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Doctoral dissertations in logistics and supply chain-related areas: 2005–2009

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Abstract The purpose of this article is to examine the output of logistics and supply chain-related dissertation research during the period, 2005–2009, and compare that output with earlier published dissertations from 1970 to 2004. Doctoral students and faculty members can identify emerging areas of research based on the year-by-year trends in topical coverage. Qualitative research analysis of 609 doctoral dissertations published by *Dissertation Abstracts International* over a 5-year period (2005–2009) was performed. Results suggest that future prospects for additional dissertations being published in logistics and supply chain-related areas are excellent. Many dissertations are emanated from colleges of engineering and business. The prominent research methodologies employed by doctoral students are modeling, simulation, and empirical quantitative methods. More colleges/universities are graduating doctoral students in these areas. Some shift is occurring with respect to the specific colleges/universities that are leading the way in terms of generating the largest number of logistics and supply chain graduates.

Keywords *Dissertation Abstracts International* · Doctoral research · Supply chain management · Logistics

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1 Introduction

The concept of supply chain management (SCM) was formerly introduced in a *Financial Times* article in 1982 [4]. Since then, SCM has become a primary focus of organizations of all types and has influenced the development of numerous university SCM programs worldwide (US News and World Report [13]). The field, which includes a variety of interconnected disciplines—logistics, marketing, manufacturing, finance, sales and others—has spawned considerable interest among academic researchers who have published and developed courses in the area. Similarly, larger numbers of doctoral students graduating in recent years have completed their dissertations in SCM and in related areas.

Since 1987, several authors have examined the publication of academic dissertations dealing with SCM-related topics. Stock [6, 7] originally examined logistics-related dissertations utilizing a manual search of *Dissertation Abstracts International*. He was able to identify 684 dissertations that had been published during the period, 1970–1986. Stock and other co-authors published periodic updates that included new dissertations at approximately five-year intervals.

Additionally, authors located outside of North America published similar overviews of dissertations from universities in other parts of the world. Gubi et al. [3] examined SCM-related doctoral dissertations in the Nordic countries and identified 75 dissertations published between 1990 and 2001 covering eight topic groups (e.g., system design/

structure/effectiveness, distribution/route planning, organizational development/competencies, system integration/integration enablers, environmental issues, inter-organizational collaboration/supplier collaboration/third-party logistics, material handling, and transport/transport systems). They specifically examined 71 of the 75 dissertations.

Vafidis [14] examined logistics issues utilizing doctoral dissertations published in Finland and Sweden between 1994 and 2003. He specifically reviewed 54 Finnish and Swedish university dissertations to determine the methodologies employed. Thus, he was not examining topical coverage of the dissertations, but nonetheless provided a compendium of dissertations created over an extended period. More recently, Zachariassen and Arlbjørn [15] identified Nordic doctoral dissertations in logistics and SCM published from 2002 to 2008. They reviewed 70 dissertations completed at 30 universities in Denmark, Finland, Norway, and Sweden and classified them by topic group using the same eight categories as Gubi et al. [3].

In this article that overviews academic dissertations published, the previous work of Stock [6–8], Stock and Luhrsen [12], and Stock and Broadus [11] is extended. During a comparable period of 5 years (2005–2009), a total of 609 dissertations were identified that dealt with logistics or SCM-related areas. While all of the dissertations referenced in this article can be individually accessed online, there exists no single source where doctoral students, faculty researchers, and practitioners can go to view all of the logistics and SCM-related dissertations. The search process can be extremely tedious and time-consuming. Thus, this compendium of dissertations offers readers the benefit of going to a single source for this information.

Additionally, the supply chain-related dissertations published in this five-year period can be examined utilizing the categories presented by Stock and Boyer [9], where the authors identified areas of potential research that could be examined by researchers in supply chain management. Also, using the structure presented by Sachan and Datta [5], the various methods utilized for data analyses in the dissertations can be examined.

Thus, the research questions addressed in this article include the following:

- Are there any trends evident in dissertation topics published from 2005 to 2009 when compared to earlier compendiums from 1970 to 2004?
- What are the most common dissertation topics examined by students in the latest compendium of doctoral dissertations?
- With the increasing interest in supply chain management (SCM) by researchers, what are the specific topics examined and methodologies utilized in SCM dissertations?
- Are the traditional universities who have historically produced the majority of logistics and SCM-related dissertations still doing so, or have other universities become significant?
- From which colleges/schools are most logistics and SCM-related dissertations published?
- What opportunities exist for future doctoral students regarding the topics their dissertation research?

This article will provide an overview of the topics examined in a large number of logistics and SCM-related dissertations. In so doing, areas of research will be highlighted and trends examined with respect to what types of research appear to be expanding in scope and frequency, and what areas remain static, or perhaps even declining, in terms of exploration by doctoral students. The types of colleges/schools where logistics and SCM-related dissertation emanate will also be examined. Future doctoral students can benefit from examining the emerging areas of logistics and supply chain-related research and the research methods used in these dissertations. Faculty researchers can benefit from identifying potential topics for article-length research studies. Practitioners can benefit from overviewing the managerial implications of the various dissertations that are usually presented near the end of the dissertation, in the conclusions section.

2 Limitations

The dissertations examined in this research study often examined more than one topic or subject. While the use of multiple raters was able to agree on the primary subject area for classifying dissertations where multiple topics were covered, there is still the possibility that errors could have been made. Additionally, only abstracts were reviewed for each dissertation inasmuch as *Dissertation Abstracts International* (*DAI*) only includes abstracts. If keywords were not included in the abstracts, some logistics and SCM-related dissertations could have been missed. Likely, such omissions are small since the authors of the dissertations wrote the abstracts, and it can be assumed that they would have included the most significant aspects of their research in their summaries.

Some dissertations may not be included in *Dissertation Abstracts International*. Authors of the dissertations or their institutions are responsible for submitting them. If they were remiss in doing so, the dissertations would not be included and thus would not have been found in a search of the database.

Dissertation Abstracts International (DAI) contains many more North American (USA and Canada) dissertations than those published in Europe, Asia, and elsewhere. While more dissertations are published in North America than elsewhere, generalizing the findings of this research internationally is not possible (although more international dissertations are included in this compendium than in any of the previously published compendiums). Discussion of the geographic areas where the dissertations were generated will be examined later in this article.

Finally, because of the time lag between submission and publication of the abstracts in the database, some dissertations may not have appeared during the time period being investigated. The researchers did look beyond 2009 for the inclusion of some "late" dissertations that were completed during 2009, but did not appear until 2010. However, only 3 months of 2010 were examined and if any dissertation abstracts appeared later, they would not have been included in this present analysis. Because some dissertations have appeared as late as 1 year or more after they were actually completed, some dissertations were no doubt missed.

3 Methodology

Following the methodology most recently utilized by Stock and Broadus [11] and by earlier compendiums on logistics dissertation research by Stock [7, 8], and Stock and Luhrsen [12], published dissertations in *DAI* were examined for the five-year period 2005–2009. Key terms and subject areas were identified based on Stock and Broadus [11] and existing definitions of logistics and supply chain management. The more commonly cited definitions of logistics and SCM are identified in the next section. Content analysis was utilized when examining the dissertation abstracts based on the key terms.

3.1 Defining logistics and supply chain management

While logistics management is a part of SCM, because earlier compendiums specifically examined that topic, key search terms and subjects had to necessarily include logistics components if comparisons were to be made with previously published studies. SCM had previously been included in earlier articles reporting on doctoral dissertations only in more recent compendiums. Thus, the keywords utilized in this article were taken from definitions of logistics and SCM offered by the Council of Supply Chain Management Professionals (CSCMP) and other sources.

The most widely accepted definition of logistics management has been offered by CSCMP [1]:

> Logistics management is that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers' requirements.

CSCMP [1] also provides a brief description of the boundaries of logistics management:

> Logistics management activities typically include inbound and outbound transportation management, fleet management, warehousing, materials handling, order fulfillment, logistics network design, inventory management, supply/demand planning, and management of third party logistics services providers. To varying degrees, the logistics function also includes sourcing and procurement, production planning and scheduling, packaging and assembly, and customer service. It is involved in all levels of planning and execution–strategic, operational and tactical. Logistics management is an integrating function, which coordinates and optimizes all logistics activities, as well as integrates logistics activities with other functions including marketing, sales manufacturing, finance, and information technology.

Definitions of SCM have been offered by CSCMP and other researchers. Stock and Boyer [9] analyzed more than 180 definitions of supply chain management to develop a consensus definition of the concept and defined the term as follows:

The management of a network of relationships within a firm and between interdependent organizations and business units consisting of material suppliers, purchasing, production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to final customer with the benefits of adding value, maximizing profitability through efficiencies, and achieving customer satisfaction. [p. 706]

The Council of Supply Chain Management Professionals [1] defined SCM as follows:

The planning and management of all activities involved in sourcing and procurement, conversion, and all Logistics Management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, Supply Chain Management integrates supply and demand management within and across companies.

CSCMP [1] also provided a brief description of the boundaries of SCM:

Supply Chain Management is an integrating function with primary responsibility for linking major business functions and business processes within and across companies into a cohesive and high-performing business model. It includes all of the Logistics Management activities noted above, as well as manufacturing operations, and it drives coordination of processes and activities with and across marketing, sales, product design, finance, and information technology.

3.2 Keyword search

Keywords and subject headings from Stock and Broadus [11] were used to search for relevant dissertations on logistics and supply chain-related topics. Additionally, because of the explosion of research in supply chain management and other topics not previously examined, the CSCMP [1] definition of logistics management, and the CSCMP [1] and Stock and Boyer [9] definitions of SCM were employed to identify additional keywords. Recent academic and practitioner journals were also reviewed for topics that might not have appeared in the Council of Supply Chain Management Professionals [1] or the Stock and Boyer [9] definitions. Such words included sourcing, sustainability, green marketing, and others.

3.3 Classification of dissertations

As was the case in earlier published studies of logistics and supply chain dissertations, classification of the dissertations into topic areas was challenging. Often, dissertations dealt with multiple issues. For example, a dissertation could examine inventory management within a general or specific industry supply chain. Outsourcing could be examined as part of logistics, supply chain management, transportation, warehousing, and/or international logistics. Environmental issues could be a separate area of exploration or part of outsourcing, supply chain management, logistics, procurement, or any number of other topic areas.

Three researchers independently examined the dissertations that were extracted from *Dissertation Abstracts International*. Inter-rater reliability was obtained as each researcher developed a subject area code for each dissertation. Discrepancies were resolved by examining those dissertations that had multiple classifications through the development of consensus among the researchers.

Table 1 provides the summary of the 25 subject areas that were developed from the keyword search process. The categories from Stock and Broadus [11] were retained, and one additional category was added: outsourcing/3PL. Category 25 had earlier been incorporated into Code 1: General Logistics, in the Stock and Broadus [11] study, but there were a sufficient number of dissertations on this topic to deserve a category of its own. The retention of 24 of the same categories from the earlier study allows some comparisons to be made longitudinally. Finally, Category 22 (supply chain management) consists of 8 sub-categories. In earlier studies, the area of supply chain management included fewer dissertations than in the present time period, 2005–2009. A qualitative assessment of the SCM category resulted in the identification of eight sub-categories (see Table 1).

Appendix 1 (available as an electronic attachment) shows the detailed information on the doctoral dissertations in terms of (1) subject code/area, (2) author's name, (3) dissertation title, (4) university/institution, (5) year of publication, (6) dissertation identification number, and (7) abstract as written by the author. The Appendix includes an abbreviated version of the full abstract as published in *Dissertation Abstracts International (DAI)*.

4 Analysis and findings

Compared with earlier studies of logistics and supply chain-related dissertation, the present study identified a significantly larger number of dissertations, both in absolute terms overall and in the average number published per year. Most of the increase is likely due to the greater number of dissertations on SCM-related topics. Part of the increase may also be due to the inclusion of more universities outside of North America that were reported in the most recent editions of *Dissertation Abstracts International*. A final potential reason for the higher number of dissertations may be due to the forthcoming retirement of academic "baby boomers." With many academicians expected to retire during the period 2005–2020, the market for new Assistant Professors is likely to be strong, in terms of both available positions and higher starting salaries. That fact would tend to positively influence the number of students entering doctoral programs to replace those who were retiring.

4.1 Observations regarding the data

Supply chain management (Category 22) was the most researched topic during 2005–2009 (see Table 2). Approximately 30 percent of the dissertations included in the 2005–2009 time period dealt with some aspect of supply chain management (Category 22). With the exponential growth in the area over the past decade, this result was not surprising. Breaking down the general topic of supply chain management into sub-categories resulted in the identification of eight groups. While many supply chain-related dissertations examined multiple topics, many specifically took a modeling approach ($N = 33$), while

Table 1 Dissertations classified by code/subject area (2005–2009)

Code	Subject area
1	General logistics (e.g., coordination, cost trade-offs, cost-service trade-offs, E-business, logistics as a part of marketing mix, marketing/logistics interface, measuring the value of logistics, and strategy)
2	Channel of distribution (e.g., buyer–seller relationships, channel relationships, relationship marketing, and vertical marketing systems)
3	Customer service/satisfaction
4	Motor transportation
5	Rail transportation
6	Water transportation (e.g., mode/carrier and port management)
7	Air transportation
8	Pipeline transportation
9	Miscellaneous transportation (e.g., brokers, consolidation, freight forwarders, hazardous materials, intermodalism, leasing, mode/carrier selection, regulation/deregulation, routing and scheduling, traffic management, transportation models and modeling, transportation networks, and transportation policy)
10	Warehousing and storage (e.g., AS/RS, materials handling equipment and processes, warehouse layout and design)
11	Inventory
12	Purchasing, procurement, and materials management (e.g., inbound logistics and supplier management)
13	Order processing and information systems
14	Decision support systems (e.g., artificial intelligence, computers in SCM or logistics, electronic data interchange, expert systems, forecasting, modeling logistics systems and supply chains, simulation, and technology)
15	Human resources and organizational issues (e.g., general management of logistics organizations, personnel development, personnel management issues in organizations, strategic partnerships, and alliances)
16	International logistics (e.g., containerization, exporting, foreign market entry strategies, logistics in non-US countries)
17	Packaging
18	Location analysis
19	DRP, ERP, JIT, Kanban, and MRP
20	Total quality management
21	Engineering logistics (e.g., government contracting, integrated logistics support, life-cycle assessment and costing, maintenance, and military logistics)
22	Supply chain management
	22.1 Modeling of the supply chain
	22.2 Specific processes/components of the supply chain
	22.3 Measurement issues (metrics, performance measures, KPIs), cost and service measures
	22.4 SCM decision making, strategy, and managing the supply chain (including collaboration and coordination)
	22.5 Supply chains and the environment (uncertainty, risk, environmental issues, regulations)
	22.6 Supply chain technologies (including information systems)
	22.7 Global & Non-US supply chains
	22.8 Miscellaneous topics (including multiple topics)
23	Reverse logistics/environment (e.g., product returns, recycling, refurbishing, remanufacturing, and reuse)
24	Miscellaneous topics (e.g., SCM or logistics education, public policy issues, and all other not otherwise classified)
25	Outsourcing/3PL

others examined specific processes or components of the supply chain ($N = 29$) or aspects of supply chain decision making ($N = 29$) (see Table 3).

An examination of keywords contained in the dissertation abstracts examined provided further evidence that the topics of decision support systems (Code 14), inventory management (Code 11), reverse logistics/environment (Code 23), and transportation (Codes 4-9) were widely cited. As shown in Table 3, these categories were researched in at least eight percent or more of dissertations published during the 2005–2009 period. When a frequency count of the keywords used in the classification of dissertations was made, these categories tended to have more mentions. Table 4 identifies the "top 10" keywords. The total does not add up to 609 inasmuch as multiple keywords were included in many dissertations, and thus, the classification of an individual dissertation might be made into any of several different categories.

Decision support systems (Code 14) continue to be researched at a reasonable level, with 12 percent of the

Table 2 Dissertations ranked by code/subject area (2005–2009)

Rank	Code/subject area	Count	(%)
1	Code 22: Supply chain management	184	30.2
2	Code 14: Decision support systems	72	11.8
3	Code 11: Inventory	49	8.0
	Code 23: Reverse logistics/environment	49	8.0
5	Code 9: Miscellaneous transportation	47	7.7
6	Code 4: Motor transportation	23	3.8
7	Code 12: Purchasing, procurement, and materials management	22	3.6
8	Code 16: International logistics	19	3.1
9	Code 24: Miscellaneous topic	18	3.0
10	Code 7: Air transportation	13	2.1
11	Code 6: Water transportation	12	2.0
	Code 25: Outsourcing/3PL	12	2.0
13	Code 10: Warehousing and storage	11	1.8
	Code 21: Engineering logistics	11	1.8
15	Code 5: Rail transportation	10	1.7
	Code 17: Packaging	10	1.7
17	Code 15: Human resources and organizational issues	8	1.3
18	Code 2: Channel of distribution	7	1.1
	Code 20: Total quality management	7	1.1
20	Code 1: General logistics	6	1.0
	Code 3: Customer service/satisfaction	6	1.0
22	Code 18: Location analysis	5	0.8
23	Code 8: Pipeline transportation	4	0.8
24	Code 13: Order processing and information systems	2	0.3
	Code 19: DRP, ERP, JIT, Kanban, and MRP	2	0.3
	Total	609	100.0

Table 3 Sub-categories for supply chain management (Category 22)

Code	Category	Count
22.1	Modeling of the supply chain	33
22.2	Specific processes/components of the supply chain	29
22.3	Measurement issues (metrics, performance measures, KPIs), cost and service measures	18
22.4	SCM decision making, strategy, and managing supply chain (including collaboration and coordination)	29
22.5	Supply chains and the environment (uncertainty, risk, environmental issues, regulations)	16
22.6	Supply chain technologies (including information systems)	7
22.7	Global & Non-US supply chains	12
22.8	Miscellaneous topics (including multiple topics)	40
	Total	184

Table 4 Topics included in logistics and supply chain-related dissertations (2005–2009)

Rank	Keyword	Count
1	Inventory	510
2	Environment	237
3	Strategy	162
4	Supply chain management	124
5	Procurement	103
6	Outsourcing	102
7	Reverse logistics	60
8	Satisfaction	41
9	Purchasing	34
10	Storage	32

dissertations during this present time period dealing with EDI, forecasting, modeling or simulation, and the use of computers in logistics and SCM. Many aspects of transportation, especially motor transportation (Code 4), exhibited increases over earlier time periods. Inventory management (Code 11) continued to be a subject of interest in doctoral dissertations with eight percent of all dissertations being related to various inventory-related topics. Showing a significant increase over previous time periods was reverse logistics/environment (Code 23), which was the subject of eight percent of all dissertations.

Customer service (Code 3), pipeline transportation (Code 8), order processing and information systems (Code 13), location analysis (Code 18), and DRP, ERP, JIT, Kanban, and MRP (Code 19) were the least researched topics in published dissertations, all being one percent or lower of the total number of dissertations published (see Table 2). Each of these topic areas has not been highly researched in any earlier time period, but a few dissertations have appeared on a regular basis. In some cases, topics such as customer service have expanded into a broader concept—customer satisfaction.

Within supply chain management, transportation, warehousing, general logistics, and many other areas, many dissertations include consideration of customer satisfaction, which contains the notion of customer service, albeit it is not the primary focus. Hence, this topic is not the primary focus of investigation, rather it is just one element or component of a much broader subject area. Likewise, order processing and information systems (Code 13) and location analysis (Code 18) are more likely to be part of a supply chain-related dissertation rather than the specific foci of dissertations on those topics.

While traditionally strong universities in the logistics and supply chain areas such as MIT, Penn State, and Michigan State have maintained or slightly increased their output of dissertations during the current five-year period (2005–2009), the Georgia Institute of Technology has significantly increased its output and is now the top-producing university of logistics and supply chain-related

Table 5 Dissertations rank by institution (2005–2009)

Rank	Institution	Count
1	Georgia Institute of Technology	27
2	Purdue University	15
	The Pennsylvania State University	15
	University of Michigan	15
5	Massachusetts Institute of Technology	14
	Northwestern	14
	University of Maryland, College Park	14
8	Texas A&M University	12
9	Arizona State University	11
10	Hong Kong University of Science and Technology (Hong Kong)	11
	University of Massachusetts at Amherst	11
12	Michigan State University	10
	Stanford University, California	10
14	University of Florida	9
	University of Illinois at Urbana-Champaign	9
16	Capella University, Minnesota	8
	Rutgers The State University of New Jersey, Newark	8
	State University of New York at Buffalo	8
	The Ohio State University	8
	The University of Texas at Austin	8
	University of Minnesota	8
22	Carnegie Mellon University	7
	Ecole Polytechnique, Montreal (Canada)	7
	Rensselaer Polytechnic Institute, New York	7
	The University of Oklahoma	7
	The University of Texas at Arlington	7
	University of California, Berkeley	7
28	Case Western Reserve University, Ohio	6
	Hong Kong Polytechnic University (Hong Kong)	6
	Iowa State University	6
	Lehigh University, Pennsylvania	6
	The University of Texas at Dallas	6
	University of Arkansas	6
	University of California, Irvine	6
	University of Hong Kong (Hong Kong)	6
36	Cornell University	5
	Oklahoma State University	5
	The Chinese University of Hong Kong (Hong Kong)	5
	The George Washington University, District of Columbia	5
	The University of Wisconsin, Milwaukee	5
	University of Illinois at Chicago	5
	University of Pennsylvania	5
	University of Phoenix, Arizona	5
	University of Tennessee	5

dissertations (see Table 5). In the previous compendium of dissertations completed by Stock and Broadus [11], the Georgia Institute of Technology and MIT were identified as having produced the largest number of logistics and supply chain-related dissertations. In the present 2005–2009 period, the Georgia Institute of Technology produced the largest number of dissertations (27) by a wide margin over other universities. The significant gap between them and other institutions was not due to those other universities necessarily producing fewer dissertations, although some did, but primarily was due to the large increase in total dissertations completed at Georgia Tech during the period (27 vs. 15 in 1999–2004).

Traditionally, strong universities such as Arizona State, Maryland, Michigan State, MIT, Northwestern, Ohio State, Penn State, Purdue, and Stanford increased or remained fairly stable in their output of dissertations, but did not show the sizable increase experienced by Georgia Tech. Conversely, universities such as Michigan, Southern California, and Tennessee exhibited declines over the previous 5-year period. It will be interesting to see if, in future years, these gains and losses continue so as to create a trend, or whether they were merely aberrations occurring during the latest period of study. Some of the changes could be due to faculty moving from one academic institution to another or the death or retirement of some senior logistics and SCM faculty.

Continuing a trend illustrated in the earlier compendiums of published dissertations, many "newer players" have emerged in doctoral education as evidenced by their inclusion in colleges/universities that have graduated students with logistics and supply chain-related dissertations. As shown in Table 5, a total of 44 colleges/universities reported students graduating that had published in the areas of logistics and SCM. This compares to a total of 21 colleges/universities earlier reported by Stock and Broadus [11]. With the increasing developments in the area of SCM, many additional topic areas are now being examined. Universities that did not have logistics programs in the past are offering degrees in areas outside of traditional logistics, but within the broader area of SCM. Hence, the inclusion of a more diverse set of topics has resulted in more than doubling the number of colleges/universities granting doctoral dissertations in these areas. Additionally, the expansion of the number of universities submitting their dissertations to *DAI* has had an influence on the increase.

While the United States continues to dominate in the publication of logistics and supply chain-related dissertations, more universities located internationally are now producing graduates in these areas. In recent years, *Dissertation Abstracts International* has included more non-

Table 6 Dissertations classified by country (2005–2009)

Rank	Country	Count	(%)
1	United States	516	84.7
2	Canada	35	5.7
3	Hong Kong	29	4.8
4	Sweden	6	1.0
	France and Singapore	6	1.0
6	The Netherlands	4	0.7
	UK	4	0.7
8	Finland	3	0.5
9	Belgium	2	0.3
	South Africa	2	0.3
11	Japan	1	0.1
	Poland	1	0.1
		609	100.0

North America (United States and Canada) = 90.5 %; Europe (Sweden, the Netherlands, Finland, France, France and Singapore, United Kingdom, Belgium, and Poland) = 4.3 %; Asia (Hong Kong and Japan) = 5 %; South Africa = 0.3 %

North American dissertations than previously. Thus, this compendium from 2005 to 2009 includes many more universities from Europe and Asia. As shown in Table 6, dissertations were published by universities in Belgium, China, Finland, France, Hong Kong, Japan, the Netherlands, Poland, Singapore, South Africa, Sweden, and the United Kingdom. Compared with the 1999–2004 period reported by Stock and Broadus [11] which included mention of no colleges/universities outside of the USA that produced five or more dissertations, the present period, 2005–2009, included five non-USA institutions that produced five or more dissertations (see Table 5)—Hong Kong University of Science and Technology, Ecole Polytechnique Montreal, Hong Kong Polytechnic University, University of Hong Kong, and The Chinese University of Hong Kong. The Scandinavian colleges/universities, primarily in Sweden, the Netherlands, and Finland, continue to produce a stable number of dissertations, supporting the results reported by Gubi et al. [3] and Zachariassen and Arlbjørn [15].

Notable is the fact that four of the five are Chinese universities. Universities in several other countries also produced varying numbers of logistics and supply chain-related dissertations, although fewer than five per university (see Tables 5, 6). Those countries included Canada, Sweden, the Netherlands, Finland, France, Singapore, South Africa, UK, Belgium, France, Japan, and Poland.

4.2 Trends in dissertation research since 1970

While the overall number of logistics and supply chain-related dissertations published has increased over previously reported periods (1970–1986, 1987–1991, 1992–1998, and 1999–2004), the growth appears to have plateaued in 2008 and 2009 (see Fig. 1 and Tables 7, 8). Of significance, since the initial reporting period (1970–1986) when the absolute number of dissertations published was 687 over a 17-year period, 609 dissertations were published during the latest 5-year period (2005–2009). Based on the yearly average of published dissertations during the two time periods, there has been a threefold increase. This may be due to more students entering doctoral programs and/or perhaps the inclusion of additional universities in the *Dissertation Abstracts International* database. However, it is more likely that the increase was due to the broadening of the scope of SCM to include many non-logistics topics which would result in additional dissertations being included. Of course, during the initial time period (1970–1986), supply chain-related dissertations would have been non-existent.

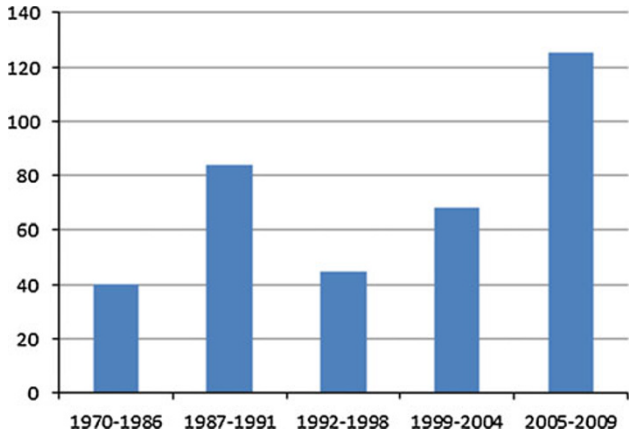

Fig. 1 Average output per year of logistics and supply chain-related dissertations (1970–2009)

Table 7 Absolute number of dissertations per year (2005–2009)

2005	2006	2007	2008	2009	Total
65 (10.7 %)	113 (18.5 %)	162 (26.6 %)	137 (22.5 %)	132 (21.7 %)	609 (100.0 %)

The plateauing of in the absolute number of dissertations published in 2008–2009 may be due to the fact that some colleges/universities offering doctoral programs in these areas have reached saturation with respect to the number of students these programs wish to admit each year given faculty and budget constraints. Certainly, doctoral programs are faculty intensive, that is, they require a great deal of faculty time for a very small number of students. With many colleges/universities having difficulty hiring new faculty due to budgetary constraints, many programs have likely "maxed out." It is unlikely that the number of students at the undergraduate and graduate levels is declining or stagnant given the very positive long-term placement prospects for students graduating from logistics and supply chain-related programs [2].

Table 8 Dissertations classified by code/subject area (1970–2009)

Code/subject area	1970–1986	1987–1991	1992–1998	1999–2004	2005–2009
Code 1: General logistics	13	18	31	20	6
	(1.9 %)	(4.3 %)	(9.8 %)	(4.9 %)	(1.0 %)
Code 2: Channel of distribution	68	38	26	20	7
	(9.9 %)	(9.0 %)	(8.2 %)	(4.9 %)	(1.1 %)
Code 3: Customer service/satisfaction	18	11	11	3	6
	(2.1 %)	(2.6 %)	(3.5 %)	(0.7 %)	(1.0 %)
Code 4: Motor transportation	47	18	10	2	23
	(6.9 %)	(4.3 %)	(3.2 %)	(0.5 %)	(3.8 %)
Code 5: Rail transportation	46	7	11	5	10
	(6.7 %)	(1.7 %)	(3.5 %)	(1.2 %)	(1.7 %)
Code 6: Water transportation	23	16	7	6	12
	(3.4 %)	(3.8 %)	(2.2 %)	(1.5 %)	(2.0 %)
Code 7: Air transportation	46	11	1	7	13
	(6.3 %)	(2.6 %)	(0.3 %)	(1.0 %)	(2.1 %)
Code 8: Pipeline transportation	7	1	0	1	4
	(1.0 %)	(0.2 %)	(0.0 %)	(0.2 %)	(0.8 %)
Code 9: Miscellaneous transportation	72	55	43	43	47
	(10.5 %)	(13.0 %)	(13.6 %)	(10.5 %)	(7.7 %)
Code 10: Warehousing and storage	24	24	6	4	11
	(3.5 %)	(5.7 %)	(1.9 %)	(1.0 %)	(1.8 %)
Code 11: Inventory	79	48	15	38	49
	(11.5 %)	(11.4 %)	(4.7 %)	(9.3 %)	(8.0 %)
Code 12: Purchasing, procurement, and material management	39	24	19	23	22
	(5.7 %)	(5.7 %)	(6.0 %)	(5.6 %)	(3.6 %)
Code 13: Order processing and information systems	10	3	5	7	2
	(1.5 %)	(0.7 %	(1.6 %	(1.7 %)	(0.3 %)
Code 14: Decision support systems	75	29	31	87	72
	(11.0 %)	(6.9 %)	(9.8 %)	(21.2 %)	(11.8 %)
Code 15: Human resources and organizational issues	2	3	16	6	8
	(0.3 %)	(0.7 %)	(1.6 %)	(1.5 %)	(1.3 %)
Code 16: International logistics	37	29	28	29	19
	(5.4 %)	(6.9 %)	(8.8 %)	(7.1 %)	(3.1 %)
Code 17: Packaging	5	2	1	4	10
	(0.7 %)	(0.5 %)	(0.3 %)	(1.0 %)	(1.7 %)
Code 18: Location analysis	38	20	4	6	5
	(5.6 %)	(4.7 %)	(1.3 %)	(1.5 %)	(0.8 %)
Code 19: DRP, ERP, JIT, Kanban, and MRP	25	32	15	11	2
	(3.7 %)	(7.6 %)	(4.7 %)	(2.7 %)	(0.3 %)
Code 20: Total quality management	0	5	2	5	7
	(0.0 %)	(1.2 %)	(0.6 %)	(1.2 %)	(1.1 %)
Code 21: Engineering logistics	0	18	7	7	11
	(0.0 %)	(4.3 %)	(2.2 %)	(1.7 %)	(1.8 %)
Code 22: Supply chain management	0	0	14	57	184
	(0.0 %)	(0.0 %)	(4.4 %)	(13.9 %)	(30.2 %)
Code 23: Reverse logistics/environment	3	9	6	13	49
	(0.4 %)	(2.1 %)	(1.9 %)	(3.2 %)	(8.0 %)
Code 24: Miscellaneous topic	10	1	8	6	18
	(1.5 %)	(0.2 %)	(2.5 %)	(1.5 %)	(3.0 %)
Code 25: Outsourcing/3PL	N/A	N/A	N/A	N/A	12
					(2.0 %)
Average per year	40	84	45	68	122

If Code 25, which originally was included in General logistics in the Stock and Broadus [11] study, were included, the N in Code 1: General logistics for 2005–2009 would have been 20 (equal to the number appearing in 1999–2004)

Table 9 College/School type

Type	Count	(%)
Type 1: Business, Management, Managerial Science, Industrial Administration	200	32.9
Type 2: Engineering, Computer Science, Information Systems, Transportation, Operations, Technology, Aerospace Material, Logistics and Maritime Studies	319	52.4
Type 3: Economics	33	5.4
Type 4: Others (e.g., Health Administration, Geography, Nursing, Public Administration, Agriculture, Arts and Sciences, Systems and Enterprises, Education, Urban Studies and Planning, Sociology, Global Affairs, Communication, Education, Animal Science, Design and Human Development, Environmental Studies, History, Humanities, Forestry, and Health Care)	57	9.3
Total	609	100.0

The majority of logistics and SCM-related dissertations have been produced by engineering and business doctoral students (see Table 9). Over one-half of the dissertations came out of engineering and the more technical types of colleges/schools (e.g., computer science, information systems), which is probably one of the causative factors for the large use of modeling/simulation. In business colleges/schools, the use of empirical quantitative methods in logistics and SCM-related research dominates, as is the case for other functional areas of business such as accounting, finance, management, and marketing.

There appears to be growing interest in logistics and SCM-related topics by other disciplines, such as health administration, geography, nursing, public administration, agriculture, and arts and sciences. However, with only one observation period (2005–2009), it is not possible to conclude that this is a trend taking place, although intuitively, it would be consistent with the spread of SCM concepts and principles across many disparate disciplines.

The dominant methodological approach taken for investigating logistics and SCM-related topics is modeling and simulation. An examination of the dissertation abstracts to determine the research methodology utilized by the doctoral student was undertaken. Similar to the approach employed by Sachan and Datta [5] to evaluate published articles in various logistics journals, each dissertation abstract was reviewed in order to ascertain the specific methodological approach used by the author. Four general methodologies were identified. Often, the author identified the research methodology used in their dissertation abstract. If that was not the case, a qualitative assessment was made by the study researchers based on the discussion of the methods employed. The results of this analysis are presented in Table 10.

Table 10 Research methodology

Type	Count	(%)
Methodology 1: Quantitative Modeling and Simulations	390	64.0
Methodology 2: Quantitative Empirical (e.g., SEM, Regression, Logistic Regressions, ANOVA, and MANOVA)	130	21.3
Methodology 3: Qualitative (e.g., case study, content analysis, interview, and focus group)	40	6.7
Methodology 4: Mixed Methodologies	49	8.0
Total	609	100.0

Almost two-thirds of all SCM-related research employed modeling and/or simulation. Slightly over 20 percent of the dissertations reported using empirical quantitative methods such as structural equation modeling, regression, and ANOVA. Relatively few dissertations employed qualitative methods. This result was a bit surprising given the rise in recent years of journal articles being published that have used various qualitative research methods. However, given the larger number of dissertations published by doctoral students in engineering and related fields during the 2005–2009 period, this may explain some of this result. Dissertations in engineering and related fields would rarely employ qualitative methods in their research.

Performing a simple chi-square test utilizing business (Type 1) and engineering (Type 2) colleges and schools cross-tabulated with the two methodologies of quantitative modeling and simulation (M1) and empirical quantitative methods (M2) resulted in a statistically significant difference (see Table 12). While the cell sizes were too small to statistically examine the use of qualitative methods in various colleges and schools, there did seem to be a tendency for non-engineering and non-business programs to employ such methods to a larger degree (see Table 11).

Tables 12 and 13 show that there is a significant association between the school type (College/School Type 1 vs. Type 2) and the methodology each type of school employ (Methodology 1 vs. Methodology 2) chi square $(1) = 83.16$, $p < .001$. It seems that the majority of both school types employ Methodology 1. However, more than 90 % of College/School Type 1 employ Methodology 1, while a large portion of College/School Type 2 also employ Methodology 2.

5 Summary and conclusions

In their concluding remarks in the 2006 compendium of logistics and supply chain-related dissertations, Stock and Broadus stated that "the health of doctoral programs remains generally good" (p. 149). That observation would still be valid today based on the five-year period of

Table 11 College/School type by research methodology

College/School Type	Methodology 1	Methodology 2	Methodology 3	Methodology 4	Total
Type 1	97 (48.5 %)	76 (38.0 %)	11 (5.5 %)	16 (8.0 %)	200
Type 2	271 (85.0 %)	24 (7.5 %)	5 (1.5 %)	19 (6.0 %)	319
Type 3	9 (27.3 %)	19 (57.6 %)	1 (3.0 %)	4 (12.1 %)	33
Type 4	13 (22.8 %)	11 (19.3 %)	23 (40.4 %)	10 (17.5 %)	57

Table 12 College/School type (1 and 2) × Methodology (1 and 2) Cross-tabulation

College/School type	Methodology 1	Methodology 2	Total
Type 1	97 (56.1 %)	76 (43.9 %)	173
Type 2	271 (91.9 %)	24 (8.1 %)	295

Table 13 Chi-square results

	Value	*df*	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson chi square	83.160	1	0.000		
Continuity correction	81.043	1	0.000		
Likelihood ratio	81.889	1	0.000		
Fisher's exact test				0.000	0.000
Linear-by-linear association	82.982	1	0.000		
No. of valid cases	468				

2005–2009. Given the larger absolute number of published dissertations, a larger per year average of published dissertations, and an increase in the number of universities worldwide graduating students in logistics and supply chain-related areas, the future of the disciplines of logistics and SCM is very positive. Because of the very high popularity of SCM in organizations, government and academia, it is likely that future research, including doctoral dissertations, will continue to expand.

As evident from the definitions of logistics and SCM, the cross-functional nature of those areas translates into a wider variety of research topics that will apply, especially to SCM. Areas such as operations\manufacturing, customer satisfaction, procurement, and marketing will continue to be applied within SCM, resulting in an increasing number and variety of supply chain-related dissertations being completed. Coupled with the increasing number of SCM academic programs at all levels of higher education, from junior colleges through 4-year colleges and universities, more students will be brought into the supply chain area. Some of those students who find the supply chain area of interest will ultimately pursue doctoral degrees. Increasing enrollments in supply chain courses will require more faculty members to teach SCM. Those new faculty hired to teach SCM courses will have completed dissertations on supply chain topics, resulting in greater numbers of dissertations to report on in subsequent compendiums of doctoral research in logistics and supply chain-related areas.

With almost 30 % of the dissertations classified under the supply chain management category, it is evident that this area is the subject of a large portion of the published dissertation research. In looking toward the future of logistics and SCM-related dissertations, we can utilize the framework established by Stock et al. [10]. They identified a number of possible research opportunities in supply chain management. Table 14 identifies those opportunities.

Dissertations included in this compendium have dealt with all of the topics suggested by Stock et al. [10], although some areas of SCM have received lesser attention. Research opportunities that have not yet attracted doctoral students to investigate them include various aspects of service supply chains, sustainability and environmental aspects of supply chains, measuring the outcomes of effective supply chain management (including customer satisfaction, costs, revenue and profit implications), leading or managing of supply chains (e.g., supply chain captains or leaders), supply chain theory, and macro supply chain issues (e.g., hunger relief, disaster response, humanitarian topics). These areas are potentially fertile areas for doctoral research which can have significant implications to both academicians and practitioners.[1]

Regarding predictions for the future, given that a large number of organizations and colleges/universities are increasingly more interested in SCM, and given the bright prospects for people to fill logistics and supply chain-related jobs in the workplace [2], we can be even more optimistic than Stock and Broadus [11]. The future prospects are not just good; they are excellent!

[1] Subsequent to the 2009, some examples of dissertations published in these under-researched areas has developed. For example, a Special issue in the International Journal of Physical Distribution & Logistics Management, Vol. 43, No. 5/6 (2013) was published which included material developed by authors from their dissertations.

Table 14 Opportunities for research in SCM

Activities		
Flows		Networks of relationships
Service versus physical goods supply chains		Strategic partnerships and alliances
Materials and information flows		Relationships between members of the supply chains
Product returns/product out-of-stocks		Managing global supply chain networks
Sourcing/procurement of products and services		Measures and metrics of supply chain performance
Benefits		
Add value	Create efficiencies	Increase customer service
Outputs of integrated supply chains	Doing more with less (e.g., six sigma, lean management)	Achieving customer satisfaction
Cost-service trade-offs	Achieving cost minimization and optimization	Minimizing supply chain disruptions and uncertainties
Increasing profitability to organizations	Cost trade-offs	
Sustainability and environmental impacts of supply chains	Risk assessment	
Constituents/component parts		
Models/structure of SCM (what it does and does not include)		
Supply chain members (e.g., organizations, functions, and processes)		
Supply chain "captain" or leader		
Miscellaneous issues		
Theory, including construct definition and theory development		
Application of quantitative and qualitative methods and approaches		
Use of technology		
Postponement in the supply chain		
Macro supply chain issues (e.g., hunger relief, disaster response)		

Source: Stock et al. [10]

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