserpio 2004; Högl, Ernst and Proserpio 2007). While the above variables are clearly distinguishable, their effect on innovation management showed to be similar as regards information and knowledge exchange, the structural anchorage of innovation management, and internal respectively external communication and collaboration.[153] A low level of dispersion was found to be associated with advantages of specialization and concentration, whereas a high level of dispersion can be associated with advantages of proximity to and preciseness of meeting de-central requisites.

The level of dispersion aggregates data regarding numbers of operational sites, full-time-equivalent employees per site, number of legal units in relation to organizational size, and centralization of decision-making and responsibility. The data stems from annual reports, internet presentations and the interviews. Dispersed structures are typical of LSPs (Cp. Carbone and Stone 2005; Lieb and Randall 1996; Sauvage 2003, as well as Chapter 2.3.2). Many LSPs are characterized by de-centralized decision making and responsibility, as well as by low concentrations of their staff, i.e. by relatively many relatively small sites. That is particularly the case for land transport carriers and forwarders, as well as for many third-party LSPs. Nevertheless, the full scale of the level of dispersion could be used with the sample.

5.2.2.3 Customer Dependency

Many LSPs are dependent on outsourcing of their customers' business (Langley et al. 2006). As a consequence, various dependencies can develop (also cp. Chapters 2.3.2 and 4.2.1.2). First, LSPs can become dependent on individual customers because their revenues and gross margins, etc. are concentrated on relatively few customers (Hewitt-Dundas and Roper 1999) or because their customer base is not diverse enough (Arbaugh and Sexton 1997). Second, the LSPs can have specific assets. The less alternative users exist, the higher the losses to the LSP in case the customer behaves opportunistically (Williamson 1985). Hence, the higher the dependency on individual customers as perceived by the LSPs, the higher their fear of opportunistic behaviour, the more risk-avoiding they have to act and the more careful they have to treat customers they feel dependent on. In cases where the dependency is mutual, risk of opportunism is equalled out. Thus, what matters is the perception of a single-sided customer dependency. This customer dependency was measured by aggregating data from annual reports, market reports and the interviews (cp. Chapter 5.1.4).

[153] Pugh et al. (1969) had shown the number of operating sites to be a strong predictor of concentration of authority. Given a certain organizational size, the number of operating sites ought to reflect the spatial distribution of staff, to a large extent, so that it stands to reason that the variables are largely correlated. In this study, the organizational structure as a whole was a variable of low inertia, so that both facets could be seen as context variables.

5.2.2.4 Growth Potential

The perceived growth potential of a company is a relevant contingency factor. The underlying rationale is as follows: It was shown by previous researchers that both product and process innovation affect growth positively (Roper, Du and Love 2008). Teece (1986) also argued that "*a firm's history - and the assets it already has in place - ought to condition its R&D investment decisions*" (p. 301), because suitable existing assets will facilitate the exploitation of innovations. Thus, firms ought to innovate in areas that they are already familiar with (also cp. Cohen and Levinthal 1990), and as their innovation-related investment decisions have to be made prior to innovation production, they ought to base it on their perceived growth respectively value creation potential. Growth potential is hence related to the usefulness of innovation efforts.

The interviews provided the impression that in the context of this study source of growth or specific means of tapping growth potential did not matter. The empirical investigation did thus not (have to) differentiate growth potential further, but could concentrate on assessing it. Growth potential was assessed based on market report data.

5.2.2.5 Importance of Technology

LSPs in general rely on physical equipment and technology for the provision of their services. Novel technologies such as RFID or GPS can often be used in process innovations or even to create new services. On the other hand, examples such as the displacement of mail services by E-mail points out the danger technology can contain. LSPs must be aware of technological developments in their environment to profit from them. It was observed that the importance of technology varies between LSPs, and that it affects the innovation management system variables. Literature points out two slightly differing aspects of technology importance: intensity or amount of technology usage on one hand and dependence on novel technology through environmental pressure respectively technological dynamism on the other hand (Sauvage 2003; Sibin, Levitas and Priem 2005) – a fine distinction that was not visible in this explorative research. Importance of technology to the single LSP was assessed based on annual reports and interview data.

5.2.2.6 Suitability of Staff

Innovation largely depends on the people who bring it about (cp. Chapters 2.3.2 and 4.2.1.2). Hence, suitability of staff is a natural contingency factor of innovation management. That refers to the choice of suitable actors, but not only: Culture is likely to be imprinted by an organization's members, and communication and collaboration are facilitated by people's attitudes and qualifications. Innovation-favourable attitudes comprise characteristics such as openness to change, challenging behaviour or curiosity (Adams, Bessant and Phelps 2006).

The measurement of qualification relied on balance sheet data respectively estimations of average personnel costs, whereas attitudes were evaluated in the interviews. It was found that both facets affect the same dependent variables in the same directions (cp. Chapters 5.2.3.3 and 5.2.3.6). As they were also connected in terms of content, it was possible and deemed

sensible to aggregate qualification and attitude to a single suitability factor (cp. Chapter 5.1.4).

The average qualification of staff in logistics organizations and in LSPs seems to be relatively low (cp. Chapter 2.3.2). Besides, LSPs' staff and their culture are noticeably down-to-earth (cp. Chapter 2.3.2), so that average suitability of staff for innovation efforts is low, as well. Both aspects can likely be explained by LSPs' specific context (cp. Chapter 2.3.4).

5.2.2.7 Other Factors

Some of the case selection criteria (cp. Chapter 5.1.1) did not lead to contingency factors:

- Effects of the width and/or content of the service spectrum of LSPs besides the previously discussed contingency factor influences were not visible.
- Ownership was also not found to have meaningful effects. Obviously, an owner who manages the company himself plays an important role and can influence innovation management heavily, but no systematic direction of that influence was observed. No effect of public listing was observed, either.
- Capital intensity also had to be dropped. The ex-ante idea was that capital-intensive businesses would be able to and feel the need to invest more into innovation to improve their asset utilization. Where the data was available, capital intensity was computed by subtracting the book value of current liabilities from the book value of total assets, and then dividing by the number of full-time equivalent employees.[154] The data does not support any influence of capital intensity. In a previous study, capital intensity could be better regarded as a measure of technology (Pugh et al. 1969). Therefore, a possibility remains that the expected effect was merely shrouded by the data.
- LSPs with a single non-LSP parent organization had been investigated as borderline cases between LSPs and logistics departments. In this context, no speciality was apparent, so that they could be integrated with the other LSPs.

5.2.3 Propositions

This section presents the results in the order of the categories of Adams', Bessant's and Phelps' (2006) framework. That is first inputs management, then knowledge management, innovation strategy, work environment, portfolio management, project management and finally commercialization.

5.2.3.1 Inputs Management

Previous research had found LSPs' proactive improvements to have a strong effect on their customers' loyalty (Wallenburg 2009). If LSPs are aware of this, then they must emphasize their innovation achievements in front of their customers to bind them. Some support for this

[154] That kind of calculation would be influenced by the age of the asset stock, and personnel-intensive areas could level capital-intensive areas. In addition, management and utilization risk of the assets are not necessarily visible in the accounts or vice versa.

was found: *"In front of customers, we call ourselves 'innovation leader' […] Bla-bla. But what is the reality? Quite often you'd consider automation […], but it does not pay off"*. Outsourcing of services in a long-term contract leads to dependencies on the contracting party for both parties. It seems as if without special incentives and gain-sharing mechanisms that setting bears in itself both the need for the LSP to emphasize its innovation pursuit rhetorically and the actual abdication of large-scale innovation. As outsourcing contracts are prominent for many LSPs, the relatively low level of innovation of LSPs and a gap between their rhetoric and their achievements can probably be both explained to some extent by their specific context.

The previously stressed importance of payback for the beginning of innovation efforts and similar examples lead to the first proposition (P1) that *"Growth potential has a positive effect on innovation intensity",* due to the expectation of high returns from innovation.[155] As there is a relatively high correlation between growth potential and importance of technology, an alternative or additional explanation for variance in innovation intensity would be a positive effect of importance of technology on innovation intensity. That could be explained by a higher need to invest into innovative technology. Proposition P1 and the four other inputs management propositions are depicted in Table 5-2 (on page 93).

Innovation expenses can be current expenses or investment expenses. The share of investment expenses in all innovation expenses is contingent upon two factors: First, it is proposed (P2a) that *"Customer dependency has a negative effect on share of investment expenses"*. The reasons are that investment expenses are affiliated with a longer time horizon than current expenses and that customer dependency increases the danger of opportunism which the LSP perceives. Thus, customer dependency works as a barrier to investments: *"We work for major enterprises. Major enterprises have cut down contract durations drastically […]. That means that true innovation […] which is capital-intensive does not occur any more"*. Apparently, the respondent's expectation of opportunism on the customer's side made him decrease his specific investments. He elaborated further: „*We used to have contracts for eight or even twelve years […] Nowadays you have got three to five years. It's quite simple: In such a setting you will only invest* [a low amount]. *We have hence got a strong focus on Human Resources, which means on process optimization*". Second, it is proposed (P2b) that *"Importance of technology has a positive effect on the share of investment expenses"* because technology is affiliated with investment expenses. *"It is 80% human resources"*, was a statement stemming from an organization for which technology did not play a major role. Someone else even substantiated his statement with the proposed effect: *"We are definitely willing to make investments in key sites and to provide them with adequate new technology"*. The human-resource-only policy seems to be further aligned with the pursuit of incremental process innovations, whereas the investment policy seems to belong to organizations which raise a higher claim.

[155] As innovation intensity is measured as a share of revenues, i.e. in relation to a size measure, organizational size does by definition not affect it.

Proposition		Fit of data		Plausible alternative cause
		Total effect[a]	Split sample[b]	
P1	Growth potential has a positive effect on innovation intensity	Very good: 7/1/0	Highly selective split	Importance of technology
P2a	Customer dependency has a negative effect on share of investment expenses	Satisfactory: 8/2/1	Split with adjacent samples	None
P2b	Importance of technology has a positive effect on share of investment expenses		Split with adjacent samples	None
P3a	Organizational size has a positive effect on availability and usage of input management tools	Very good: 8/2/0	Highly selective split	None
P3b	The level of dispersion has a negative effect on availability and usage of input management tools		No split visible	None

a: This measures the share of variance explained: The figures provide the number of cases for which the proposed contingency factors explain the dependent variable values well / explain the dependent variable values fairly well / did not fit. The verbal assessment reflects the relative frequencies of those levels of fit: A fit was declared to be "very good" if no badly-fitting case was observed and if the number of very-well fitting cases is at least twice as high as the number of fairly-well fitting cases. Where one proposition had one not-fitting case, while all others fit well or where the number of well-fitting cases was not al least twice as high as the number of fairly-well fitting cases; the proposition's fit was assessed to be "good". Propositions for which a single case did not fit and at least another case fit only fairly well were labeled to have a "satisfactory" fit, as long as the number of well-fitting cases was still at least twice as high as the number of other cases. One case where the latter condition did not hold true was assessed as a "poor" fit (but kept, because it provided the best explanation of the variance).[156]

b: This measures if the proposition is additionally supported backward by comparing the contingency factor values of high dependent-variable organizations with those of low dependent-variable organizations (medium dependent-variable organizations are omitted). "Highly selective split" indicates that all contingency factor values in one group are higher than all values in the other group. "Split with adjacent samples" indicates that all contingency factor values in one group are higher than or equal to all values in the other group. "No split visible" indicates that not all contingency factors of the group with higher average value are higher than or equal to all values in the other group.

Table 5-2: Inputs Management Propositions

Another inputs management aspect is the choice of people in innovation projects. The experts agreed on its importance: "*Most important […] are staffs who can think out of the box*". Individuals do make a difference: "*Some develop ideas all the time. Others never come up with ideas*". An expert described the ideal candidate for a position of responsibility as someone "*who has not inhaled this organization to such an extent that he sweats it out of every pore […] but who open-mindedly addresses the issues. […] 90% of our staff are supposed to have come externally*". The propensity of an individual to be innovative is also a function of attitude: "*Of course you have […] always got some people who […] defend their hitherto systems […]. That kind of resistance is regularly broken.*" However, no proposition involving an effect of the suitability of staff could be derived based on the gathered data. The

[156] The total number of organizations can vary in between propositions, due to four reasons: First, respondents were asked in the questionnaire to assess their own qualification to answer. Where this was below the respective scale's neutral value, the answers were omitted. Second, in all types of data, there were missing values. Third, there were occasions where various sources of data could not be aggregated convincingly. Last, on a few occasions values were assessed to be unreliable, compared to the case-specific context, and thus deleted.

reason is assumed to be that management distinguishes groups of individuals who have tasks of responsibility and who are supposed to be innovative – "*The level of qualification is there by now, also in academic terms*" – and those who are regarded as not innovative: "*You have got level 1 and level 2 at best. The rest are absolutely ordinary blue-collar workers*". If there is such a split, then the average level of suitability does not matter in this context.

People who are not supposed to bring innovation and change about can still be affected by it and can resist it. Hence, "*logistics staff must be shepherded*", and "*experience shows that you […] need a lot of time and patience […] to prepare people […]. You have to bring people on board*". As transportation and storage of goods involve a lot of repetitive execution tasks, the average innovation-suitability of staff is quite low: "*Many people may claim otherwise: We work in a low-wage industry*". Consequentially, the difference between qualification and attitude of management on the one hand and average suitability in LSPs on the other hand may be larger than for other industries.

Regarding the variance in availability and usage of tools it can be proposed (P3a) that "*Organizational size has a positive effect on availability and usage of input management tools*", and (P3b) that "*The level of dispersion has a negative effect on availability and usage of input management tools"*. The rationale for those propositions is that for larger and more centralized organizations the average costs of tool usage can be expected to be lower than for smaller and more dispersed organizations.

5.2.3.2 Knowledge Management

Three propositions can be made pertaining to knowledge management (cp. Table 5-3). First, it is proposed (P4) that "*Growth potential has a positive effect on proactivity of idea generation*" (cp. Table 5-3). That seems very plausible given that innovations resulting from novel ideas are an important means to tap this growth potential. However, an alternative explanation would be an effect of the importance of technology: Importance of technology might increase the need for innovation and hence create pressure to generate new ideas.

Further, it is proposed (P5) that "*Importance of technology has a positive effect on the amount of organizational learning*". Organizations are consciously aware of the possibilities that innovation offers. One expert who belongs to an organization for which technology is very important made the following statement: "*Of course, we also look what the market does, what the competitors do […] We have got the freedom to think laterally, to provide new impulses for corporate development or business development […], because our small team puts its good nose into the air, looks and screens, interviews specialized journalists, attends conventions, screens publications and is supposed to build up its own network, a bit to sit like a spider in its web, to get new impulses and constantly to ask: Is that applicable? […] Can we improve our […] business processes […] by means of that? That's just the way it is, that such a truffle pig which runs through the woods with its nose in the air, smells something at some point and says:* 'Hello, here truffle'*"*. The importance of technology as a contingency factor and the facilitation of learning by accumulated knowledge which was also observed in the cited case, support the Theory of Absorptive Capacity (Cohen and Levinthal 1990). Despite the convincing rationale for an effect of importance of technology, the data could also or alternatively support an effect of growth potential on organizational learning. The reason

would be that learning is necessary to produce innovation, and that producing innovation is a means to tap the growth potential.

Proposition		Fit of data		Plausible alternative cause
		Total effect[a]	Split sample[b]	
P4	Growth potential has a positive effect on proactivity of idea generation	Very good: 8/4/0	Highly selective split	Importance of technology
P5	Importance of technology has a positive effect on the amount of organizational learning	Very good: 6/3/0	Highly selective split	Growth potential
P6	Level of dispersion has a positive effect on consciousness of knowledge exchange facilitation[c]	Very good: 3/1/0	Highly selective split	None

a: This measures the share of variance explained (cp. in detail Table 5-2).
b: This measures if the proposition is additionally supported backward (cp. in detail Table 5-2).
c: The variable was only observed in a sub-sample of the case sample

Table 5-3: Knowledge Management Propositions

As was pointed out, knowledge exchange occurs mostly between people, so that the level of dispersion plays a critical role, and it can be proposed (P6) that *"Level of dispersion has a positive effect on consciousness of knowledge exchange facilitation"*. That view was confirmed by an expert: *"We still know each other personally […], have a beer with each other or go into the cafeteria so that relatively informal networks work very, very well. Of course we have got some things mapped in Standard Operating Procedures, but […] at the end of the day,* [successful knowledge exchange] *depends on the fact that people communicate with each other.*" Knowledge exchange between various actors is a continuous necessity. Accordingly, what is dependent on the level of dispersion is not (first) the amount of knowledge exchange, but the consciousness with which it must be planned. Knowledge exchange is not only necessary for innovation generation or adoption, but also for the roll-out of innovative processes. While according to the innovation definition, a second implementation of a novelty within a company is not an innovation anymore; the mechanisms used seem to be the same as for innovation purposes.

5.2.3.3 Innovation Strategy

Five propositions can be derived concerning the content of the LSPs' strategic innovation orientation; two concerning its level of differentiation and another two regarding the innovation-favourability of the strategic leadership (cp. Table 5-4).

While growth, increased operational capacity utilization, and standardization may seem desirable for LSPs from a performance standpoint, pursuing them is not equally reasonable for all due to differences in costs and/or outcomes associated with these three strategic elements. These elements were found largely contingent upon external factors. First, it can be proposed seemingly straight-forward (P7) that "*Growth potential has a positive effect on the*

pursuit of growth through innovation". Therein, innovation is used as a means to an end. While basically every organization likes to enjoy high levels of growth, organizations with high growth potential in their environment are more likely to pursue growth through innovation because tapping the potential is easier and thus cheaper for them than for others.

Proposition		Fit of data		Plausible alternative cause
		Total effect[a]	Split sample[b]	
P7	Growth potential has a positive effect on the pursuit of growth through innovation	Very good: 8/1/0	Highly selective split	None
P8	Customer dependency has a negative effect on the pursuit of operational capacity utilization increase through innovation	Very good: 6/3/0	Highly selective split	Level of dispersion
P9a	Customer dependency has a negative effect on the pursuit of standardization through innovation	Very good: 7/0/0	Highly selective split	Level of dispersion
P9b	Importance of technology has a positive effect on the pursuit of standardization		Highly selective split	None
P10	Importance of technology has a positive effect on the pursuit of technology-based innovation	Very good: 7/2/0	Highly selective split	None
P11a	Organizational size has a positive effect on differentiation of the strategic orientation	Very good: 10/1/0	Highly selective split	None
P11b	Suitability of staff has a positive effect on the differentiation of the strategic orientation		Highly selective split	None
P12a	Organizational size has a positive effect on innovation-favorability of the strategic leadership	Very good: 8/3/0	Highly selective split	None
P12b	Growth potential has a positive effect on innovation-favorability of the strategic leadership		Split with adjacent samples	Suitability of staff

a: This measures the share of variance explained (cp. in detail Table 5-2).
b: This measures if the proposition is additionally supported backward (cp. in detail Table 5-2).

Table 5-4: Innovation Strategy Propositions

Next, it is proposed (P8 and P9a) that "*Customer dependency has a negative effect on the pursuit of load increase through innovation*", and that "*Customer dependency has a negative effect on the pursuit of standardization through innovation*". Customer dependency appears to have a barrier effect: "*Some products are not applicable in other structures […]. If you have got large organizations as customers […], you have to work with the customers' systems*". The opposite is true, as well: "*Basically, we want to* [be] *a sausage machine […]. It's sausage, sausage, sausage […] We don't want any deviations from standard, because […] we operate a larger system*", or "*We have got an existing system, and that we have to sell.*" Apparently, revenue concentration on few customers and high levels of asset specificity limit the availability to optimization. The level of dispersion is a possible additional or alternative

explanation to propositions P8 and P9a. The rationale would be that for dispersed organizations, it is more difficult (and thus costly) to increase its average operational capacity utilization and to establish standards.

Further strategy-content related propositions are (P9b and P10) that "*Importance of technology has a positive effect on the pursuit of standardization*" and that "*Importance of technology has a positive effect on the pursuit of technology-based innovation*". The rationale for P9b is based on the technology-usage facet of technology importance, because technology usage, especially information and communication technology usage, is highly affiliated with automation which in turn facilitates standardization. The principle behind P10 is based on the technology-dependence facet of technology importance: LSPs that are generally dependent on technology are also likely to pursue technology-based innovation.

The concept of standardization was found a concept of paramount importance for understanding LSPs' innovation management, and technology as a means for automation is closely linked to it. Hence, a few further aspects shall be emphasized: First, it is worth noting that LSPs who have low customer dependency and hence strive for standardization, are quite likely not interested in ideas for local improvements: "*Innovations from the de-central structure are experienced as rather annoying*". Second, another important aspect is that standardization often goes hand in hand with modularization of services (Franklin 2008). The key reason is that, especially for third-party logistics providers, customers are quite likely to demand adjustments and modifications anyway, while the LSP does not want to have to start from scratch, every time. Finally, while contingency factors can determine even components of strategy as was just pointed out, LSPs are not robbed of all strategic choice, as the example of highly-customer dependent LSPs shows. For them, two distinct approaches coexist (cp. Child 1972): providing custom-tailored solutions or selling pre-packaged products. The solutions approach is somewhat affiliated with relatively even higher customer dependency and lower technology importance than the products approach and of course related to a lower level of standardization.

Based on the empirical data, it is proposed (P11a and P11b) that "*Organizational size has a positive effect on differentiation of the strategic orientation*" and that "*Suitability of staff has a positive effect on the differentiation of the strategic orientation*". The effect of organizational size can be explained by a higher need to differentiate the strategic orientation in a larger organization and by a higher ability to handle that differentiation, for example with the help of more or larger staff units in larger organizations. The effect of suitability of staff can be explained by a higher ability of more suitable staff to cope with differentiation. However, the appropriateness of that reasoning is decreased by the aforementioned split of staff into supposedly innovative and not supposedly innovative employees.

The key variable regarding top management behaviour with respect to innovation is how innovation-favourable the strategic leadership is. Two influences of contingency factors are proposed (P12a and P12b), namely that "*Organizational size has a positive effect on innovation-favourability of the strategic leadership*", and that "*Growth potential has a positive effect on innovation-favourability of the strategic leadership*". The positive effect of organizational size is very strongly supported by the data, but the reason is not highly intuitive. It is supposed that managers of larger organizations are on average more aware of

the need to favour innovation than managers of small or medium-sized organizations and thus act more innovation-friendly. That could be because those larger organizations have more experience in growth through innovation than smaller ones. The effect of growth potential on innovation-favourability of the strategic leadership can stem from managers' awareness that innovation-friendly leadership will trigger innovation which in turn allows tapping the growth potential. The data would support suitability of staff as an alternative explanation instead of growth potential. A rationale for such an effect could be that the more suitable the staff, the more likely innovation can be achieved and thus the more beneficial it is to encourage it.

5.2.3.4 Work Environment

Although no central unit called "*Innovation Management*" or "*R&D*" was found, innovation management tasks are often bundled centrally, incorporated e.g. in business development units, corporate development units, process improvement units, or even product development units. Further, key account units seem to be important for innovation management when customers are important enough to receive special attention. Key account managers can collect innovation stimuli from individual customers while belonging to a central unit. As size allows for specialization, larger LSPs tend to have larger and more specialized innovation management units. It is thus proposed (P13a) that "*Organizational size has a positive effect on amount and size of specialized innovation units*". In addition, it is proposed (P13b) that "*The level of dispersion has a negative effect on amount and size of specialized innovation units*". The negative effect of the level of dispersion is due to an alignment of general and specific. An overview of the propositions pertaining to the work environment is depicted in Table 5-5.

Proposition		Fit of data		Plausible alternative cause
		Total effect[a]	Split sample[b]	
P13a	Organizational size has a positive effect on amount and size of specialized innovation units	Very good: 12/0/0	Highly selective split	None
P13b	The level of dispersion has a negative effect on amount and size of specialized innovation units		Split with adjacent samples	None
P14a	Organizational size has a negative effect on autonomy of innovation teams	Very good: 8/3/0	No split visible	None
P14b	The level of dispersion has a positive effect on autonomy of innovation teams		No split visible	None
P15	Organizational size has a negative effect on usage of incentives	Very good: 9/2/0	Highly selective split	None
P16	Growth potential has a positive effect on innovation-friendliness of culture	Satisfactory: 7/1/1	No split visible	None

a: This measures the share of variance explained (cp. in detail Table 5-2).
b: This measures if the proposition is additionally supported backward (cp. in detail Table 5-2).

Table 5-5: Work Environment Propositions

The autonomy of innovation teams was specifically addressed by the questionnaire. It can be proposed (P14a) that "*Organizational size has a negative effect on autonomy of innovation teams*", presumably because size leads to formalization which then decreases autonomy. Another proposition is (P14b) that "*The level of dispersion has a positive effect on autonomy of innovation teams*". As dispersion includes a facet of de-centralization, which is defined as a non-central locus of decision-making authority, the former proposition represents a tendency to align the general with the specific.

With respect to the usage of incentives, the data indicates strongly (P15) that *"Organizational size has a negative effect on usage of incentives"*. This proposition is not instantaneously plausible. It appeared as if incentives were used particularly in organizations that place relatively little emphasis on innovation. The answer could lie in the split of staff: Where there are specialists whose job it is to create ideas, be innovative and bring change about, no special incentives are deemed necessary anymore because being innovative is what those people are already paid for. Where no specialists are, i.e. in relatively small and relatively de-centralized LSPs (cp. P14a and P14b), incentives could be in place. Accordingly, organizational size should affect the use of incentives negatively, and dispersion should affect it positively. Only the effect of size was visible in the data, though.

Finally, it can be proposed (P16) that "*Growth potential has a positive effect on innovation-friendliness of culture*". It was already pointed out that the higher the perceived growth or value creation potential is, the more effort a LSP is likely to invest for tapping that growth potential. An innovation-friendly culture should facilitate achieving that innovation.

5.2.3.5 Portfolio Management

The key contingency factor to the usage of portfolio management is organizational size (cp. Table 5-6): Asked if his organization employed a portfolio management, a first respondent replied: "*For that,* [our organization] *is too small.*" Someone from a larger organization described the process of implementing it as follows: "*We are in the process of developing something like that. We have now got a guy who basically only creates a list of existing projects […] We have got so many new projects, that we can't handle them all […] We are not perfect in that respect, but the issue has been recognized.*" A third answer pretty much completes the range of possible replies. It stems from a large organization: "*Of course, we have got a portfolio management…*" In this company, distinctions are made between strategic and non-strategic projects. The organization makes use of a database with project characteristics, milestones and current project phases. There are governance rules which describe for which financial volume which hierarchical level has to countersign. Financial resources are cleared in portions. There is also a standardized reporting on project progress. The latter answer serves to demonstrate not only the proficiency which some LSPs can demonstrate, but it also points out the close organizational linkage between project evaluation and selection on one hand and portfolio balancing on the other hand. In practice, project selection tends to be undertaken by the same body as portfolio balancing: typically some kind of steering committee.

Organizational size affects the number of projects and the organization's formalization positively. Accordingly, it should also affect usage of project evaluation and selection

positively. It can thus be proposed (P17a) that "*Organizational size has a positive effect on usage of project evaluation and selection*". Similarly, (P18a) "*Organizational size has a positive effect on usage of portfolio balancing*". The reason is that the costs of having a steering committee undertake a meeting and discuss the optimal balancing of an innovation portfolio are much less dependent on size than the benefits resulting from it. Hence, the larger the organization, the more prone to using portfolio balancing is it.

Proposition		Fit of data		Plausible alternative cause
		Total effect[a]	Split sample[b]	
P17a	Organizational size has a positive effect on usage of project evaluation and selection	Very good: 9/2/0	Highly selective split	None
P17b	Importance of technology has a positive effect on usage of project evaluation and selection		Highly selective split	Growth potential
P18a	Organizational size has a positive effect on usage of portfolio balancing	Satisfactory: 7/3/1	No split visible	None
P18b	The level of dispersion has a negative effect on usage of portfolio balancing		Highly selective split	None

a: This measures the share of variance explained (cp. in detail Table 5-2).
b: This measures if the proposition is additionally supported backward (cp. in detail Table 5-2).

Table 5-6: Portfolio Management Propositions

It can further be proposed (P17b) that "*Importance of technology has a positive effect on usage of project evaluation and selection*". There are two reasons: First, technology-based projects are likely larger and more radical than non-technology projects. They are hence more in need of evaluation. Second, importance of technology includes a facet of technology usage. LSPs that use more technology can also be expected to apply more technology in the process of evaluation and selection.

Last, it is proposed (P18b) that "*The level of dispersion has a negative effect on usage of portfolio balancing*". Portfolio balancing should best be undertaken jointly for all projects. However, the costs related to it are higher in presence of high dispersion due to increased effort of integrating de-centrally responsible persons.

5.2.3.6 Project Management

There are eight propositions concerning project management which are summed up in Table 5-7. The only sub-category in the framework for which no proposition with at least a satisfactory fit of data could be derived, is project efficiency. Naturally, the average *level* of project efficiency cannot be explained from contingency factors. Given that organizational size affects formalization positively, and that *measurement* of project efficiency can be seen as a specification of formalization, it seems plausible to propose (P19) that "*Organizational size has a positive effect on measurement of project efficiency*". The fit of data is relatively

poor, though. While no alternative contingency factor can explain the variation better, it is still possible that some random variance was observed, and that measurement of project efficiency is independent of context, as well.

Proposition		Fit of data		Plausible alternative cause
		Total effect[a]	Split sample[b]	
P19	Organizational size has a positive effect on measurement of project efficiency	Poor: 4/3/1	Split with adjacent samples	Context independence
P20a	Organizational size has a positive effect on usage of project management instruments	Good: 9/0/1	Highly selective split	None
P20b	The level of dispersion has a negative effect on usage of project management instruments		No split visible	None
P21a	The level of dispersion has a negative effect on intensity of external communication and collaboration	Very good: 9/0/0	Highly selective split	None
P21b	Importance of technology has a positive effect on intensity of external communication and collaboration		Highly selective split	Growth potential
P21c	Suitability of staff has a positive effect on intensity of external communication and collaboration		Highly selective split	None
P22a	The level of dispersion has a positive effect on collaboration with customers	Very good: 9/2/0	Split with adjacent samples	None
P22b	Customer dependency has a positive effect on collaboration with customers		Highly selective split	None

a: This measures the share of variance explained (cp. in detail Table 5-2).
b: This measures if the proposition is additionally supported backward (cp. in detail Table 5-2).

Table 5-7: Project Management Propositions

Next, it is proposed (P20a and P20b) that "*Organizational size has a positive effect on usage of project management instruments*" and that "*The level of dispersion has a negative effect on usage of project management instruments*". The rationale for those propositions is similar to the propositions P3a and P3b expressed for inputs management tools: Nearly size-independent costs of having tools combined with size-dependent benefits of having tools would explain the effect of organizational size. High dispersion on the other hand might lead to higher costs of having tools than in cases of low dispersion.

There are three propositions concerning influences on the amount of external communication and collaboration (P21a, P21b and P21c): "*The level of dispersion has a negative effect on intensity of external communication and collaboration*", "*Importance of technology has a positive effect on intensity of external communication and collaboration*" and "*Suitability of staff has a positive effect on intensity of external communication and collaboration*". However, for this dependent variable, the individual effects are particularly difficult to

differentiate, and most of the explanative power is already achieved with any two of the three proposed contingency factors. The explanation for proposition P21a, the negative effect of dispersion, is first based on the observation that dispersion creates a strong operational focus on the problem at hand: "*Understanding the business, understanding links, is something you cannot learn. Experience is the only thing that matters.*" Relatively little communication and collaboration might result from that operative-problem orientation. A different reasoning for the same effect is that some external communication and collaboration is needy of special budgets which only tend to be available centrally. Next, with respect to P21b, the proposed positive effect of importance of technology can be explained first by higher communication necessities to understand technology and to apply it and second by communication and collaboration facilitation through the usage of technology. However, a positive effect of growth potential poses a plausible alternative explanation to the influence of technology. Such an effect can evolve from LSPs communicating and cooperating more to put their growth potential into effect. Finally, a positive effect of suitability of staff on communication and collaboration, as proposed by P21c, can be explained in such a way that communication and collaboration activities have a higher benefit for highly suitable staff than for less suitable staff and are hence used more frequently. The relevance of that latter proposition is limited by the observation of a split of staff into supposedly innovative people and others, though.

Many LSPs cooperate very closely with their customers in innovation projects. It is proposed (P22a) that *"The level of dispersion has a positive effect on collaboration with customers"*. It is argued that that is the case because in dispersed structures LSPs tend to be particularly close to their customers. That proximity should facilitate collaboration. Further, it is proposed (P22b) that "*Customer dependency has a positive effect on collaboration with customers*". The rationale for that proposition is that the more dependent an LSP is on its customers, the surer it must be that they will embrace its innovations. Hence, the LSP ought to cooperate particularly much with them in its innovation projects to safeguard their acceptance.

Comparing propositions P22a and P22b with P21a, P21b and P21c, it seems likely that importance of technology or alternatively growth potential and suitability of staff affect collaboration with customers in innovation projects, as well. However, those effects did not become visible in the empirical data and do not pose alternatives to the discussed effects of dispersion and of customer dependency.

5.2.3.7 Commercialization

Marketing and sales activities can be oriented anonymously towards the market, e.g. producing and distributing a leaflet at a trade fair. Alternatively the activities can be oriented toward individual customers. An example would be a workshop with an existing or prospective customer. It is proposed (P23a and P23b) that "*The level of dispersion has a positive effect on the relative importance of individual customers in marketing and sales*" and that "*Customer dependency has a positive effect on the relative importance of individual customers in marketing and sales*" (cp. Table 5-8). The reasons are the same as before: The effects of dispersion can be explained by proximity to individual customers which will lead to their increased importance. The relatively high importance of individual customers in cases of high customer dependency is precisely a manifestation of that dependence. A manager of a highly customer dependent LSP pointed out: "*True innovations you can align very strongly*

with the customers. That means that it is very, very difficult to build an innovation which […] achieves a certain standard in the market." Apparently, there is a conflict of targets for LSPs between customer specificity of not only marketing and sales activities, but even of whole innovation projects on one hand and the aim for standardization (and modularization) on the other hand. That conflict is reflected in the already mentioned decision problem between offering custom-tailored solutions and selling pre-packaged products.

Proposition		Fit of data		Plausible alternative cause
		Total effect[a]	Split sample[b]	
P23a	The level of dispersion has a positive effect on the relative importance of individual customers in marketing and sales	Very good: 7/1/0	Highly selective split	None
P23b	Customer dependency has a positive effect on the relative importance of individual customers in marketing and sales		Highly selective split	None
P24	Importance of technology has a positive effect on usage of market research	Very good: 6/2/0	Highly selective split	None
P25	Growth potential has a positive effect on relative importance of product innovations compared to process innovations	Good: 6/4/0	Highly selective split	Importance of technology

a: This measures the share of variance explained (cp. in detail Table 5-2).
b: This measures if the proposition is additionally supported backward (cp. in detail Table 5-2).

Table 5-8: Commercialization Propositions

Next, it is proposed (P24) that "*Importance of technology has a positive effect on usage of market research*". The reasons are that technology-based innovations of competitors are an important element of what is being researched and that missing external developments can result in higher disadvantage in environments of high technology importance than elsewhere.

Finally, proposition (P25) is that "*Growth potential has a positive effect on relative importance of product innovations compared to process innovations*". It is argued that this is because growth is more likely realized by means of new products respectively services than by new processes (Teece 1986). An effect of the importance of technology poses an alternative explanation. A plausible reason for that could be that technology can be an enabler of entirely new products and thus shift the split of product vs. process innovations toward product innovations. However, it is not obvious why it should enable relatively more new products than new processes.

5.3 Conclusion

This conclusion is begun with a summary of results, most importantly from the perspective of research question 4. Afterwards, managerial implications and limitations are discussed.

5.3.1 Summary with Respect to Research Question 4

This text opened a new perspective on innovation management of LSPs. It is the first empirical investigation which applies a systemic perspective to the topic. While the data base is too small to infer statistically significant findings, it indicated some commonalities and noteworthy typical features: On average, LSPs suffer from a lack of suitable human resources rather than from a lack of financial resources, and they are not very proactive in their idea generation, while their innovation strategies tend to fit to their environments respectively overall strategies. On average, LSPs have few central innovation units with few staff. A relatively innovation-obstructive culture seems to be prominent. LSPs tend to split their people into those who are supposed to be innovative and those who are merely affected by innovation. LSPs rarely make use of innovation portfolio balancing, whereas they are very used to the technicalities of project management. Commercialization is often oriented to single customers.

Even more pronounced than the commonalities is the variance within LSPs' innovation management systems. Most of this could be explained through the identified contingency factors. A total of 39 observed and plausible propositions were shaped on how six contingency factors influence the seven systems categories of the Adams, Bessant and Phelps (2006) framework and 25 context-dependent variables pertaining to those. Organizational size was effective in ten propositions; level of dispersion in nine, importance of technology in seven, growth potential in six, level of customer dependency in five, and suitability of staff was effective only in two propositions. The author's impression is that this order reflects the factors' relative importance with respect to relevance of contingencies.

The analysis of LSPs' innovation management systems serves a higher-ranking purpose as phrased in research question 4, namely to facilitate the understanding why LSPs are not overly innovative from studies of their innovation management systems. This lead to more aggregated findings which partially refine and perfect the image from the previous chapters:

- LSPs' typical features as discussed in Chapter 2.3.3 are mirrored in the contingency factors which the empirical analysis revealed. However, what has previously often been labelled "de-centralization" is better referred to as "dispersion" to reflect both the locus of decision making and the spatial distribution of staff. Those two aspects, albeit clearly distinguishable, were shown to have the same effect and were thus aggregated to a single factor.
- Likewise, the factor "importance of individual customers" can be better labelled as "customer dependence", because that denomination better represents not only the effect of revenue, profit or customer value concentration, but also a specificity of the LSPs' assets.
- The cultural feature down-to-earth-ness is reflected in a typical innovation-adverse attitude of staff. The innovation attitude facet can be aggregated with the qualification of staff facet to a single suitability factor. The overall effect of the suitability factor appears smaller than it did after the action research on LSPs' innovation processes (cp. Chapter 4). The reason is that on many occasions, a split of staff into supposedly

innovative and irrelevant-to-innovation, i.e. supposedly not innovative, staff was observable. The actual suitability of the first group would then be the key variable.

- LSPs' organizational size was found the most important contingency factor. Further factors are growth potential and importance of technology. For the latter two factors, it appears imaginable that finer distinctions may appear in later studies.
- The question poses itself why the three contingency factors added in this text, i.e. organizational size, growth potential and importance of technology did not appear earlier. As Table A-12 on page 174 reveals, transport, storage and communication companies – which can be used as a proxy for LSPs[157] in Germany – have an average number of 10.9 employees, a figure which ranks fourth within seven service sectors, ranging from 2.8 to 29.9 employees per organization. Similarly, they have average revenues of 2.32 Mio. € per LSP, a figure which ranks third within six service sectors, ranging from 0.23 Mio. € to 14.50 Mio. € per organization.[158] It hence seems as if LSPs' average organizational size does not possess a characteristic mean value. That would indicate that firm size as a contingency factor is only relevant at the individual LSP level, but not at the industry level.[159] As regards growth potential, it can be argued that it should on average reflect exactly market growth. LSPs' market growth was calculated by Klaus and Kille (2006) who report an annual growth of the logistics market size of 2.1 percent.[160] In a similar time period[161], German Gross Domestic Product grew by an annual 1.7 percent (DESTATIS 2009).[162] Taking into account a tertiarization trend, i.e. a shift towards services through higher growth of service business than manufacturing business (e.g. Füglistaller 2002) which is expressed in higher growth of services than of manufacturing, the LSP industry does not seem to have a qualitatively higher growth potential than other industries, especially other service industries. Last, with respect to technology, no macroeconomic data is available that could be applied. There were, on the one hand, a number of works which emphasized meaningfulness of technology, especially of information and communication technology, to LSPs (cp. Chapter 3.2.2.3), but technological importance was on the other hand not characterized as an LSP speciality. In the light of information and communication technology advancements over the last decades, it must be doubted that importance of technology is in any way special to LSPs. Hipp

[157] DESTATIS (2003) reveals that the respective sector also includes telecommunications organizations, but the data is only available at the aggregated level.
[158] Also cp. the notes under Table A-12 on page 174.
[159] The same source of data also allows for calculating number of sites per organization (cp. Table A-12 on page 174). On average, LSPs have 1.13 sites, a figure ranked third among seven service sectors, ranging from 1.02 to 1.33 sites per organization. When service industries are weighted by the number or organizations, the mean value of sites per organization can be calculated as 1.06. The figures are seemingly low due to the very high share of relatively small organizations: According to DESTATIS (2008c), only 0.9 percent of all LSPs are large enterprises. That value ranks third within six service organizations, the range being 0.1 percent for hotels and restaurants to 11.0 percent for electricity, gas and water suppliers. While the LSP value is higher than this and while it can be assumed that the difference would be more pronounced for larger organizations as those are more likely to have multiple sites, the data can still be understood as an indication that the observed effects of dispersion rest stronger on dispersion of personnel (i.e. relatively large de-central units for LSPs, compared to other organizations) and decision-making than on the dispersion of sites themselves.
[160] This is a nominal value for the period 2001 to 2004.
[161] Namely 2000 to 2005
[162] The nominal GDP value in 2000 was 2,062.50 Bio. €, that in 2005 was 2,243.20 Bio. €.

and Grupp (2005) even suggest that LSPs are less technology-oriented than other service industries. Thus, it seems likely that all three contingency factors which were added in this chapter do indeed not incorporate previously undetected typical LSP features, but are "only" relevant at the level of the firm.

- For three reasons, an ex-ante assumption of noticeably bad quality of LSPs' innovation management activities stemming from the motivation to this work (cp. Chapter 1.1) is dropped at this point. First, the cases studied appeared basically well thought-through. Second, even though the cases were chosen precisely because of that characteristic (so that they are not representative in that respect), it can be taken for granted that all industries are characterized by variation in innovation management quality across different organizations (cp. Aschhoff et al. 2009), because management for innovation is particularly risky. That means that even examples of bad management do not immediately indicate particularly bad management at LSPs. Third and most basic, propositions are only derived from empirical data.
- The preliminary proposition "lack of suitable innovation-specific instruments"[163] (cp. Chapters 4.3.1 and 4.3.2) could not be investigated directly in this text. The most important reason is that the Adams, Bessant and Phelps (2006) framework does indeed pertain to structure rather than to content (cp. Chapter 1.2 and the introduction to Chapter 4).[164] However, as no respondent was able to describe their organization's innovation management concept akin to a "managerial version" of the Adams, Bessant and Phelps (2006) framework, i.e. as no one was able to provide a list of innovation management system elements that had to be managed and needed alignment, the preliminary proposition "lack of suitable innovation-specific instruments" finds some additional indirect support. It is only weakly supported here, though, because the innovation management systems had been found to be well-aligned.

5.3.2 Managerial Implications

The analyzed innovation management systems were found surprisingly[165] well thought-through and adapted to the specific company context. The most important managerial implication of this text is, hence, that LSPs should make conscious innovation management design decisions. Those can serve to handle the negative effects that the frequently present factors high customer dependency, high level of dispersion and low suitability of staff have on the management of innovation.

In addition, the descriptive part of this paper allows LSPs' managers to get a better picture of the status quo of innovation management. More importantly, by taking into account their own contingency factor values, they can benchmark their innovation management system designs against the propositions that reflect established systems.

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[163] Understood in an encompassing way, i.e. related to entire innovation management concepts, rather than merely to tools and instruments which happen to be used within, e.g., inputs management or project management

[164] Another reason is that innovation management system concepts were implicitly understood as "no more" than certain combinations of innovation management system elements. In other words, the understanding is that there is no element above – most importantly – "innovation strategy" which the seven elements are derived from.

[165] Phrased from the point of view of the unsupported ex-ante assumption of bad quality

5.3.3 Limitations and Research Implications

This research is firstly limited through its design. Even with 13 cases, it is not possible to have a case sample in which all contingency factor value combinations exist. Due to the costs of research, it was necessary to control for the legal and cultural environment in the study's design. LSPs were investigated in Germany only. It is hence possible, that for LSPs in general the legal and/or cultural environment could have an effect which does not become visible here. Influences could stem from national working law, legal requirements concerning data storage, IT security and informational duties, national culture (corporate culture, risk attitudes, preferred methods of operation) or varying marketing addressability. The subjective impression is that the above effects are unlikely to influence the design of innovation management systems.

Multiple parallel innovation management systems in diversified company groups were not analyzed, nor was a dynamic view applied to the topic. Both might prove to deliver valuable insights. In this text, innovation management configurations, i.e. interactions and (mutual) dependencies between dependent variables, were not investigated in detail. Instead, their apparent fit sufficed. Further analyses on that ought to be undertaken.

The explorative results also should be differentiated further. For example, organizational theory includes factor delineations which did not become visible in this explorative study (Child 1973; Pugh et al. 1968; Pugh et al. 1969). Likewise, environmental turbulence was not investigated in this examination (cp. Lichtenthaler 2009), assuming that all LSPs operate in a rather similar environment. In addition, the results need to be validated by future research. In particular, the construction of contingency factors will have to be tested statistically, and the effects of the propositions have to be confirmed.

The systemic perspective was found very fruitful again (cp. 3.2.4.1) and is hence recommended for future use. The framework by Adams, Bessant and Phelps (2006) was particularly helpful in this respect. Most notably, while in the specific LSP context, some sub-categories were more important than others and had to be slightly adapted, e.g. market testing was hardly relevant and collaboration was most interesting with respect to customers, the framework as a whole could be used to structure the available data well. From the systemic perspective as applied in this text, one therefore cannot go so far as to say that innovation management for LSPs seems to work *structurally* different from how it works in other industries. However, it is suggested that innovation scholars analyze the general meaningfulness of the factors customer dependency and dispersion, as well as the standardization and modularization strategies of LSPs, their internal innovation roll-out activities and the phenomenon of strongly differentiating between staff that is responsible for innovation and all the other personnel. For LSP researchers, it can be insightful to investigate the interplay between standardization and modularization further, together with the choice between a product and a solutions approach. LSPs' collaboration with their customers and their single-customer orientation should be investigated further, as well.

6 Comparison of LSPs' Innovation Inputs, Outputs and Outcomes with Other Service Providers

Building on the conceptual discussion of specificity of LSPs' innovation context (cp. Chapter 2.3) and on the empirical analyses of LSPs' innovation management (cp. Chapters 4 and 5), this text[166] amends a cross-industry comparison, as expressed by research question 5a: *"Is the LSP context to innovation significantly different from that of other service providers?"* As differences are found to be significant, they are analyzed and interpreted further, in particular by interrelating them. The ultimate research question 5b is hence: "*Which explanations for differences between LSPs' innovation achievements and those of other service organizations can be proposed?*"

Research questions 5a and 5b are answered through a secondary analysis of large-scale empirical data, stemming from the *Mannheim Innovation Panel*. Data from that panel was previously used within business studies by Hipp and Grupp (2005), as well as by Wagner (2008). This text builds on both works: Hipp and Grupp (2005) also aimed at a cross-industry comparison of services, in their case through the application of a new service typology. Wagner (2008) was the first work which had discussed a cross-section of the Mannheim Innovation Panel from the perspective of LSPs. The work also introduced a three-phase framework which this text makes use of (cp. Chapter 6.1.1). The unique contributions of this text consist first in the application of statistical tests on the interdependence of innovation achievements from the groups of LSPs vs. other service providers, second in the inter-relation of innovation inputs, outputs and outcomes to one another, and finally in the added theoretical analysis of interdependencies and possible underlying causes.

The remainder of this text is begun by a chapter on its methodology. The subsequent results chapter contains a section in which the significance of differences is tested and another in which differences are interrelated and interpreted. As before, the text is concluded with a summary regarding the answers to research questions 5a and 5b, by considerations on its managerial implications and by highlighting its limitations.

6.1 Methodology

In this section, a suitable analytical framework is derived, before the used data base is described. Last, the applied data analysis procedure is depicted.

6.1.1 Analytical Framework

Tatikonda and Montoya-Weiss (2001) had found that, while innovation is aimed at market success, market success is preceded by technical success. Technical success of innovation

[166] The text is under review with the *Journal of Supply Chain Management* as the article Busse (2010).

processes was defined as the successful generation or adoption of an innovation within[167] an innovation generation or adoption process (cp. Chapter 2.2.1). An organization that has produced such an innovation can be called an innovator. Only innovators benefit from direct[168] economic effects of their innovations. Innovation achievements can hence be differentiated into immediate technical achievements and into indirect economic achievements (Tatikonda and Montoya-Weiss 2001; Wagner 2008). Applying the nomenclature of a framework from the field of management control, technical results achieved through innovation adoption or generation processes are called innovation outputs, while economic results of commercializing innovations are called outcomes (Weber and Schäffer 2006). Examples for innovation outputs are certain types of innovations, as well as certain types of innovators. Examples for innovation outcomes are returns on innovation, growth through innovation, market share gains or cost savings. Innovation outputs are the results of certain innovation inputs, e.g. investments or activities aimed at the creation of innovation outputs (Wagner 2008). In accordance with the discussion of innovation management (cp. Chapter 2.2.1) and in compliance with the achievement framework of Weber and Schäffer (2006), innovation inputs and outputs, as well as innovation outputs and outcomes, can be linked by transformation processes, in which management *for* innovation and management *of* innovation manifest themselves. The resulting framework is depicted in Figure 6-1.

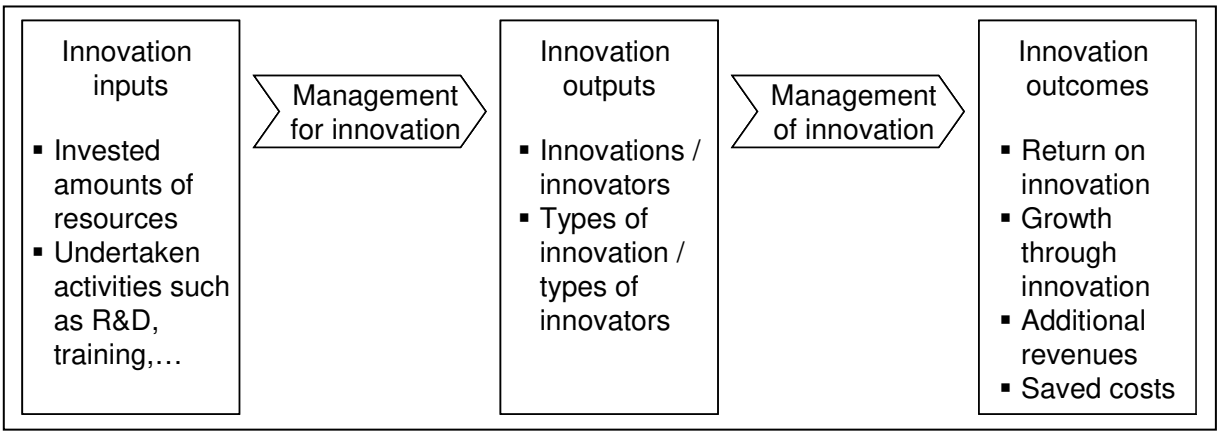

Figure 6-1: Innovation Achievement Framework
(synthesized from Tatikonda and Montoya-Weiss 2001; Wagner 2008; Weber and Schäffer 2006)

Two typologies of innovation management had originally been introduced (cp. Chapter 2.2.2): a process vs. system typology, and a management for innovation vs. management of innovation typology. Earlier chapters had focused on the former, because for the previous studies of innovation management, it was necessary to focus on either innovation processes or innovation systems as units of analysis, within which commercialization could be studied in

[167] As innovation processes were defined in such a way that they encompass commercialization (cp. Chapter 2.2.1), a link to success of the entire innovation process could falsely be interpreted to necessitate some kind of economic success. Therefore, reference is only made to successful creation of a novelty, i.e. to all innovation process activities before commercialization.
[168] There can be indirect effects such as learning (Cohen and Levinthal 1990) which are not taken into account here.

sequence with other activities respectively jointly with other categories. The situation is reversed here: For the study of innovation achievements, it is central to undertake a stepwise analysis of the transformation of innovation inputs into innovation outputs and of innovation outputs into innovation outcomes. This necessitates a distinction of management for innovation and of management of innovation, while it is irrelevant how both occur.

6.1.2 Data Base and Quality

The data used in this text stems from Germany only. The German logistics market is the largest in Europe, accounting for a market size of approximately € 170 billion (approximately $ 231.6 billion[169]) for in-house plus outsourced activities (Klaus and Kille 2006). Its importance is further strengthened by its pan-European transit function (Wagner 2008). As the cultural and legal environment is fixated, all of the data is influenced in the same way by it.

The data base of this text, the *Mannheim Innovation Panel*, belongs to the biannual Community Innovation Survey of the European Union. Responsible organizations are *Zentrum für Europäische Wirtschaftsforschung (ZEW)*, *Fraunhofer Institut für System- und Innovationsforschung* and *Institut für angewandte Sozialwissenschaft (infas)*, on behalf of German *Federal Ministry of Education and Research*. The survey design follows the OECD recommendations published in the Oslo Manual (OECD 2005). Descriptions of the panel are available online (Rammer and Schmiele 2008; Rammer and Bethmann 2009; ZEW 2009a). The survey is designed as a sampling survey.[170] Data is collected at the level of the firm and afterwards clustered to industries, as is traditionally done in economics (e.g. DESTATIS 2008c; DESTATIS 2009), as well as in parts of business-studies research (Bhojraj, Lee and Oler 2003). Clustering is coordinated internationally. Specifically, the current German industry classification DESTATIS (2008a) refers in a legally binding way to the NACE Rev. 2 classification of the European Community (EUROSTAT 2010) which in turn is based on the ISIC Rev. 4 system (UN 2009) of the United Nations (DESTATIS 2008b). Therein, land transportation firms (DESTATIS 2008a division 49), aviation firms, shipping firms, and firms offering logistics services (DESTATIS 2008a divisions 50-52 and 79), as well as courier, express and parcel service providers (DESTATIS 2008a division 53) together make up the LSP cluster, in accordance with the LSP definition (cp. Chapter 2.1). Each year and for each cluster, aggregated results from the *Mannheim Innovation Panel* are published in report form.

This text makes use of a secondary analysis of data from all reports on innovation management in individual service sectors. Those are nine publicly accessible reports (ZEW 2010a; ZEW 2010b; ZEW 2010c; ZEW 2010d; ZEW 2010e; ZEW 2010f; ZEW 2010g; ZEW 2010h) which will be referred to as the *ZEW innovation report series 2010*. They contain the latest data collected in 2009 and pertaining to 2008, as well as data for the years 2006 and 2007. One indicator in the original data, namely the share of innovation-active organizations, is only published in each survey for the most recent year. The indicator for 2007 was hence added from the *ZEW innovation report series 2009* (ZEW 2009b; ZEW 2009c; ZEW 2009d;

[169] Calculated on February 22, 2010, based on http://www.ecb.int/stats/exchange/eurofxref/html/index.en.html

[170] Its population are all legally independent organizations with a registered office in Germany, with at least five employees and belonging to sections C, D, E, I and J, to divisions 51, 72, 73, 74 and 90, as well as to groups 92.1 and 92.2 of the DESTATIS (2003) classification (Rammer and Bethmann 2009).

ZEW 2009e; ZEW 2009f; ZEW 2009g; ZEW 2009h; ZEW 2009i; ZEW 2009j), and the one for 2006 was added from the *ZEW innovation report series 2008* (ZEW 2008a; ZEW 2008b; ZEW 2008c; ZEW 2008d; ZEW 2008e; ZEW 2008f; ZEW 2008g; ZEW 2008h; ZEW 2008i). Another indicator, the share of product innovators, was not published for 2008 in the *ZEW innovation report series 2010*, but was included for the years 2007 and 2006.

Sample 2008	Corrected gross sample	Net sample	Response rate
Subtotal: LSPs	1,311	449	34.2%
Transportation industry and postal services	*1,311*	*449*	*34.2%*
Subtotal: other service providers	7,098	2,251	31.7%
Water supply and waste management	*553*	*165*	*29.8%*
Wholesale trade	*824*	*249*	*30.2%*
Media services	*839*	*257*	*30.6%*
Financial services	*937*	*248*	*26.5%*
IT and telecommunications	*827*	*253*	*30.6%*
Technical services and R&D services	*1,235*	*456*	*36.9%*
Consulting and advertising	*651*	*203*	*31.2%*
Corporate services	*1,232*	*420*	*34.1%*
Total: service providers	8,409	2,700	32.1%

Sample 2006	Corrected gross sample	Net sample	Response rate
Subtotal: LSPs	1,007	346	34.4%
Transportation industry and postal services	*1,007*	*346*	*34.4%*
Subtotal: other service providers	5,779	1,554	26.9%
Energy and water supply, mining	*569*	*132*	*23.2%*
Wholesale trade	*612*	*189*	*30.9%*
Media services[a]	*393*	*67*	*17.0%*
Credit and insurance business	*887*	*215*	*24.2%*
IT and telecommunications	*723*	*168*	*23.2%*
Technical services	*927*	*359*	*38.7%*
Management consulting and advertising	*751*	*154*	*20.5%*
Corporate services and waste management	*917*	*270*	*29.4%*
Total: service providers	6,786	1,900	28.0%

a: Sample size for divisions 59 and 60 of DESTATIS (2008a) only. Sample size for divisions 18 and 58 of DESTATIS (2008a) unknown and not included.

Table 6-1: ZEW Innovation Panel Sample Sizes

As industries evolve, classifications are updated from time to time. The *ZEW innovation report series 2010* is the first of the *ZEW innovation report series* which applies the latest DESTATIS (2008a) classification instead of DESTATIS (2003). For LSPs, virtually no changes occurred in between the classifications (DESTATIS 2003; DESTATIS 2008a), but some other industry boundaries were adjusted. The data for earlier years than 2008 was recalculated in the *ZEW innovation report series 2010* to match the updated classification, but earlier reports use the previous, slightly different industry delineations. For the two indicators

added from the *ZEW innovation report series 2008* and the *ZEW innovation report series 2009,* this results in a somewhat limited comparability over time, but discrepancies are hardly relevant, due to the re-aggregation to a cluster of other service providers.

For the years 2006 and 2008, sample sizes and response rates are depicted in Table 6-1 (Rammer and Schmiele 2008; Rammer and Bethmann 2009; Rammer 2010). LSP samples are 449 respectively 346 organizations large. The samples for other service providers contain 2,251 respectively 1,554 organizations. Response rates are 32.1 % respectively 28.0 %. Those values are very good. Non-respondent interviews complemented the survey sample, and additional large enterprises were added based on publicly available sources to ensure that the data is representative. From that total sample, the sub-populations respectively the entire population were computed (Rammer and Schmiele 2008; Rammer and Bethmann 2009). Adding the elaborated survey design (OECD 2005; ZEW 2009a), the data is regarded to be objective and credible. The high quality potential of secondary and archival data (Calantone and Vickery 2009) is hence met. Further on, the usage of this secondary data allows other researchers to control the validity of analyses, as well as to use the *identical* sample for their own research.

6.1.3 Data Analysis

This data analysis section contains two sections: In the first, the analytical procedure for the applied chi-square test of independence is depicted. The second contains the methods for the comparison of LSPs and other service providers.

6.1.3.1 Test Procedure

The only available values are mean values per year and industry, as well as sample sizes for 2006 and 2008. Inter-firm distributions are unknown, so that most statistical tests cannot be applied. It is possible, however, to make use of a chi-square test of independence of categorical variables. The single proposition of this text (P1) is that "*LSPs represent a special context to innovation*", opposed to null hypothesis (P0) that *"LSPs do not represent a special context to innovation"*. The proposition follows directly from the answer to research question 1 (cp. Chapter 2.3).[172] The data preparation and testing procedure incorporated seven steps (which are discussed in detail below):

1. Operationalizing the proposition
2. Recalculating the distribution of the original categorical variables, using the exact figures from the reports
3. Adjusting the sample for rounding effects
4. Deriving multiple missing-value scenarios
5. Calculating empirical X^2 values and determining critical X^2 values

[172] As Chapters 3, 4 and 5 focused solely on LSPs, they do not relate to the proposition.

6. Assessing for each operationalization if the null hypothesis must be retained or can be rejected
7. Aggregating the operationalizations

As regards operationalization, five nominally scaled and dichotomous variables and one ordinally scaled variable were identified from the reports. Those are: *innovation activity* (yes or no), *R&D usage* (continuously, occasionally or not), *innovator* (yes or no), *product innovator* (yes or no), *innovator with market novelties* (yes or no) and *innovator with cost-decreasing process innovations* (yes or no). Organizations are classified as innovation-active if they had any financial expenditures aiming at product or process innovations. Research and experimental development (R&D) relates to "*systematic creative work to expand existing knowledge and to use the thus gained knowledge for the development of new applications such as novel or significantly improved products respectively services or processes respectively techniques*" (ZEW 2009h, p. 4; translation by the author). Innovators are organizations which have introduced at least one product or process innovation. Product innovators and innovators with market novelties are defined analogously. The term market novelty is reserved for products which the innovator has introduced to the market as the first organization. Process innovators with cost-decreasing process innovations have introduced at least one process innovation which has lead to cost decreases. All of the above indicators relate to the three years prior to the survey. Due to the need to recalculate the distribution of the original categorical variables, as described in the following paragraph, together with their interdependence, as depicted in the following chapter, the option for direct testing of specific expectations was abandoned and a more conservative path was pursued, namely only to test for specificity of the context as a whole. The variables do not measure the latent variable context specificity itself, but context specificity should manifest itself within them. The used variables also clearly relate to different matters, so that they cannot be used to form a single construct. They were hence treated as multiple reflective operationalizations for the aggregated proposition P1, so that six testable null hypothesis operationalizations were available: $P0_a$: "*Innovation activity of LSPs is identical to that of other service providers*", $P0_b$: "*R&D usage for LSPs is identical to that of other service providers*", $P0_c$: "*Probability of being an innovator is identical for LSPs and other service providers*", $P0_d$: "*Probability of being a product innovator is identical for LSPs and other service providers*", $P0_e$: "*Probability of being an innovator with market novelties is identical for LSPs and other service providers*", and finally $P0_f$: "*Probability of being an innovator with cost-decreasing process innovations is identical for LSPs and other service providers*". The six operationalizations were used in parallel, while belonging to the same proposition. The advantage of that proceeding is that there are six opportunities to reject the null-hypothesis, which decreases the likelihood of Type II errors. However, as it also increases the likelihood of Type I errors, the classical Bonferroni correction was applied to the significance level, substituting the original significance level for the test as a whole, α_{Orig}, with $\alpha=\alpha_{Orig}/n_p$ where α is the significance level applied in each test and where n_p is the number of tests in parallel (Andersen 2001). Six propositions could be tested for the year 2006 and five of them again for the year 2008, so that $n_p=11$.

Next, the distributions of categorical variable values were recalculated, firstly without taking into account rounding influences or missing values. The reported data was inserted into a

spreadsheet document. The procedure was repeated and the data were compared to avoid transfer errors. For each report, i.e. each original industry (group), the known mean value of each categorical variable was multiplied with the sample size for that report. The frequencies of the reverse groups were assessed by subtracting the first groups' frequencies from the sample sizes.[173] For all reports of other service providers than LSPs, the data per category was then added up to a single cluster of "other service providers". The reason is that possible noticeable differences between other industries are not of interest in this research.

Next, rounding has to be taken into account. It had to be avoided to find supposedly significant differences between LSPs and other service providers which are in fact due to rounding effects that occurred for the publication of the data. For example, a share of organizations with continuous R&D reported at one precise digit to be 2% can in fact have had any value between 1.5% and a value infinitesimally smaller than 2.5%. The margin of error in this case is 50% of the reported value (= [2.5%-1.5%]/2%). Therefore, the LSP and the other service provider values calculated in the previous step were compared, and all values were replaced by a value as close to the mean value of the other group as possible.[174] Within the spreadsheet document, it was not necessary to re-round the figures in between calculations. With those modified categorical averages, sample sizes were recalculated as before. As sample sizes must be integer figures, and as share measures reflect averages calculated *from* the original data, it was necessary to round respectively truncate the recalculated figures. Having used extreme values for the mean values of categorical variables, as described above, it was necessary to round respectively truncate all values to the closest integer *against* the previous direction of correction. In the scenario without missing values those replacement values were in all cases still in between the values calculated straight from the originally reported figures and the mean value of the other group.[175]

Missing values were not discussed by the reports on the original data. If there were any missing value – as seems highly likely in survey research, but are not taken into account here, than the empirical X^2 test statistics and therefore the significance of differences would be inflated. The previous step which assumed no missing values was hence repeated twice: Once with a share of missing values of 25%, evenly distributed across all industries and variables – that share is regarded subjectively to be somewhat pessimistic, and again with a share of missing values of 50%.[176] The latter is subjectively regarded to be most likely overly

[173] For example, for LSPs in 2008, the share of organizations with continuous R&D was reported as 2% and that of those with occasional R&D as 3% (ZEW 2010f). Sample size was 449 (Rammer and Bethmann 2009). Therefore, the numbers of LSPs with continuous/occasional R&D were calculated to have been 8.98 respectively 13.47, so that the number of LSPs without any R&D was 449-8.98-13.47=426.55 organizations.

[174] For example, for the share of organizations with continuous R&D, the average for other service providers in 2008 was 13.5%>2%. Therefore, the LSP average value was replaced by 2.5%, i.e. a value infinitesimally larger than the largest one possible, and from each of the values for the individual industries, 0.5% were subtracted, so that the new average for other service providers was 13.0%.

[175] For example, for LSPs with occasional R&D, the share of organizations in 2008 that was reported to have been 3% was first replaced by 3.5% as a theoretical maximum, because the reported share for other service providers was higher than that. Multiplying the share with the sample size of 449 LSPs, 15.72 LSPs (=3.5%*449) resulted. As the share had been increased to its theoretical maximum, the value had to be truncated to 15 LSPs. The rounded value 16 would have produced an average share of 3.56…% which could not have been rounded to 3%.

[176] For innovating LSPs with cost-decreasing process innovations in 2006, repetition with 50% missing values lead to a replacement value of 12 which was smaller than the value 12.98 that had been calculated right from the reported figure, although the share of LSPs with cost-decreasing process innovations had been increased from

pessimistic. Another problem would stem from the probabilities of missing values being dependent on industry, variable or even true variable values. That issue cannot be controlled for in this research, so that it must be assumed that missing values occur completely at random (Rubin 1976; von Hippel 2004).

Next, for each scenario the empirical X^2 test statistics were computed. There was nothing special about this step: Expected values were calculated from the assumption of independent marginal totals. The quadratic deviations between the observed values and the expected values were first normalized by dividing by their expected values, and were then added up across all cells (cp. e.g. Carter and Narasimhan 1994; Stock and Mulki 2009; Templin and Noffsinger 1994 for logistics-related examples). Critical X^2 values can be obtained from spreadsheet software. They depend on the degrees of freedom and the chosen significance levels. Here, all contingency tables except the R&D table had one degree of freedom because df=(c-1)*(r-1) where df is the degree of freedoms, c is the number of columns and r is the number of rows (e.g. Agresti 2002). Three values for α_{Orig} were used: 0.1%, 1.0% and 5%. With n_p=11, α values of approximately 0.01%, 0.09% and 0.45% resulted.

The penultimate step consisted in a rather mechanic comparison of the computed empirical X^2 test statistics with the determined X^2 rejection values. If $X^2_{emp}>X^2_{rej}$, then the null-hypothesis could be rejected. If that was not the case, then it had to be maintained.

Last, the operationalizations had to be aggregated which requires two clarifications: First, it is important to point out again that there were eleven operationalizations of the same null-hypothesis respectively pertaining to the same single proposition. Those had been used in parallel, and the significance levels had been adjusted for the increased likelihood of Type I errors. A non-rejection of a null-hypothesis does not indicate that the null-hypothesis is proven, but that in that very test, it could not be falsified. Therefore, if any of the tests leads to a rejection, then the null-hypothesis is rejected (Simes 1986). Second, and more specifically, data from two cross-sections is used in parallel. A possible rejection of the null-hypothesis based on the data of just one year could be interpreted to mean that the LSP context and the context of other service providers to innovation were different only in that very year. It is however plausible to assume that context specificity is a variable of low inertia which should not change drastically from year to year, so that a cross-sectional analysis is deemed possible. The motivation to use multiple cross-sections in parallel actually stems from high inter-temporal variance of some of the achievement indicators.[177] This will be discussed in more detail in the following sub-chapter.

6.1.3.2 Comparison of LSPs and Other Service Providers

Differences between LSPs and other service providers are – even in presence of 50 percent missing values – significant at the α_{Orig}=0.1 percent level, so that it seems justified and

7% to 7.5%. The reason why this can happen is precisely that (7.5%-7.0%)*346*(1-50%)<1. Assuming a quasi-sample size of 173 values, the only integer solution for the number of LSPs with 6.5% <= share of innovators with cost-decreasing process innovations <7.5% is approximately 6.94%, leading to 12 LSPs with cost-decreasing process innovations. It becomes obvious that with the assumption of equally distributed missing values there could even have been situations without any integer solutions.

[177] It is important to note the conceptual difference between the inertia of the context itself – which, like in any cross-sectional study was assumed to be low – and the inertia respectively volatility of the reflective indicators.

reasonable to compare LSPs and other service providers. While the source data stems from the same industry reports as before, it is not regarded as a reflective operationalization of context specificity, anymore, but as descriptive and mostly manifest data that is analyzable in itself.

To enable the comparison which serves as a preparation for the explanation of differences between LSPs and other service providers, other service industries first had to be weighted to calculate the cluster of other service providers.[178] The central decision to be taken was if weights should reflect sample sizes, population sizes or industry count. The latter, i.e. equal weighting of industries, was chosen as the alternatives were assessed to overstretch the descriptive usability of the data base. However, both alternatives were calculated as well, and all interpretations of the data in the subsequent chapter are robust against the weighting method. Second, time lag had to be handled: Output and outcome indicators are related to an innovation introduced in the three years prior to the survey (e.g. ZEW 2009h), whereas some input indicators such as innovation intensity or the share of investment expenses are related to the previous year. A distinct type of time lag stems from the positive duration of innovation processes and projects. In an extreme case of very complex new services, it is imaginable that innovation processes last longer than a year. Because of time lags it was decided to investigate chronological averages. Inter-temporal averages can lead to noise reduction in the data and hence affect its "descriptive quality" positively. The period 2006 to 2008 was used, as it was assessed to be short enough to depict the present state of LSPs' and other service providers' innovation achievements (strong trends could not be identified), but long enough to reduce noise substantially. In addition, data from 2006 and 2007 that was incorporated in the *ZEW innovation report series 2010* had been recomputed to reflect the latest classification of economic activities (DESTATIS 2008a). Third, it would be desirable to analyze outputs pertaining not only to innovators, but also to produced innovations. With original data collected at the level of the firm, this is not directly possible. However, as innovation is (by definition) a relatively rare phenomenon, some inference from the share of organizations that produced a certain type of innovation to the level of presence of that kind of innovation is possible. With the above amendments and considerations, a systematic descriptive comparison between LSPs' and other service providers' innovation inputs, outputs and outcomes becomes possible.

The test procedure described in Chapter 6.1.3.1 was based on the expectation that LSPs' context should cause significant differences between LSPs' achievement indicators and those of other service providers. It was not assumed that the context was the only explanatory variable, and clearly, it is not:[179] A chain of cause-and-effect relationships exists between innovation inputs, management for innovation, innovation outputs, management of innovation and innovation outcomes, as depicted by the research framework (cp. Chapter 6.1.1). Therefore, further analyses take these interrelations quantitatively and qualitatively into account to propose reasons for differences between LSPs and other service providers in

[178] For the chi-square test of independence, the other service provider sample is made up of all added-up non-LSP values. While it does not matter to the test, the respective "weight" of each non-LSP industry is hence determined by its sample size.

[179] It is important to highlight that independence had previously not been assumed. In particular, the Bonferroni correction does not require independence of the test indicators that are used in parallel.

answer to research question 5b. Quantitatively, a marginal-total respectively conditional-probability logic was applied. For example, the share of innovators is not interpreted on a stand-alone basis, but replaced by innovators per innovation-active organizations as a measure of operational success. The method in itself is simple, but is leveraged by the potency of the data base. It is hence made possible to explain differences between LSPs and other service providers by upstream differences. The procedure results in a de-averaging of the LSP cluster and the other service provider cluster into multiple micro-clusters which can be compared individually. Table 6-4 (on page 123) provides an overview of eleven additional quantitative indicators derived in this way.

For some of the de-averaging analyses, additional assumptions must be made, because an advantage of primary data, that it can be adjusted precisely to the research question at hand, is not available. Secondary data has the advantage of likely being more objective (Calantone and Vickery 2009), but it relies more strongly on indirect analyses and interpretations of its data, and its choice of methods is limited by the given structure of the data. The kind of assumption is best explained up-front with a specific example: Average innovation intensity is reported for all organizations in the *ZEW innovation report series 2010*. By definition, only innovation-active organizations have positive innovation intensity, so that an amendment to the original data is to estimate innovation intensity of innovation-active organizations by dividing by the share of innovation-active organizations. The calculated value is an unbiased estimator if the unknown variable *revenue* does not systematically differ between the groups of innovation-active and the groups of innovation-inactive organizations. The assumption seems to stretch quite far, as – in the specific example – it seems plausible that larger organizations will be more likely to invest any resources into innovation. If that was the case, then the calculated innovation-activity of innovation-active organizations would overestimate the true value. However, for the sake of interpretability of differences between LSPs and other service providers, unbiased estimators are not required. As long as additional indicators are equally distorted between LSPs and other service providers, the differences are still interpretable. This assumption is made for some of the additionally calculated indicators, as listed in the results section.

With respect to the validity of making assumptions, Shugan (2007) points out that claims of unrealistic assumptions are void of content, because by definition assumptions are not realistic, and that assumptions belong to the input of research, but what ought to be judged is its output and the process with which the output is derived from the input. This text follows his argumentation. However, emphasis will be placed on communicating assumptions and on not drawing conclusions which rest strongly on them.

6.2 Results

The structure of the results section follows that of the data analysis section in the previous chapter, i.e. test results are presented first, before differences are analyzed. As the test procedure was already described in a high level of detail, the first section can be kept rather brief, while the second relies on more interpretation.

6.2.1 Chi-square Tests

The results of the statistical tests are depicted in Table 6-2. It is found that for eight of the 11 tests run in parallel, their specific null-hypotheses can be rejected. $P0_a$, $P0_b$, $P0_c$ can be rejected highly significantly for both 2006 and 2008. $P0_d$ could only be tested with data for 2006 and was rejected there. The case of $P0_e$ is particularly noteworthy. For 2008, $P0_e$ can be rejected (at α=0.01% with 25% missing values or at α=0.09% with 50% missing values), while for 2006, $P0_e$ cannot be rejected. This can be explained by the high volatility of LSPs' average share of innovators with market novelties. $P0_f$ cannot be rejected, irrespective of year, share of missing values and level of significance.[180]

Proposition	Year	X^2_{emp} for r_{MV} = ...			φ^a	df	X^2_{rej} for α = …[b]		
		0%	25%	50%			0.45%	0.09%	0.01%
$P0_a$: Innovation activity of LSPs is identical to that of other service providers.	2006	77.90	58.54	**40.01**	0.20	1	8.05	11.00	**15.32**
	2008	44.70	33.44	**22.76**	0.13	1	8.05	11.00	**15.32**
$P0_b$: R&D usage for LSPs is identical to that of other service providers.	2006	40.67	30.84	**20.99**	0.15	2	10.79	14.01	**18.61**
	2008	73.15	55.63	**38.58**	0.16	2	10.79	14.01	**18.61**
$P0_c$: Probability of being an innovator is identical for LSPs and other service providers.	2006	26.57	**20.26**	13.39	0.12	1	8.05	**11.00**	15.32
	2008	35.93	26.91	**18.34**	0.12	1	8.05	11.00	**15.32**
$P0_d$: Probability of being product innovator is identical for LSPs and other service providers.	2006	34.27	25.18	**17.14**	0.13	1	8.05	11.00	**15.32**
$P0_e$: Probability of being an innovator with market novelties is identical for LSPs and other service providers.	2006	1.02	0.67	0.69	0.02	1	8.05	11.00	15.32
	2008	25.16	**18.96**	12.73	0.10	1	8.05	**11.00**	15.32
$P0_f$: Probability of being a process innovator with cost-decreasing effects is identical for LSPs and other service providers.	2006	6.90	5.05	3.96	0.06	1	8.05	11.00	15.32
	2008	0.50	0.39	0.28	0.01	1	8.05	11.00	15.32

a: Without the effects of rounding of case numbers, $X^2_{emp} \sim n$, so that differences in φ are entirely due to rounding. φ was calculated for r_{mv} = 0%.

b: Significance levels are Bonferroni-corrected, i.e. α levels are divided by 11, the number of parallel comparisons.

Note: Figures in bold print in the X^2_{emp} section mark the highest share of missing values which is still tolerable to reject P0 at maximum significance (i.e. α = 0.01%). Likewise, figures in bold print in the X^2_{rej} section mark the highest level of significance at which P0 can be rejected in presence of 50% missing values.

Table 6-2: Chi-square Test of Independence Results

The φ value is a measure of the strength of the relationship between the variables (e.g. Everitt 1992). It is calculated as $\varphi=(X^2_{emp}/n)^{0.5}$ where n is the total sample size. Here, the φ values

[180] The statements relates to the levels of significance that had been chosen ex ante. With α_{Orig}=10%, χ^2_{rej} (α=0.91%; df=1)=6.80, so that $P0_f$ could have been rejected in 2006 in absence of missing values.

do not exceed 0.16 which means that industry, more specifically being an LSP or not, is only a weak predictor of the innovation-related indicators.

As Simes (1986) points out, the null hypothesis can be rejected if any of the parallel tests leads to its rejection at a certain level of significance. Setting α_{Orig} to 0.1% and thus α for each test to 0.01% and assuming a 50% share of missing values, there are six tests that lead to the rejection of P0: $P0_{a,\,2006}$, $P0_{a,\,2008}$, $P0_{b,\,2006}$, $P0_{b,\,2008}$, $P0_{c,\,2008}$, and $P0_{d,\,2006}$. It can hence be concluded in answer to research question 5a that, indeed, LSPs clearly represent a special context to innovation, as could be shown at the α_{Orig}=0.1% level of significance.

6.2.2 Comparison Results

Having rejected the null-hypothesis at the α_{Orig}=0.1 percent level – even in presence of 50 percent missing values, differences between innovation-related variables for LSPs and other service providers s are not by chance, but meaningful. This chapter is therefore dedicated to the analysis and interpretation of those differences, including those variables which – as they do not represent averages of categorical data – could not be tested on their significance.

6.2.2.1 Unrelated Comparison

A calculation of inter-temporal averages for 2006 to 2008 could occur for twelve indicators in the original data. Indicators O_1, O_{4a}, $O_{4b,}$ O_5, O_6, O_7 and O_8 (cp. Table 6-3) were already defined in Chapter 6.1.3.1, based on the *ZEW innovation report series 2008 to 2010*. The others are defined as follows: Innovation intensity (O_2) refers to the share of revenue which is used as innovation expenditure (also cp. Chapters 3.2.2.1 and 5.2.3.1).[181] The share of investment expenses (O_3) concerns the mixture of innovation expenses which can be current expenses or investment expenses. Two indicators relate to revenues with product innovations, namely to revenues with market novelties (O_9) and to revenues with imitations (O_{10}). Both measure "*revenues generated […] with the according innovations*" (ZEW 2009h, p. 3; translation by the author) and refer to the previous three-year period. As market novelties are new to the entire market, they must also be new to the introducing organization. Imitations[182] are, as the name suggests, not new to the market, but new to the imitating organization, because otherwise they would not be innovations. For an innovator its market novelties plus its imitations make up all its product innovations, so that market novelty revenues plus imitation revenues equal all revenues from product innovations. Two final indicators relate to process innovations: Those can first help in decreasing costs (O_{11}). The respective indicator "*refers to unit costs respectively process costs of the respective year which could be saved due to process innovations introduced in the previous three-year period*" (ZEW 2009h, p. 3; translation by the author). Second, process innovations can increase revenue through quality improvements (O_{12}). The related indicator measures "*revenue increase compared to the previous year's revenues which can be traced back to quality improvements that were achieved by process innovations introduced in the previous three-year period*" (ZEW 2009h,

[181] For financial services, innovation intensity is related to gross interest earnings plus gross commission earnings (banks) respectively premium earnings (insurances).

[182] The term is adopted here because term labels follow the original. However, it seems not to have been chosen optimally, because it excludes unconscious and deliberate re-inventions, implying that the supposedly imitating organization was aware of the existence of some other organization's market novelty.

p. 3; translation by the author). A slight systematic measurement difference exists between indicators O_9 and O_{10} on the one hand and O_{11} and O_{12} on the other hand, as the former measure a share of a changed value, whereas the latter measure a change. In temporal terms, there is congruence between the periods in which an organization is labelled "innovator" because of a certain innovation and the period for which outcomes are classified as innovation-related due to the same innovation.

Indicator		LSPs	Other service providers	Comparison[a]
O_1	Share of innovation-active organizations	33%	53%	-38%
O_2	Average innovation intensity	2.2%	2.6%	-18%
O_3	Share of investment expenses[b]	76%	45%	69%
O_{4a}	Share of organizations with continuous R&D	2%	12%	-86%
O_{4b}	Share of organizations with occasional R&D	4%	10%	-65%
O_5	Share of innovators	29%	46%	-37%
O_6	Share of product innovators[c]	21%	35%	-40%
O_7	Share of innovators with market novelties	5%	12%	-55%
O_8	Share of process innovators with cost-decreasing effects	10%	14%	-31%
O_9	Average share of revenues with market novelties	1.3%	2.3%	-45%
O_{10}	Average share of revenues with imitations	5.1%	9.1%	-44%
O_{11}	Average cost-per-process decreases through cost-decreasing process innovations	2.1%	3.1%	-34%
O_{12}	Average revenue increase through quality-improving process innovations	2.0%	2.5%	-19%

a: The value equals the difference between the LSP value and the value of other service providers, divided by value of other service providers.
b: The original reports depict absolute innovation-related investment and current expenses.
c: The average for 2006 and 2007 was used, as no value was available for 2008.

Table 6-3: Original Indicators on Innovation Inputs, Outputs and Outcomes

In the nomenclature of the research framework, indicators O_1 to O_{4b} relate to innovation inputs, indicators O_5 to O_8 to innovation outputs and indicators O_9 to O_{13} to innovation outcomes (cp. Figure 6-1 on page 110). With the exception of O_3, all indicators are constructed in such a way that relatively more innovative (groups of) industries are characterized by relatively higher values: An industry with high innovation inputs should be comprised of many organizations active in innovation (O_1), by high innovation intensity (O_2) and/or by organizations engaged in relatively much Research & Development (O_{4a} and O_{4b}). Likewise, an industry with high innovation outputs should have many innovators (O_5). More specifically, it should have many product innovators (O_6) or even more specifically innovators

with market novelties (O_7). It should also have many innovators with cost-decreasing process innovations (O_8). Last, an industry with high innovation outcomes should feature high revenues with market novelties (O_9), high revenues with imitations (O_{10}), high cost-per-process decreases through cost-cutting process innovations (O_{11}) and/or high revenue increases through quality-improving process innovations (O_{12}).

For each of the original indicators, Table 6-3 includes a comparison of the average values – which are the only available values – for the LSP cluster and the cluster of other service providers. Again with the exception of O_3 which indicates that LSPs' innovation expenses are rather dominated by investment expenses, while the innovation expenses of other service providers are made up nearly evenly of investment and of current expenses, all LSP values are noticeably, i.e. at least 18% (O_2) and up to 86% (O_{4a}), lower than the values of other service providers. Less LSPs than other service providers invest any resources into innovation (O_1), and LSPs have lower innovation inputs than other service providers, both in terms of spending (O_2) and in terms of R&D (O_{4a} and O_{4b}). With respect to innovation outputs, there are fewer innovators (O_5), product innovators (O_6), innovators with market novelties (O_7) and fewer innovators with cost-decreasing process innovations (O_8) among LSPs. As regards innovation outcomes, LSPs on average benefit from lower revenues with market novelties (O_9), with imitations (O_{10}), and through the effects of quality-improving process innovations (O_{12}) than other service providers do. Their cost-per-process decreases through cost-cutting process innovations are also lower than those of other service providers (O_{11}). The above indicators strongly support the analysis of Wagner (2008) who had compared LSPs to other industries, based on the 2005 cross-section of the *Mannheim Innovation Panel* data and concluded that LSPs are hardly innovative.

6.2.2.2 Interrelated Comparison

To answer research question 5b, an explanation of the differences between LSPs and other service providers is aimed for. Table 6-4 provides an overview of eleven additional quantitative indicators derived to this aim. General assumptions are dynamic stability, as well as the absence of different distortions between the revenues (for A_1, A_{2a}, A_{2b}, A_8, A_9, A_{11}) respectively costs per process (A_{10}) of the compared clusters for LSPs and other service providers (cp. Chapter 6.1.3.2). The additional indicators will next be discussed individually, before an aggregated interpretation is tried.

By definition only resource-investing LSPs have positive innovation intensity. It is thus a useful amendment to the original data to add an indicator that relates innovation intensity to the cluster of investing organizations (A_1). While average innovation intensity of all organizations was 18% lower for LSPs than for other service providers (cp. O_2 in Table 6-3 on page 121), innovation intensity of innovation-active LSPs is actually 33% higher than that of innovation-active other service providers (cp. A_1 in Table 6-4). With the knowledge of only O_2, it could have been speculated that LSPs might have low innovation achievements due to under-funding of their innovation efforts. That seems much more unlikely with the additional knowledge of O_1, as taken into account by A_1. However, it cannot be concluded from this research which relative inherent resource needs LSPs have in their innovation efforts, compared to other service providers.

Indicator		Calculation	LSPs	Other service providers	Comparison[a]
A_1	Average innovation intensity of innovation-active organizations	$A_1=O_2/O_1$	6.6%	5.0%	33%
A_{2a}	Average investment expense related innovation intensity of innovation-active organizations	$A_{2a}=O_2/O_1*O_3$	5.0%	2.2%	124%
A_{2b}	Average current expense related innovation intensity of innovation-active organizations	$A_{2b}=O_2/O_1*(1-O_3)$	1.6%	2.8%	-41%
A_{3a}	Share of innovation-active organizations with continuous or occasional R&D	$A_{3a}=(O_{4a}+O_{4b})/O_1$	16%	42%	-61%
A_{3b}	Share of organizations with continuous or occasional R&D that have continuous R&D	$A_{3b}=O_{4a}/(O_{4a}+O_{4b})$	31%	53%	-41%
A_4	Innovators per innovation-active organizations	$A_4=O_5/O_1$	90%	88%	2%
A_5	Product innovators per innovator	$A_5=O_6/O_5$	72%	75%	-5%
A_6	Innovators with market novelties per product innovators	$A_6=O_7/O_6$	25%	34%	-24%
A_7	Process innovators with cost-decreasing effects per innovators	$A_7=O_8/O_5$	33%	30%	9%
A_8	Average share of revenues with market novelties per innovators with market novelties	$A_8=O_9/O_7$	24%	20%	22%
A_9	Average share of revenues with product innovations per product innovator	$A_9=(O_9+O_{10})/O_6$	30%	33%	-7%
A_{10}	Average cost-per-process decreases through cost-cutting process innovations per process innovator with cost-decreasing effects	$A_{10}=O_{11}/O_8$	21%	22%	-3%
A_{11}	Average revenue increase through quality-improving process innovations per innovator	$A_{11}=O_{12}/O_5$	7%	5%	29%

a: Equals the difference between the LSP value and the other service provider value, divided by the value for other service providers

Table 6-4: Additional Indicators Linking Innovation Inputs, Outputs and Outcomes

Comparable adjustments of the original indicators for the share of investing organizations are made to other innovation input indicators: Innovation-active LSPs have an investment expense related innovation intensity which is 124% higher than that of other service providers (A_{2a}), compared to a difference of 69% across all organizations (O_3). This can be explained by the equipment-based nature of LSPs' services (cp. Chapter 2.3.2). On the other hand, innovation-active LSPs are characterized by current expense related innovation intensity which is 41% lower than that of other service providers (A_{2b}). The surplus in investment expenses of innovation-active LSPs more than offsets their relative lack of current expenses (A_1). Wagner (2008) had explained that for LSPs, "*innovation often materializes in form of technological advanced infrastructure and equipment investments*" (p. 220), and that LSPs' innovation "*is often an incremental process*" (p. 219). The statements suggest that two

distinct clusters of innovation exist for LSPs, one pertaining to resource-intensive adoptions of technological equipment and infrastructure, the other referring to resource-scarce incremental innovations.

Next, the indicators O_{4a} and O_{4b} do not take into account that organizations which do not aim to be innovative will certainly not undertake R&D activities.[183] The data was hence recomputed excluding all non-investing organizations (A_{3a}). Still, the share of investing LSPs that undertakes any R&D is 61% lower than that of other service providers. It can hence be concluded that for innovation-active LSPs, R&D is noticeably less often used than for innovation-active other service providers. In addition, among LSPs with any R&D, continuous R&D is 41% rarer than among their counterparts in other service providers (A_{3b}). A plausible reason can be derived from the R&D definition element of knowledge creation: Supposing that LSPs strive for less radical novelties than other service providers, they ought to be less than average needy of new knowledge and hence of R&D activities (cp. A_6). This reasoning is supported by the previously discussed split of innovation into two clusters: The input cluster of new technological equipment is certainly affiliated with lower degrees of novelty, because technology is adopted rather than generated by LSPs.[184] The second cluster could already be identified with incremental innovations which by the R&D definition need less R&D. While the original data itself refers only to the firm level and not to the project level, the previous considerations suggest that LSP innovation tends to be rather incremental. Another possible explanation for the infrequent R&D usage would be that LSPs' typical down-to-earth-ness works as an affective barrier and thus influences their R&D usage negatively. From the current data base, neither explanation can be tested.

Further amendments are made to some of the output indicators to better assess if LSPs have different likelihoods of becoming (a certain kind of) innovator. First, it is reasoned that innovations do not emerge purely by chance, but require certain development effort. It follows that only organizations that are innovation-active can become innovators. The share of innovators is hence related to the share of innovation-active organizations (A_4). The value for LSPs is 2% higher than for other service providers, indicating similar frequencies of innovation-active organizations to become innovators. Aschhoff et al. (2009) suggest that the difference between the shares of innovation-active organizations and the shares of innovators reflect ongoing and aborted innovations. In the long run, the difference should hence be interpretable as an indicator of failure. Accordingly, the data does not indicate differences in failure between LSPs and other service providers.

For LSPs, their share of product innovators is 40 percent lower than for other service providers (O_6). Rather than interpreting this difference on its own, it is investigated if within innovators, there are particularly many or few product innovators (A_5).[185] The LSP value is

[183] Excluding indirect purposes of R&D such as learning

[184] As adoption refers to "imitations", it is likely less needy of R&D than generation.

[185] With respect to the make-up of the group of innovators, it would be interesting to compare the shares of product and process innovators among LSPs to those of other service providers. As the *ZEW innovation report series 2010* does not depict the share of process innovators, the *ZEW innovation report series 2009* is used instead. The average share of only-product innovators among innovators for the period 2003 to 2007 is 29.8% for LSPs and 34.3% for other service providers. The share of simultaneous product and process innovators among innovators is 39.0% for LSPs and 39.4% for other service providers. Last, the share of only-process innovators among innovators is 31.2% for LSPs and 26.4% for other service providers. These data suggest a

5% lower than the value of other service providers. The difference in indicator O_6 is hence mostly explained by LSPs' noticeably lower shares of innovation-active organizations (O_1).[186]

Next, the share of innovators with market novelties in all organizations is 55% lower for LSPs than for other service providers (O_7). When linked to the super-ordinate share of product innovators, this difference does not vanish entirely: Among LSPs who are product innovators, there are 24% less organizations with market novelties than among other service providers (A_6). This finding suggests that the LSP industry is indeed characterized relatively strongly by imitations. Without being able to identify cause and effect, indicators A_{3a}/A_{3b} and A_6 fit well to one another. Both phenomena can be explained by the atomic nature of logistical services which is effective as an upper threshold to the radicalness of innovations in existing systems (cp. Chapter 2.3.2). Down-to-earth-ness (cp. Chapter 2.3.3) can also serve as a partial explanation for the low R&D usage and the low radicalness of innovations.

In analogy to the previous indicators, it would be desirable to relate the share of innovators with cost-decreasing process innovations (O_8) to the share of process innovators. The latter is unknown, but an additional indicator can "at least" take varying shares of innovators between LSPs and other service providers into account (A_7). While the original indicator, the share of innovators with cost-decreasing process innovations in all organizations (O_8), was 31% lower for LSPs than for other service providers, the LSP share of innovators with cost-decreasing process innovations per innovator (A_7) is 9% higher than the value of other service providers. This suggests that LSPs' likelihood to produce cost-decreasing process innovations is – if they produce any innovations at all – at least not smaller, possibly even higher, than that of other service providers. A higher likelihood could for example be explained by a current cost focus of LSPs. Overall, with respect to the additional output indicators (A_4, A_5, A_6 and A_7), the only relatively strong – and therefore c. p. more likely significant – difference is that innovators among LSPs are less likely innovators with market novelties than innovators among other service providers are.

The innovation outcome indicators in the original data (O_9, O_{10}, O_{11} and O_{12}) should further be linked to their respective groups of beneficiaries, e.g. only innovators with market novelties benefit from revenues achieved through market novelties (A_8). It is found that LSPs with market novelties achieve a 22% higher share of revenues through those market novelties than other service providers (A_8). That difference indicates relatively high immediate benefits for LSPs out of their market novelties, which is at first surprising when contrasted with LSPs' low R&D usage (A_{3a}, A_{3b}), because relatively high shares of revenues from market novelties should encourage LSPs to strive for creating more of them. However, as long as there are few LSPs aiming at radical novelties (A_{3a}, A_{3b}) and few market innovators (O_7, A_6), it is plausible that those that succeeded have relatively high benefits.

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noteworthy high prominence of process innovators respectively a noteworthy low prominence of product innovators among LSPs. It can be explained from the typical context (cp. Chapter 2.3): First, in outsourcing, LSPs often take over logistical systems which are already set-up. As product innovation tends to occur relatively early across life cycles (Teece 1986), innovations in set-up systems are relatively often process innovations. Second, the atomic character of logistical services manifests itself in a difficulty to innovate the most basic service element: There are finitely many ways to effectively and efficiently provide a single act of transportation, storage or handling. That atomic character hence restricts logistical product innovation to cases where innovation is related to large amounts of service provisions, so that process innovation may be relatively more prominent.

[186] Counterbalanced by their somewhat higher share of innovators per innovation-active organizations (A_4)

For indicator O_{10}, a direct comparison with its group of beneficiaries, i.e. imitators, is not possible, because their prominence is unknown. It cannot be computed from the difference of product innovators and innovators with market novelties, because a product innovator can have produced both types of product innovation.[187] However, when the shares of imitation revenues and of market novelty revenues are added, a comparison with the exactly known aggregate of product innovators is possible (A_9): LSPs have shares of revenues with product innovations per product innovator which are 7% lower than those of other service providers. The comparison indicates that LSPs' immediate benefits from all of their product innovations are somewhat lower than those of other service providers. It follows from this indicator and from indicator A_8 that LSPs' share of additional revenues with imitations per imitator is more than 7% lower than those of other service providers. With relatively high benefits from market novelties (A_8), but relatively low benefits from imitation (A_8 and A_9), the question arises again why LSPs do on average not generate more radical novelties. A possible, but once again not testable explanation would be that market novelties are relatively more expensive to generate for LSPs than for other service providers.

Next, LSPs who are process innovators with cost-decreasing process innovations have cost-per-process decreases through those innovations which are 3% lower than those of other service providers (A_{10}). The difference appears negligible.

Finally, the group of LSPs with quality-improving process innovations must be taken into account. However, the prominences of that group and of its super-ordinate group of process innovators are unknown, so that a comparison of the indicator O_{12} and its beneficiaries is not possible. Unlike before, the indicator cannot be incorporated in a more encompassing group, either. Rather than neglecting that class of benefits, indicator A_{11} is defined which relates O_{12} to the prominence of the group of innovators. Unlike A_8 to A_{10}, it cannot be directly interpreted, but is merely a variable that is defined to take additional information into account: If the original indicator O_{12} was interpreted on a stand-alone basis, it would suggest that LSPs benefit less from quality-improving process innovations than other service providers. Indicator A_{11} adjusts this figure for the prominence of innovators among both groups, which adds information to it, because all process innovators which benefit from additional revenues through quality improvements are innovators. The auxiliary indicator A_{11} is 29% higher for LSPs than for other service providers, which would indicate 29% higher benefits of LSPs with quality-improving process innovations if the groups of process innovators who benefit from additional revenues through quality-improving effects were equally frequent among LSPs who are innovators and among other service providers who are innovators. As it is, the difference in indicator A_{11} has the opposite algebraic sign to that of indicator O_{12}, and it at least suggests relatively higher benefits for LSPs from process innovations with quality improvements.

From a simultaneous view at the respective differences between LSPs and other service providers which the outcome-per-beneficiary indicators A_9 and A_{10} depict, and which the auxiliary indicator A_{11} hints at (cp. Table 6-4 on page 123), LSPs cannot be said to have

[187] There is only one equation and one inequation with two unknown variables, namely the share of imitators and the revenues through imitations per imitators. It is merely possible to deduce that at least 21%-5%=16% of all LSPs and 35%-12%=23% of all other service providers were imitators.

strongly noticeable lower innovation outcomes per beneficiary than other service providers. This finding could not have been drawn from the original indicators (cp. Table 6-3 on page 121), and it is of high importance to future research, because together with the similar share of innovators per innovation-active organization (A_4) it suggests that LSPs' benefits from their innovation management are ordinary. This indicates that the specific challenges for LSPs which had been identified earlier (cp. Chapter 3.2.2.7, 4.2.6, 5.2.1.7 and 5.2.3.7) do not affect LSPs' innovation management benefits noticeably below the level of other service providers, either because the challenges are no greater than elsewhere, or because LSPs manage them well enough to remove potential negative effects. Either way, the finding is highly relevant to LSPs' managers, because it signifies that LSPs can achieve equally much in innovation processes and with innovation as other service providers do.

The finding of LSPs' presumably ordinary innovation outcomes per innovator raises the question why 38% less of the LSPs are innovation-active than of the other service providers (O_1). To investigate this, it could be aimed at turning the previous (auxiliary) outcome-per-beneficiary indicators into "productivity measures" by further relating them to innovation inputs. It is unknown how innovation intensity is allocated to varying classes of innovation projects so that no further indicator is calculated. The comparison logic can be applied qualitatively, nevertheless:

- Those LSPs that do invest resources into innovation efforts,[188] invest approximately 33% more than other service providers (A_1).
- The share of innovators among innovation-active organizations is calculated to be 2% higher for LSPs than for other service providers (A_4).
- The immediate outcomes for successful innovators among LSPs appear to be similar to those of other service providers (A_9: 7% lower for product innovators; A_{10}/A_{11}: 3% lower respectively c. p. 29% higher for process innovators).

The above figures suggest that in the face of similar-appearing technical success rates and similar outcomes per innovator, it could be noticeably high inputs which innovation-active LSPs currently have to invest that prevent many innovation-inactive LSPs from undertaking innovation efforts. Inactivity with respect to innovation could be due to LSPs' own previous experience of low returns from innovation, to their having observed competitors with low returns or to their realistic assessment of their own abilities, thereby anticipating low returns if they aimed for innovation. It must be conceded though, that there are multiple important variables that could not be taken into account here, such as differences in operating margins respectively cost levels, different revenue cannibalization effects or different innovation-related risks.

As innovation-active LSPs have higher innovation intensity than innovation-active other service providers, while the frequencies of becoming innovator and the outcomes per innovator are similar for both groups, it can be concluded that LSPs require relatively more resources for their innovation processes than other service providers do. Innovation intensity recurs to all innovation-related expenditures, i.e. resources are used within management for

[188] It can be taken for granted that precisely those organizations aim to become innovators which invest any resources.

innovation and management of innovation. As no reasons are apparent, why LSPs' innovation management should be inefficient compared to other service providers' innovation management, it is proposed that, for LSPs, innovation is inherently more costly than for other service providers. With respect to the origin of LSPs' inherently higher resource needs, LSPs' specific context (cp. Chapter 2.3) which had been found to be obstructive, rather than facilitating (cp. especially Chapter 4.2), is a highly plausible explanation. It fits to the previous result (cp. Chapter 5.2.1.6) that innovation projects are usually finished whenever possible, even if budget plans or schedules have to be given up (also cp. A_4; Mahlendorf 2008). Another explanation which could be effective in parallel or as an alternative would be the lack of specific instruments (cp. Chapter 4.3.2). Either way, the research implication is clearly that LSPs' future research should firstly pay attention to LSPs' resource usage in their innovation management, i.e. that emphasis should lie on obstructive factors. The former is also a management implication. Another implication is that LSPs' decision on their innovation activity should be investigated further. Previous, albeit anecdotal, evidence in the case study analysis (cp. Chapter 5) also pointed at the existence of cognitive deficits related to the possibility of innovation for LSPs respectively to its potential usefulness. Likewise, LSPs' typical down-to-earth-ness could affect the willingness to innovate negatively.

6.3 Conclusion

This conclusion starts with a brief summary of results. Afterwards, managerial implications are discussed. The chapter closes with limitations and research implications.

6.3.1 Summary with Respect to Research Questions 5a and 5b

The first purpose of this text was to investigate inference-statistically if the LSP context to innovation and innovation management is indeed specific. Differences exist, and were shown to be significant at the 0.1% level, even when adverse rounding and missing values of the original data are taken into account. This finding serves to answer research question 5a.

The second purpose of the text was to propose explanations for differences between LSPs and other service providers in answer to research question 5b. Comparisons of LSPs and other service providers for the period 2006 to 2008 were firstly undertaken. They confirmed Wagner's (2008) conclusion, that LSPs are less innovative than other organizations, in fact with respect to their innovation inputs, outputs and outcomes. It was further investigated where differences between LSPs and other service providers come from. With the help of the research framework, it was possible to amend eleven additional indicators that relate the original ones to another. In many cases, upstream differences explain downstream differences nearly entirely. Other differences remain: The share of innovation-active LSPs is noticeably lower than that of other service providers. Next, the innovation expenditures of innovation-active LSPs contain a relatively large fraction of investment expenses and a relatively small fraction of current expenses which together let their innovation expenses be relatively high. There seem to be two clusters of innovations: first resource-intensive adoptions of technological equipment and infrastructure and second incremental innovations that require

scarce resources. That explanation fits two other remaining phenomena, namely a relatively low usage of R&D by innovation-active LSPs and a relative scarcity of market novelties.

The data suggests, that LSPs who are innovation-active are approximately as likely to become innovators as other service providers are, and innovators among LSPs benefit from similar immediate outcomes per innovator as other service providers do, so that apparently the benefits of innovation processes are similar for LSPs and for other service providers. On the other hand, the costs associated with innovation processes are higher for LSPs than for other service providers, which is a likely explanation why fewer LSPs are innovation-active. The remaining set of phenomena appears to fit each other well.

6.3.2 Managerial Implications

It was found that there are as many innovators among innovation-active LSPs as among innovation-active other service providers. Innovators among LSPs and other service providers also benefit from similar positive outcomes, so that overall, the benefits which managers can expect from innovation processes and from the exploitation of their innovations appear to be similar for LSPs and other service providers.

For LSPs, innovation as of today seems to be more costly than for other service providers, as LSPs currently need an innovation intensity which is 33% higher than that of other service providers. Thus, innovators among LSPs benefit from below average outcomes in relation to their innovation inputs which c. p. suggests relatively low returns on innovation for the average of LSPs. LSPs should hence pay particular attention to the efficiency of their innovation projects and to payback of their innovation-related investments, especially of their resource-intensive new equipment.

More specifically, it was found that LSPs with market novelties have a 22% higher share of revenues with market novelties than other service providers. This is hence a field where the higher average innovation intensity of innovation-active LSPs is nearest to being compensated. Currently, the respective shares of innovators are only 5% of LSPs, compared to 12% of other service providers. For this type of innovation, more than averagely efficient innovation management could pay off, first. A different path to the same goal would be for LSPs to aim at increasing the degree of novelty of innovations which they currently generate.

6.3.3 Limitations and Research Implications

This text was aimed to be original in a number of ways: It is the first partly confirmatory investigation of LSPs' innovation inputs, outputs and outcomes. It is the first cross-industry comparison of that topic, and it could make use of the highly representative data of the Mannheim Innovation Panel. With respect to methodology, it pointed out a procedure to re-calculate a categorical data sample from reported averages, thereby systematically considering rounding and integrating considerations on missing values.

There are, however, multiple limitations to this text which must be acknowledged. Most basically, as a secondary and meta-analysis, the text depends on the accuracy of its data base, the *ZEW innovation report series*. Particularly, representativeness of the data at the industry level and randomness of missing values had to be relied upon. The structure of the available

data constricted the scope of the analysis to averages at the firm level. Future studies should also take variance across firms into account, and they should investigate innovation at the project level. At the project level, it is particularly interesting if the notion of two clusters of innovation projects can be confirmed. If so, then it is recommended to investigate why equipment adoptions are so capital-intensive in relation to the impact they have respectively why they have no larger impact. With respect to the second innovation cluster, it would be worthwhile to research why LSPs seem to be content with incremental innovations.

The interrelated comparison methodology had to rely on a number of premises about its data base: It rests on the comparability of the original indicators across industries; it assumed not systematically differing revenues across the groups it compared; and it was supposed that time lags and dynamic changes could be levelled out by calculating chronological averages to eliminate noise. The aggregated interpretation of the additional indicators rested further on the supposition that LSPs' operating margins are not noticeably higher than those of other service providers, and that LSPs' innovation-related risks are not much smaller than those of other service providers. Making the listed assumptions was precisely what made the comparison of differences between LSPs and other service providers possible, but the results of that section are limited through them, so that they have to be regarded as propositions. Future research should aim to avoid the limitations of this text and confirm respectively test its findings.

The most important result of this text is that the LSP context to innovation was shown to be specific. That fact is both a justification of and a call for future studies on the specificity of LSPs' innovation context, on the mechanisms in which the special context causes phenomena in which LSPs differ from other service providers, and on LSPs' innovation management, especially their management for innovation. This text followed a call for cross-industry comparisons in services (Zeithaml, Parasuraman and Berry 1985), and its findings of significant differences between LSPs and other service providers underline the importance of sector-specific investigations. It is not claimed, however, that differences are caused by the inherent nature of belonging to the LSP industry or not. Hipp and Grupp (2005) for example had in their analysis not found effects of the industry itself. Contingency factors (cp. Chapter 5), more specifically those with typical values (cp. Chapter 4), can likely be used to substitute the industry variable. In this text, contingency factor values were unknown so that a substitution would not have been possible. Where it is possible to replace the industry variable, it should still be taken into account that managers rely on comparisons with their own competitive environment. That raises again the question of homogeneity of the LSP industry. As was argued before, this work and therefore this text place emphasis on LSPs' commonalities and their differences to other service providers. The *ZEW innovation report series 2010* suggests that there are differences within the LSP industry, as well as within other industries. Those could also be addressed by future studies.

This text could only make use of secondary data that was already published in report form. Further data from the original *Mannheim Innovation Panel* should be used to investigate LSPs' innovation, as well as its difference to innovation of other service providers. The study was confined to Germany. While the legal and cultural context was thus controlled for, it could not be varied. The results should hence be subjected to trans-national comparisons. Considering the diversity of behavioural biases which LSPs' decision making could suffer from (Carter, Kaufmann and Michel 2007), it also seems appropriate and important to include

behavioural explanation approaches. With the purely manifest data at hand, decision making biases could not be taken into account. They could for example be investigated within in-depth analyses of individual cases. After such endeavours have been undertaken, scholars might aim to identify improvement potentials and/or success factors. Finally, future studies should use the original panel data for longitudinal analyses as soon as a sufficient amount of data exists to handle the volatility of output and outcome figures without calculating averages.

7 Conclusion

This chapter draws a conclusion from the research project. It collects the evidence on the research-motivating question: *"Which reasons can be proposed as to why LSPs are not particularly innovative?"* which had been disaggregated into research questions 1, 2, 3, 4, 5a and 5b, and which had been answered fragmentarily throughout Chapters 2 to 6. The purpose of the first sub-chapter is not merely to repeat previous summaries (cp. Chapters 2.3.4, 3.3.1, 4.3.1, 5.3.1 and 6.3.1), but to aggregate them with respect to the research-motivating question. Another section in this conclusion lists major academic contributions of this dissertation. As the previous chapters had already contained individual limitation analyses and propositions for future research – where appropriate – they are not repeated.

7.1 Aggregated Proposition on Root Causes

This section builds on the finding from Chapter 6.2.1 that LSPs' innovation context is indeed significantly different from that of other service providers. Attention is therefore directed towards noteworthiness of LSP data in comparison to other service providers. A visual representation of the holistic view gained in this project is depicted in Figure 7-1. It extends the innovation achievement framework that was introduced in the previous chapter (cp. Chapter 6.1.1, especially Figure 6-1 on page 110).

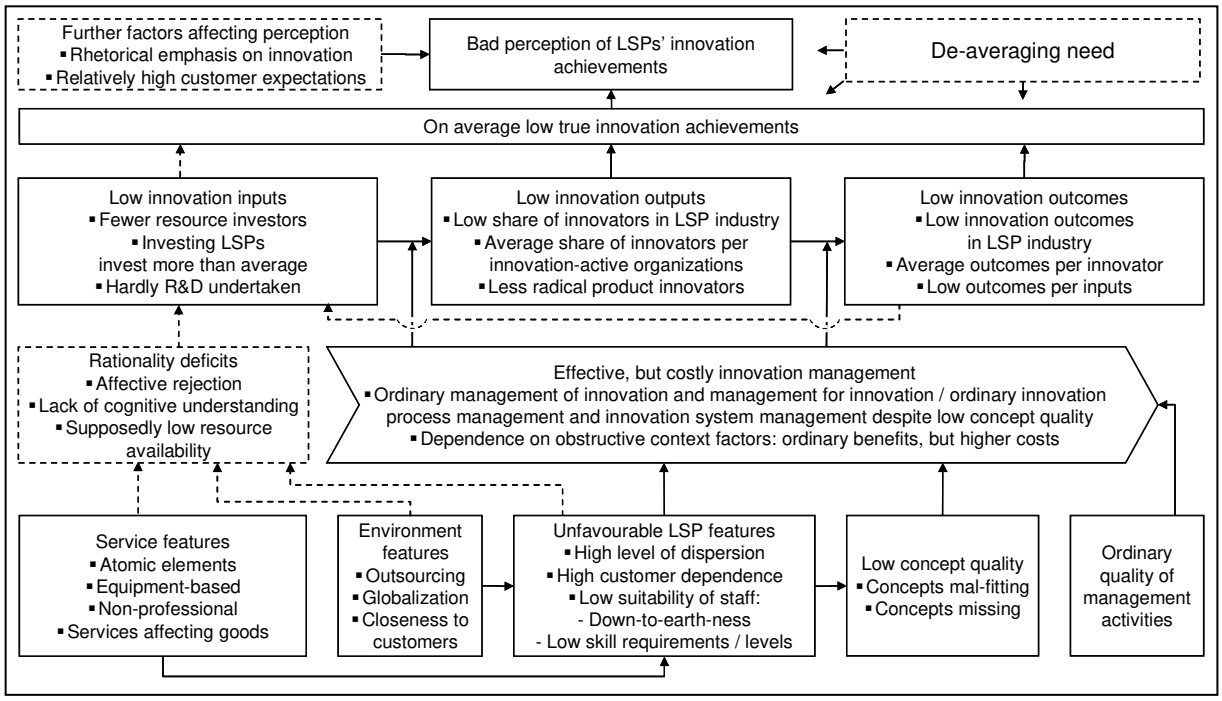

Figure 7-1: Aggregated Proposition on Root Causes of LSPs' Low Innovation Achievements

The explanation is begun with the three dimensions of innovation inputs, outputs and outcomes which together make up LSPs' true innovation achievements. In each of those dimensions, the LSP industry as a whole is characterized by low figures compared to other service providers (cp. Table 6-3 on page 121; Wagner 2008). Statements that LSPs are hardly innovative (cp. Chapter 1.1) can hence be strongly supported. However, from the business-studies point of view of this work, the average values across the entire industry were not insightful enough yet, so that multiple efforts at de-averaging were undertaken, the results of which will be described in the following paragraphs. Before that occurs, a side issue is highlighted that could be investigated in more detail in future studies: The analysis in this work had focused on LSPs' actual achievements, but the impression which LSPs instil in external parties, such as their customers, could also be affected by further factors beyond actual achievements. For example, previous research on outsourcing relationships between LSPs and their customers had identified a positive effect of LSPs' proactive improvement on their customer's loyalty (Wallenburg 2004; Wallenburg 2009). At the same time, it was found that contract designs frequently do not establish incentives for innovation (Lukassen 2009; Weber et al. 2008). Thus, it is imaginable that LSPs are willing to innovate, but feel prevented from doing so, as the inputs management analysis of the case studies (cp. Chapter 5.2.3.1) showed.[189] If LSPs are aware of the possible effect on customer loyalty, then they are inclined to rhetorically emphasize how innovative they are. A customer's comparison between the stressed innovation achievements of multiple LSPs and the actual innovation achievements of the industry could then lead to the impression that LSPs do not live up to their promises. In addition, it seems plausible that once an outsourcing contract is set up, the customer's expectations of the LSP's deliverables will rise rather than fall which in turn can lead to disappointments. Further factors could be effective, in particular psychological ones.

A relatively low share of innovation-active LSPs is the central explanation for LSPs' low innovation achievements, because it procreates low shares of innovators among LSPs and low innovation outcomes for the LSP industry as a whole (cp. Chapter 6.2.2.2). Even among innovation-active LSPs, there is noteworthy little R&D usage by LSPs which corresponds with a lower radicalness of the innovations which product innovators among LSPs generate (cp. Table 6-4 on page 123). Compared to the number of innovation-active LSPs, there are ordinarily many innovators among LSPs, and benefits per innovator also appear to be ordinary (cp. Table 6-4 on page 123). However, due to relatively high innovation intensity per innovation-active LSP, LSPs' outcomes in comparison to their inputs are noticeably low (cp. Chapter 6.2.2.2).

The transformation processes of innovation inputs into outputs and of innovation outputs into outcomes is where innovation management manifests itself (cp. Chapters 2.2.2 and 6.1.1). Similar shares of innovators per innovation-active organization and similar benefits per innovator among LSPs and other service providers can therefore be understood as positive effects of LSPs' innovation management. To achieve those effects, LSPs however need innovation intensity that is noticeably higher per innovation-active LSP than per innovation-active other service provider, so that their innovation management can be understood to be more costly than that of other service providers.

[189] This aspect in itself belongs to LSPs' actual true innovation achievements.

LSPs' management can apply innovation management concepts as aids in the transformation processes. Both transformation processes can hence conceptually be characterized by certain inherent minimum resource needs, by certain quality of management and by certain fit of innovation management concepts used by the LSPs. This allows distinguishing between inherent resource needs and efficiency losses.

Factors such as LSPs' operating environments, their typical features or their service features can be understood to relate to LSPs' inherent resource needs, because those facts are not directly or immediately changeable by LSPs' innovation management. Context factors were studied conceptually (cp. Chapter 2.3) and empirically (cp. Chapters 4 and 5).[190] It was found that LSPs' services are standardized, non-professional and equipment-based services, for which the service provision outcomes are much more important than the acts of service provision, and that they are comprised of atomic elements, i.e. individual acts of transportation, storage or handling (cp. Chapter 2.3.2). LSPs' environments are imprinted by outsourcing, globalization of LSPs' customers and of LSPs themselves, as well as by the need to be spatially close to those customers (cp. Chapter 2.3.1). LSPs' service features and their environments together lead to four typical LSP features which are high customer dependence, high dispersion, noticeable down-to-earth attitudes, and low average staff qualification (cp. Chapters 2.3.3 and 4.2). The cultural respectively willingness aspect down-to-earth-ness and the staff qualification facet can be aggregated to a single suitability factor (cp. Chapter 5.2.2.6). The typical LSP features were observed to be of an obstructive, rather than facilitating, nature (cp. Chapter 4.2). They can hence be postulated to increase LSPs' inherent resource needs for the transformation of innovation inputs to outputs. Besides, LSPs' service features can be postulated to explain those remaining effects in LSPs' innovation inputs and outputs which could not be traced back to upstream effects (cp. Chapter 6.2.2.2): First, the equipment-based nature of LSPs' services is a plausible explanation for the high share of investment expenses in LSPs' innovation intensity. Next, the atomic nature of logistical services works as an upper threshold to the radicalness of innovations in existing systems (cp. Chapter 2.3.2) which together with down-to-earth-ness can explain the low R&D usage, as well as the low radicalness of innovations. Last, the first two effects together appear to explain the postulated split of innovations into incremental innovation generations and into resource-intensive innovation adoptions, quite well. Overall, the expected effects of LSPs' specific innovation management context (cp. Figure 2-1 on page 21) were tentatively confirmed throughout this research.

As was suggested before, LSPs' relatively high resource usage does hence not indicate bad quality of LSPs' management for innovation, but can be traced back to factors that are inherent resource needs for innovation. In the face of the empirical results (cp. Chapters 4 and 5) and in view of the fact that innovation management is always a management of high risk and uncertainty with varying quality across organizations (Aschhoff et al. 2009), an ex-ante

[190] Due to the explorative nature of LSPs' innovation management analysis, it was not possible to undertake cross-industry comparisons throughout Chapters 4 and 5. Thus, it may seem as if the discriminatory power of LSPs' typical features, of LSPs' services features and of their environment's features cannot be guaranteed. However, none of those factors purely emerged empirically. All of them were also anchored in the relevant literature, as well as in theoretical deliberations. It is not necessary for characteristic features to be unique in order to be influential. In other words, validation of the effectiveness of characteristic context factor values (cp. Weber 1996) suffices.

assumption that LSPs' innovation management would be found to be of a relatively bad quality does thus not hold. LSPs' innovation management quality is hence likely ordinary.

LSPs' actual innovation management appears to be particularly difficult, nevertheless, because it has to handle the previously discussed obstructing factors and because it has to apply (previously) mal-fitting or missing concepts (cp. Chapters 4.2.1 and 4.2.2). It was shown that adverse features or conditions are manageable with the right instruments (cp. Chapter 4.2). To remedy their negative effects, an analytical process model for innovation generation, implementation and roll-out was developed (cp. Figure 4-4 on page 71). Besides, LSPs in the case study sample had lacked systemic component kits (cp. Chapter 5), e.g. managerial versions of the Adams, Bessant and Phelps (2006) framework, and the LSPs in the work group (cp. Chapter 4) emphasized LSPs' need of an implementation tool (such as the generic one proposed by Busse and Wagner 2008b). It can therefore be stated that for LSPs, suitable concepts are amiss[191] or are miss-fitting. Future research should hence aim to generate more and better context-adequate innovation management concepts.

The low share of innovation-active LSPs had previously been treated as a given. The suggestion of low average returns on innovation which follows c. p. from low outcomes per inputs is a very plausible explanation. At least three information transfer mechanisms could be responsible: First, non-investors can learn from their own, earlier low returns and adjust their innovation efforts accordingly. Second, they can observe low returns of their competitors. Last, they could actually anticipate how their own organizations would perform in the face of the obstructing factors and hence decide not to invest any resources.

Alongside the aforementioned rational reasons, it is possible that at least some LSPs suffer from rationality deficits with respect to the beginning of innovation efforts and the investment of resources into them. "*We get something moved from A to B*" was an archetypical rejection reply from a company that was asked if they were willing to participate in this research. Apparently, the respondent rejected the idea of innovation management precisely because she could not anticipate the existence of a logistical product novelty. Further, albeit purely anecdotal, evidence from the same background also hinted at affective rejection of efforts for innovation or at perceived resource restrictions. Even though this research did not concentrate on psychological facets, it is not bold to base cognitive deficits in the atomic nature of LSPs' services and in LSPs' on average low skill levels, to found affective rejection in LSPs' down-to-earth-ness and to assume their environment, in this case capital intensity and low margins, as the antecedent of perceived monetary restrictions. A study of LSPs' rationality deficits and of possible remedy measures appears worth to be amended (cp. Weber and Schäffer 2006).

7.2 Major Academic Contributions

Beside their contributions to the answer of the research-motivating question respectively to the answers of research questions 1, 2, 3, 4, 5a and 5b, each chapter after the introduction was configured to be accessible on its own and to make a lasting contribution on its own. Thus, the major academic contributions of this dissertation are to be organized by chapter.

[191] This work understands the transfer of scientific concepts into corporate practice at least partly as a scientific task.

Chapter 2 first laid the groundwork for Chapters 3 to 7 by highlighting basic features of research on LSPs, and by synthesizing various aspects of innovation and innovation management that had been identified from the literature. A conceptual analysis of LSPs' environments' features, of their services features and of LSPs' typical features followed which further justified the focus of this work on LSPs' innovation management.

A theoretical assessment of innovation management research streams concerning their relevancy for LSPs was undertaken in Chapter 3. A combined process-system categorization framework was derived from relevant research streams and previous frameworks. The existing, previously highly dispersed, knowledge on LSPs' innovation management was integrated into that comprehensive framework. A long-term research agenda was proposed from the literature review. Amendments to it were made in each conclusion of the following chapters.

In Chapter 4, the effects of typical LSP features were empirically investigated and were found to be mostly obstructive. A comparative analysis of previous innovation generation process models was undertaken, and requirements on an analytical model of LSPs' innovation generation, implementation and roll-out processes were established. Based on action research, a four-phase analytical model thereof was proposed. It abides by those requirements. The model includes detailed descriptions of in total twelve activities with responsible actors, IT and management instruments and success factors. It is usable as an audit tool. Finally, the approach generated a process-system interaction framework.

Chapter 5 contains the empirical usage of the Adams, Bessant and Phelps (2006) review as a framework in a first study of 13 cases of LSPs' innovation management systems. LSPs' innovation management systems were explored, six contingency factors were proposed, 25 variables were identified as contingent upon those, and 39 relationships were proposed that describe the influence of the contingency factors on those dependent variables. The chapter confirmed the effectiveness of the typical factors and served to further refine them.

Chapter 6 consists of the first large-scale investigation of LSPs' innovation inputs, outputs and outcomes with an in-depth cross-industry comparison. It incorporated inference-statistical testing of context specificity and confirmed the hypothesis gained from Chapter 2.3, that indeed, LSPs' innovation context is significantly different from that of other service providers. The chapter also provided a disaggregation of the relatively vague motivating phenomenon into multiple distinct phenomena. An effort to explain differences showed that most effects can be related to upstream effects in such a way that differences between LSPs and other service providers vanish. Remaining effects fit to one another and could be explained from LSPs' context.

Finally, the first section of this chapter aggregated findings from previous chapters to a comprehensive "big picture" of why LSPs are perceived not to be particularly innovative. It can serve as a preliminary medium-range theory on the specialty of LSPs' innovation management. As the investigation was of an explorative, mostly qualitative and cross-sectional nature, that big picture in itself is to be understood as a proposition, and not as a definitive answer.

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Appendices

Author(s)	Year	Research topic / purpose	Approach / data base	Recommended future research
van Hoek	2001	Generate insight into cross-company and cross-functional alliances in the supply chain, understand mechanisms to develop and control those	Confirmatory telephone survey of 78 LSPs in the Netherlands; 3 in-depth case studies of globally operating service providers from the Netherlands and the USA	*No recommendations made*
Stapleton and Hanna	2002	Analyze how a technological innovation affects a steamship line's decision to use an internal or third-party sales force; examine applicability of transaction cost framework for innovation-adoption related firm governance decision	Confirmatory mail survey of 126 responses from 31 steamship lines in the United States	Differentiate various market conditions; distinguish customer segments into final shippers and forwarders; examine other industries, other technological innovations and further functions; supplement transaction cost framework
Chapman, Soosay and Kandampully	2003	Identify factors that nurture innovation in logistics services, investigate contributions of new resources and their application to LSPs	Desk research	*No recommendations made*
Hyland, Soosay and Sloan	2003	Identify learning behaviours present in distribution centres which enable continuous improvement and build capabilities to establish an innovative culture	Explorative case study (10 distribution centres from Australia and Singapore)	More specific learning behaviours that suit the environment in which distribution centres operate
Sauvage	2003	Clarify contribution of technological effort to the performance of the logistics outsourcing relationship	Explorative and confirmatory survey of 99 LSPs in France	Take into account shippers' satisfaction or expectations; analyze how technological effort is/should be taken into account in outsourcing decision process
Soosay and Hyland	2004	Examine and compare factors that drive innovation	Explorative case study (10 distribution centres from Australia and Singapore)	Role of collaboration in enhancing and driving innovation

Note: Articles are sorted first by year and second by author name.

Table A-1: Overview of Reviewed Articles (I)

Author(s)	Year	Research topic / purpose	Approach / data base	Recommended future research
Flint, Larsson, Gammelgaard and Mentzer	2005	Begin construction of a theory on logistics innovation; LSPs' managers approach affiliated with logistics innovation creation	Explorative case study (5 LSPs and 2 logistics management departments from Sweden, Switzerland, the US and the United Kingdom)	Validate findings; compare logistics innovation to product innovation and to other service contexts; non-process models of logistics innovation; extent of formal management; aspects of social interaction; extension towards supply-chain learning
Kimura	2005	Explore effects of regulatory effects on logistics and logistics innovation	Secondary analysis of macro-economical data on LSPs in Japan	More in-depth analysis of the effects and most efficient methods of logistics outsourcing in a variety of industries
Lai, Ngai and Cheng	2005	Report on state of IT adoption in Hong Kong, identify benefits of and barriers to adopting IT and give managerial recommendations	Explorative survey of 195 LSPs from Hong Kong	Longitudinal study on evolution of IT adoption; confirmatory work based on technology adoption model, on theory of reasoned action and on diffusion of innovation; use multiple informants and objective performance measures
Panayides and So	2005	Assess impact of relationship orientation on organizational learning, innovation, supply chain effectiveness and on supply chain performance	Confirmatory survey of 251 LSPs in Hong Kong	Use client data or dyadic data; use additional or other items for constructs; longitudinal study; further studies on influence of organizational capabilities on supply chain performance
Soosay	2005	Investigate individual employees' competencies	Explorative case study (10 distri-bution centres from Australia and Singapore)	Apply more objective measures concerning usefulness of tools and the overall innovativeness of firms
Soosay and Hyland	2005	Examine continuous innovation strategies adopted; identify contingency factors	Explorative case study (10 distri-bution centres from Australia and Singapore)	Apply further statistical methods to detail and validate findings
Soosay and Sloan	2005	Investigate drivers of change and how those drivers support organizational objectives; examine resistance to change	Explorative case study (10 distri-bution centres from Australia and Singapore)	*No recommendations made*
Evangelista and Sweeney	2006	Investigate ICT adoption in small LSPs: technological profile, role of ICT tools in service customization and factors influencing ICT adoption	Survey of 153 small LSPs from Italy, based on action research framework	*No recommendations made*

Table A-2: Overview of Reviewed Articles (II)

Author(s)	Year	Research topic / purpose	Approach / data base	Recommended future research
Lin	2006	Study factors influencing technology adoption	Confirmatory mail survey of 122 LSPs in Taiwan	*No recommendations made*
Soosay and Chapman	2006	Investigate performance measures used and analyze how they facilitate improvements and continuous innovation	Explorative case study (10 distri-bution centres from Australia and Singapore)	*No recommendations made*
Wu	2006	Analyze logistical innovations from 1984 to 2003	Secondary analysis of delphion patent statistics on top 100 LSPs	Observe critical technologies, such as RFID; analyze effect of innovativeness on firm performance and customer satisfaction, as well as on customer's LSP selection
Lin	2007	Study factors influencing technology adoption	Confirmatory mail survey of 557 LSPs in China	Cross-national comparative studies on innovation adoption; research on effects of other influencing factors, such as individual, cultural and technological context
Panayides *(2007a)*	2007	Examine influence of organizational learning on relationship orientation, logistics service effectiveness and firm performance	Confirmatory survey of 251 LSPs in Hong Kong	Link between organizational learning and innovation; other consequences of organizational learning; performance antecedents; market orientation instead of relationship orientation; impact on supply chain performance
Panayides *(2007b)*	2007	Examine influence of organizational learning on relationship orientation, logistics service quality and firm performance	Confirmatory survey of 251 LSPs in Hong Kong	Use client data or dyadic data; longitudinal study; differences between resources and capabilities; demographic or service characteristics; objective measures; other consequences of organizational learning such as innovation; performance antecedents in logistics; supply chain learning

Table A-3: Overview of Reviewed Articles (III)

Author(s)	Year	Research topic / purpose	Approach / data base	Recommended future research
Deepen, Goldsby, Knemeyer and Wallenburg	2008	Expand operationalization of logistics outsourcing performance; develop conceptual model to assess relationship between relationship engagement factors and logistics outsourcing performance; test those models	Confirmatory internet-based survey of 549 LSP-customer relationships in Germany	Study on transactional logistics services; other countries; further constructs which might affect logistics outsourcing performance; moderating effects of further factors; effects of both outsourcing performance dimensions on other performance levels and on customer loyalty; effect of different levels of logistics outsourcing performance on customer lifetime value
Flint, Larsson and Gammelgaard	2008	Find out extent to which firms project what customers will value in the future, demonstrate supply chain learning and manage innovation; investigate correlations between those processes; analyze effects on performance perceptions	Confirmatory mail survey of 40 LSPs and 281 non-LSPs in Denmark, Sweden and the United States	Expand understanding of innovation within supply chain context; explore how firms can better anticipate emergent supply chain opportunities; identify ways of tracking data on leading indicators of change; supply chain learning
Lai, Li, Wang and Zhao	2008	Investigate IT capability of LSPs, its antecedents and consequences	Confirmatory mail survey of 105 LSPs in China	Confirmatory work in other countries and with larger samples; further development of scales; more objective measures; effect of firm's prior competence on development of IT capability; integration of customer orientation and of competitor orientation into conceptual model
Lin	2008	Study factors influencing technology adoption	Confirmatory mail survey of 557 LSPs in China	*No recommendations made*
Lin and Ho	2008	Study factors influencing green technology adoption	Confirmatory internet-based survey of 153 LSPs in Taiwan	Research on effects of other influencing factors; effects of green technology adoption on environmental performance and on supply chain performance
Verwaal, Verdu and Recter	2008	Develop insights into influence of transaction costs on organizational learning in the context of strategic logistics outsourcing decisions	Confirmatory mail survey of 121 LSPs in the Netherlands	Add factors such as length of outsourcing contract, partners or hostages; interdependence between outsourcing, organizational learning and transaction costs; more accurate approach to frequency of transaction with a partner

Table A-4: Overview of Reviewed Articles (IV)

Author(s)	Year	Research topic / purpose	Approach / data base	Recommended future research
Wagner	2008	Develop a conceptual model for innovation management in the LSP industry; investigate empirically the status quo of innovation management	Secondary analysis of Mannheim Innovation Panel data on 688 LSPs in Germany	Other factors that influence LSPs' innovation activities; confirmatory work, also in other countries and longitudinally; relation between innovation activities, types of innovation and impact on customer satisfaction, market or firm performance; types of strategies and organizational routines; innovation adoption; innovation barriers; normative models on innovation management
Lin	2009	Study organizational determinants of RFID adoption	Confirmatory mail survey of 142 LSPs in Taiwan	Cross-national comparative studies; research on effects of other influencing factors; moderating effect of LSP service type on RFID adoption
Shen, Wang, Xu, Li and Liu	2009	Regard innovation as a system and analyze relationships between elements in the context of systems theory	Desk research	*No recommendations made*
Wallenburg	2009	Study effect of proactive improvement on customer loyalty; analyze selection of proactive improvement focus (cost vs. Performance); target role of service complexity and contract duration	Confirmatory internet-based survey of 298 LSP-customer relationships in Germany	How proactive improvement enhances customer loyalty (functional value vs. social capital enhancement); longitudinal study; cross-cultural comparison; further B2B services; further moderating effects; importance of interaction elements; management of LSPs' own proactive improvement; encouragement through customers

Table A-5: Overview of Reviewed Articles (V)

Category 1: Inputs management

Variable I: Innovation intensity

Measurement: interview data

Variable II: Share of investment expenses

Measurement: questionnaire data, interview data, annual report data

Aggregation of questionnaire items: equally-weighted mean value of items I and II minus equally-weighted mean value of items III and IV

Questionnaire items		n_o [a]	μ_o [b]	σ_o [c]
1	Enough employees in innovation projects	10	3.29	1.92
2	Sufficient leeway for staff to strive for innovation	10	3.44	1.09
3	Sufficient financial resources to strive for innovation	10	4.70	1.16
4	Adequate financial resources in innovation projects	10	4.07	1.54

Variable III: Tool support

Measurement: questionnaire data, interview data

Aggregation of questionnaire items: equally-weighted mean value of all items

Questionnaire items		n_o [a]	μ_o [b]	σ_o [c]
5	Suitable formal systems and instruments to support innovation	10	4.47	1.34
6	Sufficient instruments and techniques for quality control and improvement	10	5.14	1.17
7	Sufficient amount of instruments and techniques to foster creativity	10	2.76	0.89
8	Adequacy of management and IT instruments to support innovation efforts	10	3.92	1.18

Category 2: Knowledge management

Variable IV: Proactivity of idea generation

Measurement: questionnaire data, interview data

Aggregation of questionnaire items: equally-weighted mean value of all items

Questionnaire items		n_o [a]	μ_o [b]	σ_o [c]
9	Hiring of employees because of their unique knowledge	8	3.52	1.89
10	Hiring of experts from competitors	8	2.83	1.34
11	Staff evaluation based on number of new ideas	8	2.60	0.75
12	Adequacy of instrument usage in innovation processes	10	3.49	1.28
13	Idea generation supported by instruments	8	2.76	0.58
14	Measurement of number of novel ideas	8	3.56	1.99

a: n_o is the number of organizations for which values exist. Three organizations did not participate in the survey. All items were measured on a seven-point Likert scale, ranging from 1= "I do not agree at all." to 7 = "I agree completely." For three organizations, there was more than one questionnaire (in total: 15 questionnaires from 10 organizations). All individual questionnaires were first adjusted for the respondent's answer skewness. Then, all items were removed where the respondent's assessment of his qualification to answer was below the neutral value. The organizational value was computed on equally-weighted, skewness-adjusted, sufficiently competent individual answers.

b: The mean value in the sample, μ_o, was calculated on equally-weighted organizational values.

c: The standard deviation per item, σ_o, was calculated on equally-weighted organizational values.

Notes: The questionnaire-component of the factor value for each organization was deduced from the mean value of equally-weighted organizational item values and from its rank within the sample.
The response rate was 41.7% as regards questionnaires (15 out of 36) and 37.0% as regards organizations (10 out of 27).

Table A-6: Dependent Variable Measurement (I)

Variable V: Amount of organizational learning

Measurement: questionnaire data, interview data

Aggregation of questionnaire items: equally-weighted mean value of all items

Questionnaire items		n_o [a]	μ_o [b]	σ_o [c]
15	Systematic external search for knowledge	8	4.31	1.07
16	Continuous learning from the environment	8	5.00	1.05
17	Storage of relevant knowledge	8	4.32	1.64
18	Learning from past experience	8	4.56	1.07
19	Systematic analysis of relevant patent data	8	2.07	0.96
20	Usage of external knowledge for business purposes	8	4.56	1.22
21	Striving to make use of tacit knowledge	8	2.80	1.09

Variable VI: Consciousness of knowledge exchange facilitation

Measurement: interview data

Category 3: Innovation strategy

Variable VII: Pursuit of growth through innovation

Measurement: interview data, annual report data, market report data

Variable VIII: Pursuit of operational capacity utilization increase through innovation

Measurement: interview data, annual report data, market report data

Variable IX: Pursuit of process standardization

Measurement: interview data, annual report data, market report data

Variable X: Pursuit of technology-based innovation

Measurement: questionnaire data, interview data, annual report data, product information data, market report data

Aggregation of questionnaire items: value item I minus value item II

Questionnaire items		n_o [a]	μ_o [b]	σ_o [c]
22	Focus on technological novelties in process innovations	10	3.56	1.64
23	Focus on administrative novelties in process innovations	10	5.14	1.07

Variable XI: Differentiation of the strategic orientation

Measurement: questionnaire data, interview data

Aggregation of questionnaire items: equally-weighted mean value of all items

Questionnaire items		n_o [a]	μ_o [b]	σ_o [c]
24	Existence of innovation targets	10	4.30	1.29
25	Verbal phrasing of innovation strategy	10	2.85	1.30
26	Description of temporal innovation behaviour compared to competitors	10	4.32	1.57
27	Differentiation of innovation strategy between business units	10	4.73	1.23
28	Consideration of process innovations	10	6.25	0.83
29	Conscious choice of tolerable kinds of risks	10	5.50	1.31
30	Conscious choice of tolerable risk levels	10	5.80	1.17

a: n_o is the number of organizations for which values exist (cp. in detail Table A-6 on page 168).
b: The mean value in the sample, μ_o, was calculated on equally-weighted organizational values.
c: The standard deviation per item, σ_o, was calculated on equally-weighted organizational values.

Table A-7: Dependent Variable Measurement (II)

Category 4: Work environment

Variable XII: Innovation-favourability of the strategic leadership

Measurement: questionnaire data, interview data

Aggregation of questionnaire items: equally-weighted mean value of all items

Questionnaire items		n_o [a]	μ_o [b]	σ_o [c]
31	Ability to cope with failure	10	4.65	1.58
32	Visibility of top-management commitment	10	5.48	1.79
33	Existence of a change vision	10	5.61	1.38
34	Open-mindedness of management concerning change	10	5.11	1.72
35	Management support for novel methods	10	5.02	1.23
36	Creative usage of plurality of opinions	10	4.06	0.93
37	Employee encouragement by top management	10	4.80	1.77

Variable XIII: Amount and size of specialized innovation units

Measurement: questionnaire data, interview data, annual report data

Aggregation of questionnaire items: equally-weighted mean value of all items

Questionnaire items		n_o [a]	μ_o [b]	σ_o [c]
38	Existence of a central coordination responsibility	10	4.28	1.79
39	Existence of a central planning responsibility	10	3.95	1.18
40	Existence of a central assertion responsibility	10	3.69	1.23
41	Existence of a central steering responsibility	10	4.31	1.57

Variable XIV: Autonomy of innovation teams

Measurement: questionnaire data, interview data

Aggregation of questionnaire items: equally-weighted mean value of all items

Questionnaire items		n_o [a]	μ_o [b]	σ_o [c]
42	Decision competence of project leaders	10	4.34	1.38
43	Accountability of project leaders	10	4.38	2.09

Variable XV: Usage of incentives

Measurement: questionnaire data, interview data

Aggregation of questionnaire items: equally-weighted mean value of all items

Questionnaire items		n_o [a]	μ_o [b]	σ_o [c]
44	Existence of incentives at individual level	10	3.35	1.88
45	Existence of incentives at group level	10	4.29	2.10
46	Existence of incentives at organizational level	10	3.91	2.10

a: n_o is the number of organizations for which values exist (cp. in detail Table A-6 on page 168).
b: The mean value in the sample, μ_o, was calculated on equally-weighted organizational values.
c: The standard deviation per item, σ_o, was calculated on equally-weighted organizational values.

Table A-8: Dependent Variable Measurement (III)

Variable XVI: Innovation-friendliness of culture

Measurement: questionnaire data, interview data

Aggregation of questionnaire items: equally-weighted mean value of all items

Questionnaire items		n_o [a]	μ_o [b]	σ_o [c]
47	Amount of freedom to pursue new solutions to problems	10	5.52	1.10
48	Multifunctionality of teams	10	4.97	1.62
49	Team-internal collaboration	10	4.34	1.73
50	Amount of team-internal information exchange	10	4.36	1.54
51	Vision of innovation teams	10	4.42	1.83
52	Atmosphere of confidence and support	10	4.44	1.65
53	Commitment of innovation team members	10	4.97	1.80

Category 5: Portfolio management

Variable XVII: Usage of project evaluation and selection

Measurement: questionnaire data, interview data

Aggregation of questionnaire items: equally-weighted mean value of all items

Questionnaire items		n_o [a]	μ_o [b]	σ_o [c]
54	Existence of central project evaluation	9	4.46	2.39
55	Assessment of financial resource requirements for individual project	9	5.06	2.15
56	Assessment of human resource requirements for individual project	9	4.93	2.20
57	Estimation of project duration for individual project	9	4.48	2.19
58	Assessment of technical success probability for individual project	9	3.71	2.53
59	Planning of financial success for individual project	9	5.28	1.84
60	Consequential project termination where necessary	9	4.66	1.43
61	Persistence of project evaluation result	9	2.99	0.94

Variable XVIII: Usage of portfolio balancing

Measurement: questionnaire data, interview data

Aggregation of questionnaire items: equally-weighted mean value of all items

Questionnaire items		n_o [a]	μ_o [b]	σ_o [c]
62	Usage of portfolio management to get a general view of innovation projects	9	3.15	1.84
63	Usage of portfolio management to optimize overall innovation project risk	9	3.03	1.78
64	Assessment of overall project portfolio	9	3.04	1.46
65	Mixture of project durations in portfolio	9	3.08	1.07
66	Mixture of project sizes in portfolio	9	2.94	1.31
67	Mixture of project risks in portfolio	9	2.88	0.88
68	Mixture of innovation radicalness in portfolio	9	2.94	1.72
69	Mixture of product and process innovation projects in portfolio	9	4.11	2.20

a: n_o is the number of organizations for which values exist (cp. in detail Table A-6 on page 168).
b: The mean value in the sample, μ_o, was calculated on equally-weighted organizational values.
c: The standard deviation per item, σ_o, was calculated on equally-weighted organizational values.

Table A-9: Dependent Variable Measurement (IV)

Category 6: Project management

Variable XIX: Measurement of project efficiency

Measurement: questionnaire data

Aggregation of questionnaire items: equally-weighted mean value of all items

Questionnaire items		n_o [a]	μ_o [b]	σ_o [c]
70	Measure of cost deviations	10	4.70	1.86
71	Measure of benefit deviations	10	4.79	1.65
72	Measure of duration deviations	10	4.48	1.74

Variable XX: Usage of project management instruments

Measurement: questionnaire data, interview data

Aggregation of questionnaire items: equally-weighted mean value of all items

Questionnaire items		n_o [a]	μ_o [b]	σ_o [c]
73	Usage of milestones	9	5.28	1.14
74	Level of detail of project evaluation increases with project duration	9	3.69	0.97
75	Rigidity of project evaluation increases with project duration	9	3.83	1.57
76	Width of instrument usage in innovation processes	10	3.96	1.63
77	Existence of process model for innovation generation	10	3.21	1.55
78	Existence of process model for innovation adoption	10	2.50	1.12
79	Usage of a stage-gate model	10	2.78	1.20
80	Formalization of process reviews	10	4.66	2.17

Variable XXI: Intensity of external communication and collaboration

Measurement: questionnaire data, interview data

Aggregation of questionnaire items: equally-weighted mean value of all items

Questionnaire items		n_o [a]	μ_o [b]	σ_o [c]
81	Frequency of information exchange with external organizations	8	3.38	1.73
82	Frequency of fair visits	8	4.61	1.87
83	Frequency of conversations with customers	8	5.98	1.07
84	Continuity of competitor observation	8	5.95	1.37
85	Frequency of customer interviews on competitors	8	4.36	1.43
86	Frequency of cooperation with research institutions	8	3.71	1.16
87	Frequency of management consultancy advice	8	3.59	1.75
88	Participation in multi-organizational innovation projects	8	3.49	1.34

Variable XXII: Collaboration with customers in innovation projects

Measurement: questionnaire data, interview data

Aggregation of questionnaire items: equally-weighted mean value of all items

Questionnaire items		n_o [a]	μ_o [b]	σ_o [c]
89	Consistency of customer involvement	10	4.63	1.76
90	Frequency of idea generation by customer	10	3.57	1.88
91	Innovation purpose to fulfil individual customer's wishes	10	3.62	1.85
92	Overly high customer-specificity of novelties	10	3.46	1.91

a: n_o is the number of organizations for which values exist (cp. in detail Table A-6 on page 168).
b: The mean value in the sample, μ_o, was calculated on equally-weighted organizational values.
c: The standard deviation per item, σ_o, was calculated on equally-weighted organizational values.

Table A-10: Dependent Variable Measurement (V)

Category 7: Commercialization

Variable XXIIII: Orientation of marketing and sales (single customer vs. market)
Measurement: interview data

Variable XXIV: Usage of market research
Measurement: questionnaire data, interview data
Aggregation of questionnaire items: equally-weighted mean value of all items

Questionnaire items		n_o [a]	μ_o [b]	σ_o [c]
93	Reasonability of market research for industry	9	6.18	1.27
94	Usage of market research	9	5.60	1.79
95	Payoff of market research	9	5.47	1.89

Variable XXV: Relative importance of product innovations compared to process innovations
Measurement: questionnaire data, interview data
Aggregation of questionnaire items: equally-weighted mean value of items I to V minus equally-weighted mean value of items VI to X

Questionnaire items		n_o [a]	μ_o [b]	σ_o [c]
96	Measurement of product innovation generation numbers	9	4.17	1.98
97	Measurement of product innovation adoption numbers	9	3.78	1.91
98	High number of product innovation generations	9	3.00	1.89
99	High number of product innovation adoptions	9	2.48	1.23
100	Pre-planning of new services	10	4.87	1.15
101	Measurement of process innovation generation numbers	9	4.53	2.08
102	Measurement of process innovation adoption numbers	9	4.14	2.19
103	High number of process innovation generations	9	3.59	1.18
104	High number of process innovation adoptions	9	2.62	1.10
105	Pre-planning of new processes	10	5.05	1.02

a: n_o is the number of organizations for which values exist (cp. in detail Table A-6 on page 168).
b: The mean value in the sample, μ_o, was calculated on equally-weighted organizational values.
c: The standard deviation per item, σ_o, was calculated on equally-weighted organizational values.

Table A-11: Dependent Variable Measurement (VI)

Sector	Mining and quarrying	Electricity, gas and water supply	Wholesale and retail trade[a]	Hotels and restaurants	Financial inter-mediation	Real estate, renting and business activities	Transport, storage and tele-commu-nication
Number of organizations	2,775	13,641	708,063	255,356	48,869	901,483	132,819
Employees subjected to social insurance contribution	82,980	283,740	3,817,022	707,350	994,811	3,033,312	1,441,693
Number of sites with at least one employee subjected to social insurance contributions	3,192	15,200	783,826	263,929	65,094	923,327	149,445
Number of sites with at least one employee subjected to social insurance contributions per organization	1.15	1.11	1.11	1.03	1.33	1.02	1.13
Employees subjected to social insurance contribution per organization	29.9	20.8	5.4	2.8	20.4	3.4	10.9
Revenues [Mio. €]	19,187	197,811	1,372,871	58,150	n/a[b]	499,240	308,779
Revenues per organization [Mio. €]	6.91	14.50	1.94	0.23	n/a[b]	0.55	2.32
Revenues per employee subjected to social insurance contribution [€]	231,223	697,156	359,671	82,208	n/a[b]	164,586	214,178

a: Also including repair of motor vehicles, motorcycles and personal and household goods

b: Revenue figures for financial intermediates are not meaningful.

Notes: All sector denominations follow the translations by DESTATIS (2003). The classification of sectors as service sectors followed ZEW (2009b); ZEW (2009c); ZEW (2009d); ZEW (2009e); ZEW (2009f;) ZEW (2009g); ZEW (2009h); ZEW (2009i), as well as ZEW (2009j). The choice of sectors focused on privately organized service industries. The figures refer to data reported for December 31, 2007.

Table A-12: Key Figures for Service Industries in Germany
(adapted from DESTATIS 2008c)