Received September 2002
Revised April 2003, August 2003

Doctoral dissertations in logistics and supply chain management

A review of Scandinavian contributions from 1990 to 2001

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Keywords *Logistics, Supply-chain management, Cross-functional integration*

Abstract *Logistics and supply chain management (SCM) are broad disciplines in which many different, cross-functional tasks are investigated. In Scandinavia, research in logistics and SCM experienced a significant boom during the 1990s; the steadily increasing interest in participation in the annual NOFOMA Nordic Logistics Conference and the steadily growing number of PhD students enrolled in the Scandinavian research environments emphasizing the study of logistics and SCM bear witness to this intensification. In addition, a great number of doctoral dissertations in this field are completed in Scandinavia, adding greatly to the existent store of knowledge concerning a wide range of logistics and SCM phenomena. However, to date, precious little effort has been devoted to providing an overview of these dissertations. This paper is designed to fill that void. To that end, 75 doctoral dissertations published from 1990 to 2001 are identified. The framework classifies the dissertations into a series of main themes indicative of the state of Nordic research in logistics and SCM. Suggestions for future research based on this survey are likewise provided.*

1. Introduction

Recent decades have seen a pronounced upsurge in research in logistics and supply chain management (SCM) across the globe. Both areas are by nature broad in spectrum. They span a range of different functional areas within any given company and a series of companies along any given vertical supply

International Journal of Physical Distribution & Logistics Management
Vol. 33 No. 10, 2003
pp. 854-885

0960-0035
DOI 10.1108/09600030310508690

The authors wish to thank all those who spent time, answering our e-mail queries and phone calls regarding doctoral dissertations related to the fields of logistics and supply chain management completed at their respective research environments, even if there were no dissertations to report. A special thank to Patrick Appelqvist for his help in extracting data from two dissertations written in the Finnish language.

chain. The approaches applied in studies of logistics and SCM may differ in several ways. For instance, research-oriented approaches may differ with respect to theoretical concerns such as the entity of analysis, the type of company or companies investigated, the determination of problem relevance, the reliability and validity of the research results, the use and interpretation of the generated theory and the choices related to methodology (e.g. qualitative versus quantitative research). All are examples of topics that PhD students may be required to address in the process of earning their doctorates.

At present, there is no comprehensive digest of the doctoral dissertations completed in the Nordic countries under the auspices of the NOFOMA research community. NOFOMA is a Scandinavian research forum which organizes an annual Nordic Logistics Conference, hosted by Denmark, Finland, Iceland, Norway and Sweden. A common Nordic curriculum is missing, with the possible exception of Vafidis' (2001) analysis of Finnish and Swedish dissertations completed between 1994 and 1998. The purpose of this paper is to initiate a process to fill this void. Incipiently, an overview of the dissertations completed from 1990 to 2001 within the Nordic countries will be provided. The year 1990 was chosen as the starting point for this investigation, as it marks the year in which the NOFOMA network was formally established.

Providing such a dissertation overview is important for at least three reasons. First, PhD students must, in the course of their dissertation project, provide a literature review of what they have researched within a given topic area. The manner in which dissertations are referenced here makes it possible to conduct a detailed investigation of their approach, e.g. the dissertations' research frameworks, methodologies, applied theories and empirical observations. Thus, this paper aims to provide PhD students, other academic staff and practitioners with an overview of what has been researched in Scandinavia within the aforementioned subject area, and how this research has been conducted. Second, providing such an overview also makes it possible to compare the investigated themes in Nordic dissertations with those in dissertations completed in the US, as compiled by Stock (2001). Third, such a contribution makes it possible to identify gaps between current, state-of-the-art thinking within logistics and SCM and the themes actually researched in dissertations.

In all, 75 pertinent dissertations are identified, and of this total, the author team reviewed 71. Based on a range of dimensions, the dissertations are then classified into different categories. Taking this classification as the point of departure, the authors outline the key characteristics of a Nordic logistical paradigm. Finally, this classification will be called upon again to identify new, potential research areas.

This paper is primarily inspired by curricula of US-based dissertations presented in papers by Stock (1987, 1988, 2001), Stock and Luhrsen (1993). However, these authors incorporate highly detailed reviews of the implicated

dissertations into their monographs, an attribute that lies beyond the scope of this survey.

This paper is organized as follows. Section 2 provides a brief overview of earlier contributions dealing with doctoral dissertation reviews. The applied methodology for this study is described in brief in Section 3, while Section 4 deals with the limitations of the study due to the chosen methodology. Section 5 describes the review framework against which each dissertation is measured. Section 6 deals with the results of the data processing process. A discussion of the collective data presented in the dissertations characterizes Section 7, while Section 8 of this paper is devoted to a discussion of the overall conclusions arrived at over the course of the study and an attempt to provide some perspective on future research activities.

2. Existing reviews of doctoral dissertations

The literature does report a small, but important group of earlier studies addressing the content of doctoral dissertations within logistics and logistics related areas. For example, Stock (1987, 1988) investigated a total of 684 American PhD dissertations concerned with logistics and related subject areas written between 1970 and 1986. Results were organized on:

(1) the basis of the professional subject areas the dissertations addressed;

(2) which universities these PhDs came from; and

(3) the quantities of PhDs produced.

Stock's investigation pinpointed a number of logistics disciplines which had been largely ignored by these studies, areas ranging from the strategic role of logistics in the maze of activities that is marketing and the utilization of customer service to create a competitive edge to the place of logistics in the organizational hierarchy.

Then in 1993, Stock and Luhrsen conducted a study of American PhD dissertations completed between 1987 and 1991 (422 in all) that was organized according to topic and source university. The main conclusions of their study were:

(1) the number of doctoral dissertations being produced had reached the saturation point;

(2) traditional logistics programs did still produce the greatest number of PhDs;

(3) there were a number of new colleges and universities advancing in the ranks of institutions turning out logistics-related doctorates;

(4) traditional areas of logistics (e.g. transportation, warehousing, inventory control) were still well researched; and

(5) very little research effort had been afforded for topics like strategic aspects of logistics, international logistics, organizational issues and order processing and information systems.

Subsequently, Stock (2001) completed his third paper on PhD dissertations within logistics and logistics-related areas, this one covering the period from 1992 to 1998 (317 dissertations in all). The following is a summary of the chief conclusions of this study:

(1) The number of PhDs being produced is stable, as the levels during this period are the same as those recorded from 1987 to 1991.

(2) subject areas attracting the greatest interest include:
- miscellaneous transport;
- general logistics;
- decision support systems;
- international logistics; and
- channels of distribution.

(3) Subject areas in which research interest is waning:
- warehousing;
- inventory;
- location analysis;
- MRP/DRP/JIT; and
- Kanban.

Moreover, the subjects of packaging and pipeline transport are still ignored.

(4) Areas attracting more extensive research attention are:
- customer service/satisfaction;
- human resources and organizational issues;
- international logistics; and
- SCM.

(5) Universities with logistics research traditions are not the only ones turning out PhDs in logistics and logistics-related areas.

Scandinavia has also produced a single contribution discussing doctoral dissertations within logistics and SCM. Vafidis (2001) authored a study incorporating 25 Swedish and Finnish PhD dissertations written between 1994 and 1998. In this study, Vafidis compared these dissertations on the basis of several criteria:

(1) the research topic addressed;

(2) research design applied (quantitative, qualitative or triangulation);

(3) the type of contribution (disciplinary or practical – here, Vafidis distinguishes between open frameworks designed to form a basis for theorizing and/or generating hypotheses, and predetermined frameworks designed as a means for testing theory);
(4) methodological approach (analytical, system or action research); and
(5) logistics research theories espoused.

Vafidis (2001) concludes that the variety of research topics appearing in the investigated dissertations leads to a fragmented discipline. Arlbjørn (1999, 2000) has reached a similar conclusion based on the work of Whitley (1984). In short, this fragmentation arises because the dissertations mainly seek to fulfil practical purposes. The methodology applied in these dissertations also varies from quantitative to qualitative to combinations of quantitative and qualitative methods (also called triangulation), while the studied research efforts are grounded in both positivistic and hermeneutical paradigmatic beliefs. Regardless of the theory they apply, however, the dissertations' conclusions rest solely on a paradigmatic understanding of theory. In fact, several even mention that there are many extant theoretical perceptions, from principles and hypotheses to rules, paradoxes and laws, a state of affairs that Stock (1997) also treats, taking Bothamley's (1993) *Dictionary of Theories* as his point of departure. Perhaps as a direct result of this circumscribed conceptualization of theory, the chief theories applied in these Nordic dissertations include Transaction Cost Economics (Williamson, 1985) and General Systems Theory (Von Bertalanffy, 1968). Finally, Vafidis (2001) resolves that in fact there is no explicit Nordic logistics paradigm.

3. Methodology

In the study in hand, data derived from Nordic PhD dissertations within logistics and SCM have been worked up in six main steps.

(1) Identifying Nordic research environments working with logistics and SCM.
(2) Completing an e-mail questionnaire study (phase one).
(3) Reviewing received dissertations (phase one).
(4) Presenting a working paper addressing this theme at NOFOMA.
(5) Contacting research environments and authors of dissertations not yet received directly (phase two).
(6) Reviewing received dissertations (phase two).

3.1 Identifying Nordic research environments working with logistics and SCM

The first step in identifying dissertations relevant to our research purposes was to prepare a comprehensive list of the research environments working with

logistics and SCM in the Nordic countries. By providing a list of research environments in logistics and SCM within the Nordic countries, the NOFOMA network was of great help in this endeavor. In all, 30 research environments spread out over Denmark, Norway, Finland and Sweden were identified (see Appendix 1 for a list of these environments). Research environments in Iceland were not contacted, as we know that PhDs within these topic areas are not yet being produced there.

3.2 Completing an e-mail questionnaire study (phase one)

A brief questionnaire was constructed containing a description of our purpose and a request that the recipient prepare a reference list of PhD dissertations dealing with logistics and SCM completed during the 1990-2001 period. This questionnaire was then e-mailed to contact persons at each of the identified research environments. If staff members at any of these institutes (PhD students and/or professors) were personal acquaintances, these persons were chosen to receive this e-mail. Via these personal connections, we received a number of carefully prepared reference lists quite rapidly. For those environments to which we did not have any personal connection, we contacted research directors, department managers, professors and secretarial staff. In this e-mail query, we also asked how we might procure the pertinent dissertations for review. Would we be able to borrow them from the institutions themselves, would they provide free printed copies, or could they provide us with information on how to purchase published dissertations?

3.3 Reviewing received dissertations (phase one)

The e-mail questionnaire from phase one resulted in the identification of 53 dissertations, of which we were able to review 32. In order to structure the review process, a standardized fact sheet was filled out for each dissertation. The review framework that informs this fact sheet is described in Section 5.

3.4 Presenting a working paper addressing this theme at NOFOMA

In June 2002, we presented a working paper addressing Nordic PhD dissertations within logistics and SCM at the NOFOMA network Nordic Logistics Conference held in Trondheim, Norway. This presentation resulted in the identification of an additional batch of dissertations, bringing the total to 75, as presented in this paper. At the conference, we also had several selected researcher colleagues from this Nordic research community review the newly expanded list of dissertations.

3.5 Direct contact with research environments and authors of dissertations not yet received (phase two)

In the second phase, we made direct e-mail and phone contact with the authors of dissertations we had not yet received or with their affiliated research environments.

3.6 Reviewing received dissertations (phase two)
The second contact phase brought in 39 dissertations to add to the 32 that we had already reviewed. This new batch of dissertations was also reviewed (review framework discussed later in this paper). In Appendix 2, the 71 reviewed dissertations out of an identified total of 75 dissertations are marked with an asterisk (*). Two dissertations are authored in Finnish. These have been reviewed by a Finnish colleague based on guidelines from the author team. Of the four unreviewed dissertations, one is from Norway, and the rest are from Finland. We were unable to receive the four dissertations due to a lack of sufficient information about the author, or because the institutional library in question had no record of the dissertation we requested or because the dissertation in question was out of print at the publisher.

4. Limitations

This paper is the first attempt to provide a complete outline of Nordic PhD dissertations within logistics and SCM. Despite its inclusive nature, this research is not without its limitations. Three limitations have been identified. First of all, we have been able to review 71 of the 75 known dissertations, or (95 percent). Thus, the fact that 5 percent of the known population has not been reviewed opens up the possibility that these dissertations may have influenced the results of this study if they had also been reviewed. Second, it is impossible to rule out the possibility that respective authors' subjectivity has played a role in the reviewing process. However, each member of the author team has completed an individual review of the first five dissertations, whereupon these reviews have been compared in order to obtain a common understanding from author to author of the criteria informing the optic through which these dissertations can be viewed. In spite of this measure, it cannot be guaranteed that all dissertations have been reviewed through the identical optics. Third, the collection of our raw data, Nordic PhD dissertations within logistics and SCM, was limited to the NOFOMA network. Clearly, other Nordic research environments and research departments, such as those whose main research fields are marketing, foreign trade and information technology, may produce logistics and SCM-related PhD dissertations. This study can only formulate conclusions based on the number of dissertations identified within the NOFOMA network.

5. Review framework

The review framework was inspired by the earlier, similar studies discussed at the start of this paper. With the structure of those studies in mind, we developed and implemented a review fact sheet comprising reference information applicable to the following nine key characteristics shown in Table I.

No.	Key characteristic	Range of variation
1	Year of publication	From 1990 to 2001
2	Dissertation type	Book
		Collection of articles
3	Primary entity of analysis	Manufacturer
		Carrier
		Wholesaler
		Retailer
		Inventory hotel
		N/A
4	Level of analysis	Functions
		Firm
		Dyad
		Chain
		Network
		N/A
5	Main purpose of the dissertation	Primarily to describe
		Primarily to be explorative
		Primarily to explain
		Primarily to understand
		Primarily to diagnose
		Primarily to be normative
		Primarily to intervene
6	Research design applied	Theoretical/desk research
		Empirical quantitative
		Empirical qualitative
		Empirical triangulation
7	Time frame of the empirically-based dissertations	Snap shot
		Longitudinal
		N/A
8	Type of theory generated	Toward T1 theory
		Toward T2 theory
		Toward T3 theory
9	Containing elements of philosophy of science	Yes
		No

Table I.
Review elements

5.1 Review elements

5.1.1 Year of publication. Year of publication refers to the specific year each dissertation was finalized. Again, the period being considered is 1990-2001.

5.1.2 Dissertation type. Nordic PhD candidates can choose to hand in their final project for evaluation in either one main publication (a book format) or as a collection of articles. The number of articles in collections varies, but they should all have undergone a blind review process before publication. Included in such an article collection is a smaller-scale contribution designed to link the separate articles together.

5.1.3 Primary entity of analysis. This analytical issue concerns the specification of the type of company that is the primary entity of analysis in a given dissertation. It also examines whether the study adopts the producer's or the retailer's point-of-view. Some dissertations do not posit any specific type of company in addressing research questions, in which case they are marked N/A (not assessable) with respect to this review issue.

5.1.4 Level of analysis. Level of analysis indicates the perspective from which the dissertation in question investigates logistics problems. Harland (1996) has discussed how the concept of SCM has been used in the literature. To this end, she identified four separate perspectives: an intra-organizational perspective, a dyadic perspective, a chain perspective and a network perspective. This conceptual apparatus is also employed here, though we have added a fifth category, namely the functions perspective (i.e. logistical problems related to a specific division/area in a firm, e.g. a warehouse). The dyadic perspective implies a level of analysis at which problems involving two companies, e.g. a producer and a supplier, or a producer and a third-party logistics provider, are investigated. If the chain is the level of analysis, then the dissertation in question seeks to elucidate logistical problems in a supply chain, e.g. a group consisting of a producer, a supplier and a customer. Finally, if the network is identified as the level of analysis, then logistical problems involving a range of actors on the horizontal level of the value chain, e.g. a collection of suppliers connected to one or more producers have been the chief concern of the evaluated dissertation.

5.1.5 Main purpose. According to Andersen (1999), a research effort may serve any one of seven different purposes. Efforts with a *descriptive* intent may focus on historical as well as current events and phenomena. For instance, such an effort may attempt to describe how several variables are interconnected, or how a particular outsourcing process has been handled. Efforts with an *explorative* aim investigate relations and/or phenomena about which there is no extant knowledge. As such, they identify problems. Typically, investigations with this type of aim result in the formulation of a series of hypotheses and/or propositions that must later be tested in a different type of study so as to ensure the applicability of these results in a broader context. Studies with an *explanatory* objective seek to elucidate the background for certain observed phenomena. For example, a company may decide to outsource its finished goods warehousing to cut costs or to improve its service. In other words, research efforts of this type seek to generalize. If a research effort is described as seeking to *create understanding*, then it looks to get behind certain phenomena so as to turn up new ways of viewing these phenomena. That is, such efforts aim to attain a new and more detailed understanding of pre-existing concepts, or reach the desired understanding by developing completely new concepts. Projects with a *diagnostic* purpose take as their point of departure a series of pre-defined symptoms, the impetuses for which they

then seek to delimit and prioritize. When subscribing to a *normative* intent, research efforts pinpoint a range of concrete solutions to an identified problem. If the purpose of a study is to *intervene*, it assumes that the researcher participates actively in the problem-solving process, so as to be able to report on this process. Action research, as described by Gummesson (1991), is an example of research striving to fulfill such a purpose.

5.1.6 Research design. Research design is a designation of whether or not a particular dissertation includes empirical work. If not, it is characterized as either purely theoretical or desk research. In our review framework, we divided the contributions with an empirical bent into three subcategories:

(1) empirical work based on quantitative methods;

(2) empirical work based on qualitative methods; and

(3) empirical work in which both quantitative and qualitative methods are applied to the same object of study (also referred to as method triangulation).

5.1.7 Time frame. Only the dissertations with an empirical research design have been considered here, and they are divided into three time frame designations:

(1) snapshot;

(2) longitudinal; and

(3) N/A.

By snapshot, we mean that empirical data on one or more phenomena are collected in one round. As such, this type of empirical work captures a single moment in time, like a snapshot. Longitudinal studies have the opposite nature, as they entail that the researcher return to the observed phenomena again and again, e.g. to be able to derive an impression of a particular development trend. Dissertations that make no specific reference to time frame are marked N/A.

5.1.8 Type of theory generated. The theoretical sphere is home to a wealth of different types of theories. Countless debates have been raised concerning what qualifies a statement as theory (cf. the discussion between Sutton and Staw (1995) and Weick (1995)). Needless to say, several different research traditions may operate concurrently on the transcontinental level, but the same holds true in the interdisciplinary realm, yes even for sub-disciplines. Furthermore, discrepancies may also arise as a result of the different paradigms to which researchers subscribe, a problem outlined by Arlbjørn and Halldórsson (2002). In order to clarify how research in logistics is best characterized, we will draw on the discussion about the different nature of problems investigated by Jensen (1995) and the way in which Arlbjørn (2000) applies this discussion to logistics literature.

Jensen (1995) classifies theories into three groups based on the type of problems they confront. Moreover, he distinguishes between *practical* and

theoretical problems. Practical problems arise when it is possible to imagine a situation that is better than the one at hand; that is, when there is a description or an idea at the ready to solve the problem. Typically, practical problems have a normative dimension. The solution to such a problem has two steps:

(1) outline possible methods to achieve the new situation; and

(2) implement these methods.

It goes without saying that a practical problem cannot be considered solved until something is done or changed. A theoretical problem, on the other hand, is based on a pre-existing theory. This theory forms the basis for the researcher's expectations and enables him/her to make predictions and define what is normal. A theoretical problem arises when there is evidence that something is wrong with an existing theory. The evidence can take the form of observations, results of experiments or conceptual indicators. At times, the distinction between practical and theoretical problems seems easy to draw; at other times, this task can be very difficult. Taking this contrast between practical and theoretical problems as his point of departure, Jensen describes three different types of theories:

(1) T1 theory;

(2) T2 theory; and

(3) T3 theory.

A brief introduction to these three types of theories are as follows.

T1 theory. According to Jensen (1995), a great deal of all science and research aims to provide solutions to practical problems by establishing standardized or routine procedures. A T1 theory is said to be scientific if "it is possible to produce evidence for its effectiveness in solving a practical problem or in deciding the best solution given a number of alternative proposals". Such a theory consists of a collection of principles, procedures, concepts, notations and symbols, etc. The type of knowledge produced by T1 theories is often attained through trial-and-error processes and is experimental in nature.

T2 theory. Type 2 theories provide answers to theoretical problems in the sense that they explain what needs explaining. In short, their main function is to explain. These explanations are often based on deduction grounded in general principles or inferences derived from analogies. The main purpose of T2 theories is to provide possible reasons for why given phenomena occur.

T3 theory. Theories generated by applying T2 theories to practical problems are known as T3 theories. In fact, theories in the management and business sciences are very often T3 theories. Such theories presuppose some general psychological, sociological or economic theory – a T2 – and then, based on this background, attempt to ascertain how the practical problems are best solved.

5.1.9 Containing elements of philosophy of science. This review issue is a measure of whether or not the individual authors of the reviewed dissertations

address problems related to philosophy of science along with problems with their own and the investigated actors' objectivity and subjectivity (e.g. by adopting a scientific paradigm, and addressing concepts such as ontology and epistemology).

As a final note on this review process it should also be noted that the review of any one dissertation was not considered definitive until it had been discussed in the context of a meeting attended by the entire committee of authors. We felt that this would ensure that the dissertation appraisals were as objective as possible.

6. Results

This section contains the results of the data processing process. First, the results attained by the process of review – the investigation of the nine key characteristics described earlier – to which the 71 dissertations were subjected are presented. These results are presented in tables, each accompanied by a series of explanatory comments. Finally, the results of an analysis of the titles of the original population of 75 dissertations will be put forward.

6.1 Number and type of dissertations finalized in the period 1990-2001

Table II contains a chronological schematic accounting for the sum total of identified and reviewed dissertations from the indicated time frame. The figures in the table bear witness to an increase in the number of completed dissertations in the logistics field, which began in the mid-1990s and has continued since. It is unclear whether the source of this growth is to be found in increased resource allocation in this particular area of research or if the trend can be ascribed to the general rise in the number of PhD-scholarships awarded. However, the growing number of participants at the past five Nordlog conferences indicates that the number of ongoing PhD projects in the field of logistics might be deemed responsible for the recent increase in the number of doctoral dissertations completed in this field. Nordlog is a forum for Scandinavian PhD students, a doctoral symposium held on the day before each year's NOFOMA conference. Of all the Nordic countries, Sweden has produced the greatest number of dissertations within the time period analyzed in this paper. This may be due to the fact that Sweden is considered the first Nordic country to have taken up the study of logistics, beginning with concepts such as materials administration, time study analysis and distribution planning. But the fact that Sweden is the Nordic country with the most industry may also contribute to their position as the producer of the greatest number of dissertations.

In Table II, the dissertations are also divided according to format; that is, whether they were published in book/report form or as collections of articles. The table clearly demonstrates that the majority of the dissertations examined have been published in the book/report format (56 out of 69). Whereas more

Table II.
Number and type of PhD dissertations finalized in the period 1990-2001

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Total
All identified dissertations													
Danish	–	2	3	1	1	1	1	2	–	–	3	1	15
Finnish	–	–	–	–	3	4	2	3	3	2	1	2	20
Norwegian	–	–	–	–	1	2	3	1	1	3	1	–	12
Swedish	–	–	2	1	–	2	1	3	5	5	5	4	28
Total	–	2	5	2	5	9	7	9	9	10	10	7	75
Reviewed dissertations													
Danish reviewed													
Book/report	–	2	3	1	1	1	1	1	–	–	3	1	14
Collection of articles	–	–	–	–	–	–	–	1	–	–	–	–	1
Total Danish	–	2	3	1	1	1	1	2	–	–	3	1	15
Finnish reviewed													
Book/report	–	–	–	–	2	3	1	3	1	1	1	2	14
Collection of articles	–	–	–	–	–	1	1	–	–	1	–	–	3
Total Finnish	–	–	–	–	2	4	2	3	1	2	1	2	17
Norwegian reviewed													
Book/report	–	–	–	–	1	1	3	1	1	1	1	–	9
Collection of articles	–	–	–	–	–	–	–	–	–	2	–	–	2
Total Norwegian	–	–	–	–	1	1	3	1	1	3	1	–	11
Swedish reviewed													
Book/report	–	–	2	–	–	1	–	3	4	2	4	3	19
Collection of articles	–	–	–	1	–	1	1	–	2	2	1	1	9
Total Swedish	–	–	2	1	–	2	1	3	6	4	5	4	28
Reviewed in total													
Book/report	–	2	5	1	4	6	5	8	6	4	9	6	56
Collection of articles	–	–	–	1	–	2	2	1	2	5	1	1	15
Total	–	2	5	2	4	8	7	9	8	9	10	7	71

than half of those dissertations published as collections of articles come from Sweden, it seems that this formatting decision can be localized even further. Students at Chalmers Technical University produced seven out of the nine Swedish collections of articles, whereas the last two were from Lund University.

6.2 Primary entity of analysis

In Table III, the dissertations addressed by this survey are classified according to their primary entity of analysis. Some dissertations consider several entities of analysis; again, we have classified these according to their primary entity of analysis. Clearly, the manufacturer and carrier entities are two of the areas most often researched (measured together, they characterize 57 of the 69 dissertations). In a way, this is quite surprising. One would think that we would have turned up more dissertations focusing specifically on the consumer end of business relations (here measured through wholesaler, retailer and inventory warehousing entities). After all, this area of logistics is not only the most competitive in a number of different industries, but it is also home to significant innovative moves and most often the source of technological breakthroughs.

6.3 Level of analysis, arranged according to year of publication

Table IV classifies the dissertations with respect to their operative level of analysis as well as year of publication. Examination of the data reveals that the frequency with which the dissertations operate on the analytic levels of functions within a firm and single firm in itself, measured together, is quite high (40 out of 71). Not until the second half of the 1990s do dissertations operating with an inter-organizational approach, applying dyadic, chain or network levels of analysis, begin to appear (in all 21 out of 71). Moreover, Norwegian and Swedish dissertations seem to exhibit a marginally greater tendency toward inter-organizationally oriented analysis than those of their Nordic neighbors. On the one hand, it is remarkable that not more dissertations have an inter-organizational level of analysis despite the increasing attention toward such that started at the beginning of the 1980s. On the other hand, the evolutionary process of science takes time to advance. In retrospect, this seems obvious (Coyle *et al.*, 1996). In the future, we expect to see an even greater number of dissertations utilizing inter-organizational levels of analysis, e.g.

Entity	Manufacturer	Carrier	Wholesaler	Retailer	Inventory hotel	N/A	Total
Danish	9	5	–	–	–	1	15
Finnish	11	3	–	–	–	3	17
Norwegian	6	3	–	–	–	2	11
Swedish	10	10	–	–	1	7	28
Total	36	21	0	0	1	13	71

Table III. Primary entity of analysis

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Total	
Danish reviewed														
Function	–	1	1	1	–	–	–	–	–	–	–	–	3	
Firm	–	–	–	–	1	–	1	–	–	–	3	1	6	
Dyad	–	1	–	–	–	–	–	2	–	–	–	–	3	
Channel	–	–	–	–	–	–	–	–	–	–	–	–	–	
Network	–	–	1	–	–	–	–	–	–	–	–	–	1	
N/A	–	–	1	–	–	1	–	–	–	–	–	–	2	
Total Danish	–	2	3	1	1	1	1	2	–	–	3	1	15	
Finnish reviewed														
Function	–	–	–	–	–	–	–	–	–	–	–	–	–	
Firm	–	–	–	–	2	3	1	3	–	2	–	–	11	
Dyad	–	–	–	–	–	–	–	–	1	–	–	1	2	
Channel	–	–	–	–	–	1	–	–	–	–	1	–	2	
Network	–	–	–	–	–	–	–	–	–	–	–	1	1	
N/A	–	–	–	–	–	–	1	–	–	–	–	–	1	
Total Finnish	–	–	–	–	2	4	2	3	1	2	1	2	17	
Norwegian reviewed														
Function	–	–	–	–	–	–	–	–	–	–	–	–	–	
Firm	–	–	–	–	–	1	–	–	–	1	1	–	3	
Dyad	–	–	–	–	–	–	2	1	–	–	–	–	3	
Channel	–	–	–	–	–	–	–	–	1	1	–	–	2	
Network	–	–	–	–	–	–	–	–	–	1	–	–	1	
N/A	–	–	–	–	1	–	1	–	–	–	–	–	2	
Total Norwegian	–	–	–	–	1	1	3	1	1	3	1	–	11	
Swedish reviewed														
Function	–	–	–	–	–	–	1	–	1	1	1	–	4	
Firm	–	–	2	–	–	1	–	2	2	2	3	1	13	
Dyad	–	–	–	–	–	–	–	–	–	–	–	–	–	
Channel	–	–	–	–	–	–	–	1	1	–	1	1	4	
Network	–	–	–	–	–	–	–	–	–	–	–	2	2	
N/A	–	–	–	1	–	1	–	–	1	2	–	–	5	
Total Swedish	–	–	2	1	–	2	1	3	5	5	5	4	28	
Total														
Function	–	1	1	1	–	–	1	–	1	1	1	–	7	} 40
Firm	–	–	2	–	3	5	2	5	2	5	7	2	33	
Dyad	–	1	–	–	–	–	2	3	1	–	–	1	8	} 21
Channel	–	–	–	–	–	1	–	1	2	1	2	1	8	
Network	–	–	1	–	–	–	–	–	–	1	–	3	5	
N/A	–	–	1	1	1	2	2	–	1	2	–	–	10	
Total	–	2	5	2	4	8	7	9	7	10	10	7	71	

Table IV.
Level of analysis arranged according to year of publication

focusing on SCM problem areas, in accordance with the same trend observed by Stock (2001).

6.4 Main purpose, research design and time frame

Table V exhibits the distribution of the dissertations with regard to main purpose, applied research design and time frame. The seven categories in

	DK	SF	N	S	Total	
Purpose						
To describe	3	2	2	7	14	
To explore	4	9	2	4	19	
To explain	2	–	–	5	7	
To understand	3	2	2	5	12	
To diagnose	–	–	–	–	–	
To be normative	2	4	4	5	15	
To intervene	–	–	–	2	2	
N/A	1	–	1	–	2	
Purpose total	15	17	11	28	71	
Research design						
Theoretical (desk research)	8	1	5	7	21	
Empirical quantitative	–	3	–	3	6	} 50
Empirical qualitative	7	7	3	10	27	
Empirical triangulation	–	6	3	8	17	
Research design total	15	17	11	28	71	
Time frame						
Snapshot	6	12	4	19	41	
Longitudinal	–	3	2	1	6	
N/A	1	1	–	1	3	
Time frame total	7	16	6	21	50	

Table V.
Main purpose, research design and time frame

Table V, each designating a specific dissertation objective, stem from the work of Andersen (1999). Simplification was also necessary in this phase of data processing, so that each dissertation might be classified as being representative of only one category. The majority of the dissertations are either descriptive or explorative (together, 33 out of 71); not a single one is diagnostic in nature. Whereas a significant number of the dissertations – approximately 20 percent (15 out of 71) – display a normative objective, only two of the dissertations can be classified as having a direct intent to intervene (both are Swedish). Thus, action-based research strategies are not very common among Nordic PhD projects. One reason can be, the right timing of logistics and SCM projects to follow within the time period where the PhD projects are to be completed. Another reason can be that such a research strategy can be perceived as being too risky because projects can be stopped or postponed several times leading to lack of empirical data in the PhD project.

Taking descriptive, exploratory and explanatory projects as one group, we see that they feature greater critical distance, more observing and less involvement directly with the field. These three classes make up the bulk (40 out of 71) of the reviewed dissertations. A second group, including projects designed to create understanding, be diagnostic, be normative, or to intervene, features more active involvement and a closer proximity to the research object. Together, this group constitutes 29 out of 71 reviewed dissertations.

The results of the applied research designs in the investigated dissertations are also summarized in Table V. The table differentiates between four separate types of research design, one of which is theoretical in nature while the remaining three are different types of empirically-based research designs. To clarify, the term "triangulation" is intended to indicate that the data collection process inherent in the given dissertation has both qualitative and quantitative elements. As the data in this table make clear, the bulk of the dissertations involved in this study are grounded in empiricism (50 out of 71). In turn, the majority of these dissertations are based on qualitative methods (27 out of 50), and most of these are case studies. Twelve percent of all these dissertations (6 out of 50) adopt a classical theoretical point of departure in its purest form (quantitative-based research design). In the end, these statistics are but further proof that research in the field of logistics is overwhelmingly empirically oriented and that, as such, the field oftentimes lacks a solid theoretical foundation. This problem is discussed in more depth at the point at which each of the dissertations is typecast according to its theoretical orientation. The dissertations are distributed with regard to T1 theory, T2 theory or T3 theory orientation in a table appearing in the same section.

In the third part of Table V, the empirically oriented dissertations (50 of 71) are classified according to the time frame on which they operate. As the table indicates, the data collection process is geared to producing a snapshot in almost every one of the applicable dissertations (41 out of 50). Unfortunately, this places a severe limit on the researcher's ability to analyze data according to a progressive perspective, not a trivial concern considering the fact that the implementation and development of logistics systems often is a very complex, long-term process.

6.5 Type of theory generated

As demonstrated by Table VI, theory of type T3 is in greater abundance (characterizes 34 of 71 dissertations) than types T1 and T2. Moreover, the results seem to suggest that there is little pure research taking place in the fields of study with which this report is concerned (21 out of 71). Perhaps researchers feel that the fields are mature enough already and do not require any additional pure research, or perhaps this lack can be ascribed to the intimate connection between universities and industry which pertains in this discipline.

Table VI. Type of theory generated

Theory type	T1	T2	T3	Total
#	16	21	34	*71*

6.6 Does the dissertation deal with the philosophy of science?

Do the implicated dissertations make an active effort to incorporate theories and methods originating in the philosophy of science? Table VII provides the statistical answer to this question. As it turns out, about 45 percent (32 out of 71) do not actively incorporate theories or methods originating from the philosophy or theory of science, or they incorporate them to a very minimal extent. While more than half of the Danish and Norwegian contributions do not consider this topic, about two-thirds of the Finnish and Swedish contributions do. In the 55 percent that do take up these concerns, philosophical considerations bear more weight in some dissertations than they do in others. That notwithstanding, philosophy of science is certain to play a more and more prominent role in future dissertations as PhD level research programs become increasingly more formalized and new research environments continue to spring up, as reported by Gammelgaard (2001). Within NOFOMA, initiatives connected to doctoral courses addressing such topics have been strengthened since 1998.

6.7 Dissertations distributed according to topic groups and country of origin

Table VIII represents our attempt to group all the identified dissertations according to topic or theme. Through careful study of the titles of these dissertations, we were able to arrive at a total of eight subject groups into which the dissertations were then categorized. One-third deals with logistics system design, structure and effectiveness (25 out of 75). This fraction comprises 50 percent of the Finnish, 33 percent of the Danish, 18 percent of the

	DK	SF	N	S	Total
Yes	6	10	5	18	39
No	9	7	6	10	32
Total	15	17	11	28	71

Table VII. Does the dissertation deal with philosophy of science?

No.	Topic groups	DK	SF	N	S	Total
1	System design/structure/effectiveness	5	10	5	5	25
2	Distribution/route planning	1	3	2	3	9
3	Organizational development/competencies	3	1	–	3	7
4	System integration/integration enablers	1	1	1	5	8
5	Environmental issues	–	–	–	2	2
6	Inter-organizational collaboration/supplier collaboration/third party logistics	3	3	2	3	11
7	Material handling	–	–	–	3	3
8	Transport/transport systems	2	2	2	4	10
Total		15	20	12	28	75

Table VIII. Dissertations distributed according to topic groups and country of origin

Swedish and 42 percent of the Norwegian dissertations. Environmental issues and material handling are the topics represented by the smallest fractions, and all of these are Swedish. The latter topic should come as no surprise since, as mentioned, the logistics movement in Scandinavia originates in the Swedish study of material handling.

With respect to the remaining subject groups, geographic representation is more equally distributed, though Norwegian dissertation authors seem to have a special interest in systems design, systems integration and transport/transport systems. There are other subject groups that do not appear in this table, though one would have expected to see them in a consideration of a decade's worth of Nordic doctoral dissertations. This will be addressed in full in Section 7.

7. Discussion

In this section, some of the most significant findings from the prior section will be discussed in more detail. The section is divided into three sub-sections:

(1) main problem domain in the dissertations;

(2) type of theory generated; and

(3) topics not included in the dissertations analyzed.

Figures are provided in the first two sub-sections in order to provide these discussions with a framework. Accordingly, these sub-sections will be initiated by a brief theoretical discussion of the parameters employed in these figures.

7.1 Main problem domain in the dissertations

The concept of problem domain and its relevance for the dissertations considered in this study can be explained in terms of the dimensions occupying the two axes in Figure 1. The first dimension – the various entities of analysis

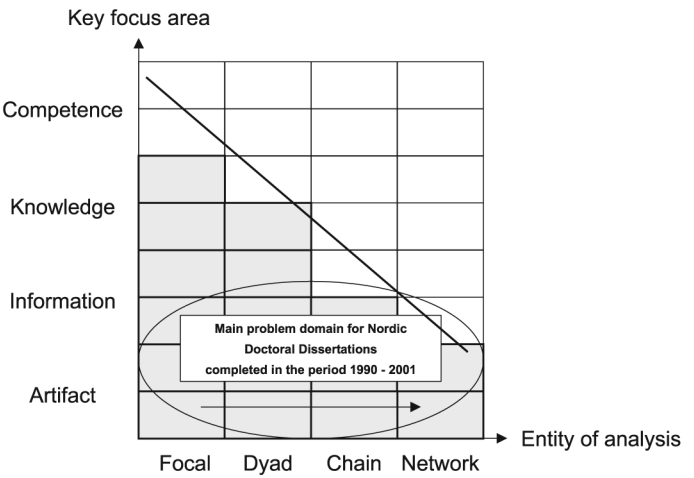


Figure 1.
Main problem domain for the dissertations reviewed

– is plotted on the *x*-axis, while the second dimension – the key focus area, a designation for the topical problems that dissertations address – occupies the *y*-axis. These dimensions were developed as an attempt to collate the results from three earlier steps in the analysis of these dissertations; namely, the documentation of their year of publication, the documentation of their operative level of analysis and the documentation of the title analysis process. Combining the findings of these three analytic processes has made it possible to position the implicated dissertations in a larger context.

7.2 Main problem domain for the dissertations reviewed

As mentioned, the *x*-axis in Figure 1 indicates which entity of analysis the individual dissertations have adopted. It is segmented into four levels:

(1) focal (or single firm);

(2) dyad;

(3) chain; and

(4) network.

The *y*-axis, on the other hand, is intended to indicate the dissertations' foci with respect to knowledge accumulation. Again, this axis is segmented into four levels:

(1) artifact;

(2) information;

(3) knowledge; and

(4) competence.

To clarify, the term "artifact" is meant to connote a focus on the physical elements of logistics, the movement of goods, warehousing and the like. "Information" refers to various types of information and planning systems related to the flow of information.

While quite familiar to researchers in this field, the concepts of knowledge and competence are not static entities. They, too, are changing with the times and must be seen in a broader perspective. Prompted by the rapid pace of technological renewal and increasingly shorter product life cycles, more and more corporations are going back to basics, focusing on their core competencies. Any extraneous production tasks and/or technologies are outsourced. As a result, production tasks not only become narrower, but also more specialized. Individual corporations become more and more dependent on their suppliers and collaborators with regard to the sourcing of goods, technology and know-how.

It becomes clearer and clearer that the single company is no longer the locus of competition. Instead, companies have begun competing based on the strength of their supply chains. As such, the demand for the sourcing of new

expertise is rising, and companies have been forced to accumulate competencies with respect to supply chains and networks. Despite the pressure to adapt quickly, these companies must be careful to structure these supply chains with the right partners and gird them with the right competencies. These are the conditions we have attempted to embody with the two uppermost levels on the *y*-axis, knowledge and competence, respectively. The shaded cells in the figure are intended to indicate those problem domain areas that have been addressed by the body of research completed to date. Conversely, the unshaded cells indicate research areas that have not yet been subject to thorough analysis, and, as such, should be considered relatively unresearched (Ellegaard *et al.*, 2001; Møller and Johansen, 2001).

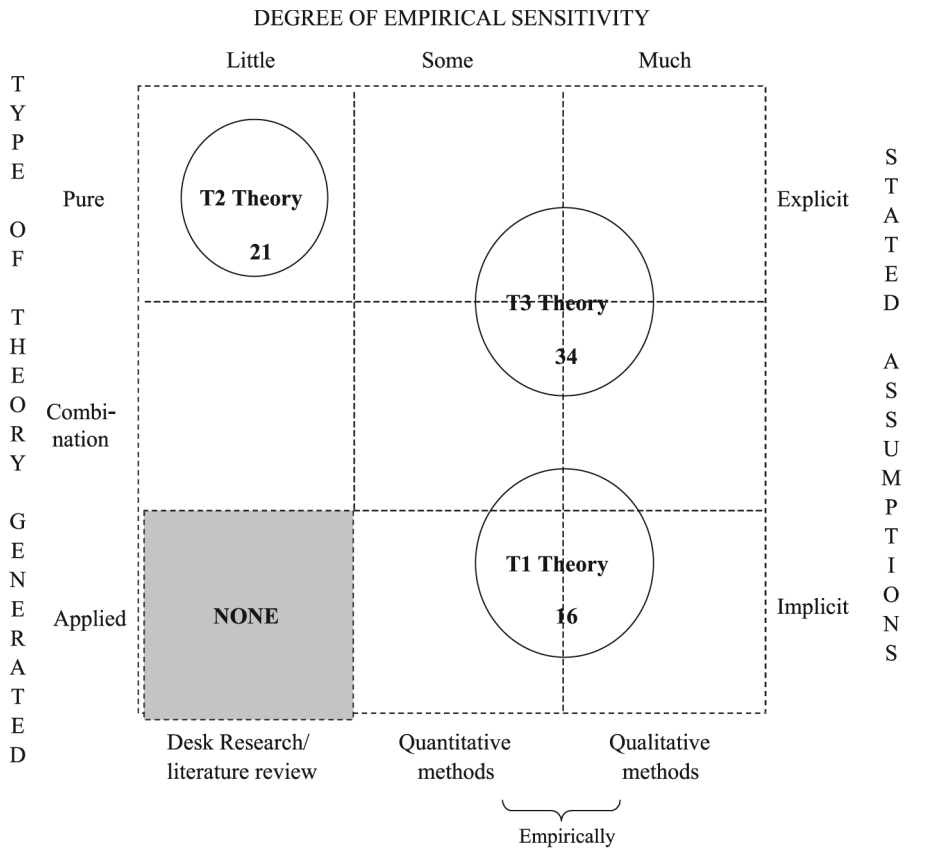
A majority of the dissertations reviewed in this study fall under the shaded portion of Figure 1. Clearly, the authors of the bulk of these dissertations have chosen to focus on either artifacts or information, while the focal and dyadic levels are the most often used entities of analysis in these same dissertations. One explanation for this state of affairs might be that these dissertations bear the mark of a specifically Nordic tradition, or Nordic logistics paradigm, which takes precisely this situation as its point of departure and places a significant amount of emphasis on artifacts and structural conditions. Another possible explanation for this phenomenon is that the alternative types of dissertations have been overlooked for some reason in the identification process, or that representatives of these alternate types are yet to come.

7.3 Different types of theories generated

Arlbjørn (2000) has applied the three different theory types proposed by Jensen (1995) and related these types to four other research dimensions: the purpose of the developed theory, the assumptions made by the study object, the degree of empirical sensitivity exerted and the data collection methods employed. The latter is further specified in Figure 2. The circles in Figure 2 represent different situations that have been judged as those in which theories come into being in logistics research. It should be noted that, if this classification theme is applied to other fields of research, the circles might change position and the diameter of the circles might vary. The number at the bottom of each theory type circle corresponds to the number of dissertations reviewed which operate with the given theory.

7.4 Different types of theories and processes behind their development

The dimensions specifying the type of theory generated and the assumptions made about the study object (the vertical axes) are directly related, and the same holds true for the remaining two dimensions (the horizontal axes). In clarification, the distinction between pure and applied theory is a measure of the individual researcher's level of ambition. If his/her ambition is to generate pure theory, we can assume that he/she relegates him/herself to very precise assumptions about the study object. In other words, the entity of analysis in



Source: Arlbjørn (2000)

Figure 2.
Different types of theories and the process behind their development

such a project is very well defined. Thus, dissertations, which strive to generate pure theory, exhibit a concern for theoretical and philosophical relevance and, as such, are generally characterized by a long-term perspective and a desire to advance the specific discipline (Gummesson, 1991). Pure theories are typically explanatory in nature. In contrast, applied theories tend to be concerned with improving corporate performance; i.e. making recommendations. Thus, they are more normative in nature. With this method of theory classification in mind, Arlbjørn (1999, 2000) has ventured the hypothesis that, by and large, Scandinavian PhD dissertations concerned with logistics are positioned in the qualitative portion of the T3 theoretical sphere, while their American counterparts tend to position themselves in the quantitative portion of the T1 theoretical sphere. Perhaps not surprisingly, Drejer *et al.* (2000) reached a similar conclusion in their study of a related field, operations management. But

contributions in the fields of logistics and/or SCM may employ any of the three types of theories outlined earlier (Arlbjørn, 2002).

To continue, the entity along the lower horizontal axis, data development techniques, is a blanket designation for the range of different techniques an individual researcher may adopt in order to solve the problem facing him/her. If a researcher chooses literature studies as the primary source for his/her research, the work can – relatively speaking – demonstrate little empirical sensitivity. In this way, the traditional distinction between theoretical and empirical studies can be drawn. Two things happen as we draw closer to applied theory: the level of abstraction is diminished and the likelihood that the theory will become diffuse increases.

Having completed this more or less theoretical treatment of the three different types of theory propounded by Jensen (1995), we turn to the implications that these theories have for the dissertations we reviewed in this particular study. The results of Table VI, which, incidentally, are also incorporated into Figure 2, underpin our earlier assertion that logistics research is extremely empirically oriented in nature. Only a handful of the contributions were able to earn the T2 theory designation. These statistics bring a number of questions to mind. First, does logistics research require an infusion of pure research, pure research which would turn out pure theory in the form of T2 theory? What constitutes a truly logistic theory? Do such theories exist and, if not, should they be developed?

7.5 Topics not addressed by the dissertations analyzed

After studying the 71 dissertations, we were able to identify some subject areas that had merely received a cursory theoretical or empirical treatment in the dissertations. Some of these less-researched areas are also identified by Skjøtt-Larsen (2000). The following nine topics represent an attempt to summarize these subject areas. These subject areas are not arranged in any particular order:

(1) *Customer demand.* As mentioned previously, the fact that this area was largely ignored is somewhat of a mystery, as customer decisions ultimately drive the direction and configuration of the supply chain. Accordingly, it is also home to most groundbreaking logistical innovations. With product profit margins shrinking, producers have to bolster their earnings through efficiency in logistics; this is where POS data exchange capabilities and optimized replenishment systems, etc., come to the fore.

Also speed has become a more and more tangible factor in competitive advantage. The ability to garner consumer responses rapidly is an invaluable tool for companies hoping to project a customer-oriented profile. Thus, the interrelationships between logistics/SCM and customer relationship management (CRM) need to

be looked at more closely. At present, CRM is more linked to marketing but we believe that it could strengthen the logistics/SCM field as well.

(2) *Strategic sourcing*. Time and again, the literature underscores how important it is that a company differentiates its sourcing tactics. In reference to the discussion in this paper, one might have expected that at least some dissertations would have taken up the challenge of attempting to identify how companies ought to handle the sourcing of their knowledge and competencies.

(3) *Align network (the organizational development of networks)*. Although the discipline of logistics has branched out into supply chain/network perspectives in praxis, we still know little about how such networks should/ought to be managed and how elements inherent in these networks, knowledge and competencies among them, are developed. If, as previously maintained, the locus of competition is shifting from the single company to supply chains/networks, then this field of consideration represents a challenge of great magnitude for researchers to come.

(4) *Leanness and agility*. Do concepts like leanness and agility have anything to contribute to the discipline of logistics? In the last half of the period covered by this survey, these two concepts have received more and more attention in management literature. If truly lean and/or agile supply chains are to be attained, then it is necessary to explore the relationship between these two concepts and the logistics topics listed in Table VIII.

(5) *Environment/sustainability*. The authorities and environmentally aware consumers are making greater and greater demands of corporations' (supply chains') activities; they must be as protective of the environment as possible. In fact, in some product circles, a sound environmental report is the equivalent of a considerable competitive advantage.

(6) *Design for supply chain (the interplay between supply chain and product development)*. Integrating a company's product development processes and its SCM more seamlessly is a sure step toward reducing the time-to-market for its products and logistics costs as well.

The following three topics are all related to information technology. With ever more supply chains becoming "wired" the IT dimension should be expected to get increasing interest from logistics researchers. Also, because many basic logistical activities are automated, it would be interesting to currently see how IT could enrich the emerging focus areas (Figure 1) within the research field.

(7) *E-commerce (B2B, B2C transactions, etc.)*. None of the dissertations considered in this survey has touched on the aspects of the E-commerce wave. Of course, this may be ascribed to the fact that the most recent dissertations in this survey began in the late 1990s, the point at which this topic truly became prominent.

(8) *Information systems/integration enablers (e.g. enterprise resource planning, advanced planning systems)*. One might have expected to come across dissertations considering the integration of electronic information systems and the challenges and opportunities this process represents for corporate systems in general, perhaps with a special focus on the implementation aspect and organizational characteristics, etc.

(9) *Virtual logistics*. Investigations of possibilities and practicalities associated with new logistics and supply chain solutions employing state-of-the-art technologies such as global positioning systems (GPS), geographic information systems (GIS), personal digital assistants (PDA), radio frequency identification (RFID) and Web portals. An important outcome of the technological advance is the rise of provisionary chains working in a "plug, play and unplug" mode to adapt to changing customer requirements.

Of course, one or more of the above subject areas may have been considered by any number of dissertations that we were unable to procure, or by those which we were unable to identify due to the chosen methodology. However, a clear distinction must be made between treating such a topic in a peripheral manner in a dissertation and letting one of these topics function as the main theme of a dissertation. Furthermore, this survey does not account for soon-to-appear PhD dissertations, which might possibly remedy the omissions we have just briefly abstracted.

8. Conclusion

This paper is the first publication that has attempted to provide an overview of the body of recent Nordic PhD dissertations. It is not certain that all the PhD dissertations that have been completed within the specified time frame have been accounted for. As stated, this survey has attempted to provide an introductory picture of the body of dissertations produced under the auspices of Nordic research institutes in a recent ten year period. In general, the dissertations considered were empirically oriented. Although various early dissertations use logistics principles applied to both intra-organizational, dyadic supply chain and network perspectives to underpin their arguments, the past five years have witnessed a trend toward increased interest in supply chains and networks in dissertations. Still, even these dissertations have tended to treat traditional logistics topics, e.g. key focus areas such as the artifact and information levels considered by this study. In short, the research community expects much of the logistics dissertations that are in the pipeline at the present. The authors of this survey have every intention of expanding the knowledge base initiated here through the collection of more data, and we also intend to hone our data analysis methods. Based on this paper, we recommend the following initiatives.

8.1 Nordic dissertation abstract database

We suggest that a Nordic database containing doctoral dissertation abstracts be established, a practice that has already been instituted in the US. This task might appropriately be conducted as a joint development activity within the NOFOMA network. In addition, it represents the perfect opportunity to initiate a partnership with an organization in the European research framework – e.g. the European Logistics Association (ELA) – and/or in the North American research framework – e.g. the Council of Logistics Management (CLM). As Gammelgaard (2001) has also pointed out, the Nordic research groups in this field are diminutive, and such a database would represent a substantial improvement to the knowledge base on which future Nordic PhD candidates have to draw.

8.2 Expanding the time frame

That the time frame in this paper be expanded to include dissertations completed between 1970 and 2001, for example, and that the review process to which these dissertations are subjected be further developed and honed.

8.3 Extended scope

That the scope which informs this survey be broadened to allow for a comparison of the Nordic approach to the European and/or American approach.

8.4 Focus on methods and theories in dissertations

That the fact that the process behind this paper – in which existing PhD dissertations have been classified – has added relevance for current PhD students be recognized. These students could use the same process to achieve a greater focus on the problems and theories they are grappling with in their own dissertations.

8.5 Outlining different research approaches

This study has focused on research approaches applied within Scandinavia. The main research approach is based on qualitative methodologies and builds upon well-established theories such as transaction-cost theory, resource-based theory and contingency theory. It could be interesting to expand the scope of this research to cover US dissertations, as well as dissertations from other parts of Europe, Asia and Australia. Such comprehensive research could focus on different research traditions and perceptions on the content, context and processes of researching logistics and SCM.

Finally, if one assumes that it takes an average of 3.5 years to complete a PhD program, then the 71 dissertations considered by this review represent a workload of not less than 248.5 years! This enormous effort dedicated to forwarding the study and understanding of logistics and SCM should, if nothing else, elicit our respect.

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Appendix 1
(See Table AI.)

Denmark
Copenhagen Business School
Aalborg University
University of Southern Denmark
Roskilde University
Aarhus School of Business
Danish Technical University
Institute for Transport Studies

Finland
Helsinki University of Technology
Helsinki School of Economics and Business Administration
Lappeenranta University of Technology
Turku School of Economics and Business Administration
Tampere University of Technology
VTT – Technical Research Center of Finland
University of Oulu
Swedish School of Economics and Business Administration

Norway
Norwegian School of Management BI
SINTEF Industrial Management
Institute of Transport Economics
Western Norway Research Institute
Norwegian Institute of Fisheries and Aquaculture
Norwegian School of Economics and Business Administration
Norwegian University of Science and Technology

Sweden
Chalmers University of Technology
Linköpings University
Lund University
Swedish National Road and Transport Research Institute
Transport Research Institute
Gothenburg University
Växjö University
Örebro University

Table AI.
Research environments contacted by e-mail

Appendix 2

Danish dissertations

Aalborg University

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Aarhus School of Business

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Seristö, H. (1995), *Airline Performance and Costs – An Analysis of Performance Measurement and Cost Reduction in Major Airlines.*

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University of Oulu

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Svensson, G. (2001), *Sårbarhet i logisticskanaler – En studie av svensk fordonsindustri* (submitted/defended at the Gothenburg University School of Business).