SBB Lab

Universität St.Gallen

Stephan Reinhold
Christian Laesser
Daniel Bazzi

The intellectual structure of transportation management research:
A review of the literature

Working Paper Series / Report No. 005
SBB Lab

May 2015

SBB Lab
University of St. Gallen
Dufourstrasse 40a
CH-9000 St. Gallen

The SBB Lab is a center of competence affiliated with the Institute for Systemic Management and Public Governance (IMP-HSG) at the University of St. Gallen.

The SBB Lab

- is a leading research center for service and transport management between the state and the market,
- has an impact on practice, especially on the Swiss Federal Railways (SBB) as well as the application-oriented research in Europe, and
- contributes to the agenda setting in the field of expertise of the national and international research communities.

Authors

Stephan REINHOLD, Dr., is project manager and postdoctoral researcher at the Institute for Systemic Management and Public Governance (IMP-HSG).

Christian LAESSER, Prof. Dr., is managing director of the SBB Lab and head of the Tourism and Transportation Research Center at the Institute for Systemic Management and Public Governance (IMP-HSG).

Daniel BAZZI, M.A. HSG, is research associate and doctoral candidate at the Institute for Systemic Management and Public Governance (IMP-HSG).

Suggested citation

Reinhold, S., Laesser C. & Bazzi, D. (2015). The intellectual structure of transportation management research: A review of the literature. *Working Paper Series 005*, St. Gallen: SBB Lab.

An earlier version of this paper was presented at the 2014 Swiss Transport Research Conference. The authors wish to acknowledge the research assistance of Nicole Fahr and Mira Figesthaler on this project and thank STRC 2014 participants for valuable comments.

May 2015

SBB Lab

www.sbb-lab.ch

Table of contents

Tables

Figures

0 Abstract

"Transportation management" and "management of transportation" are keywords frequently featured, yet rarely comprehensively defined or explained in peer-reviewed publications in the transportation research domain. In this study, we reveal and analyze the hitherto implicit intellectual structure of this advanced and diverse research field using bibliometrical methods. On the basis of a systematic review of 900 scholarly articles published between 1946 and 2012, we identify 55 topical clusters that delineate and weight the dominant associations with the term "transportation management" as either a specific or executive function at an operational, strategic, and normative level. Moreover, we identify two avenues for further research that warrant future transport-specific research and that might potentially yield findings that can be generalized beyond this industry context.

Keywords

Transportation management – Review – Intellectual structure – Bibliometrical analysis

1 Introduction

“Transportation management” and “management of transportation” are keywords frequently featured, yet rarely comprehensively defined or explained in peer-reviewed publications in the transportation research domain. On the one hand, there might be a strong consensus among the relevant community of researchers about the essence of this concept (Nag, Hambrick, & Chen, 2007). However, on the other hand, they might never have explicitly considered how the associations they form between the content of their publications and “transportation management” create an implicit understanding of this concept as well as shape the intellectual structure of research associated with the management of transportation. From our reading of the literature, and as we will demonstrate with this study, the latter is the case.

This development is not unique to transportation research. The evolution of research fields is subject to the social construction of academics that contribute to a respective field’s development (Nag et al., 2007). As fields mature, boundaries and central definitions in social sciences shift. Research priorities change, knowledge accumulates, and new methodologies allow for novel insights which together refine our understanding of core concepts on the basis of a constant interaction between abstract ideas and the specific empirical cases studied (Tsoukas, 2009). As a result, this pattern of scientific progression mostly fails to produce ever more specific and consentient definitions of key terms. Instead, definitions are contested and abound (e.g., Nag et al., 2007; Zott, Amit, & Massa, 2011); parallel progressions within research fields proliferate. However, on the positive side, the parallel progression is a reflection of researchers’ creativity as well as eager interest in the study of a particular research topic.

Literature reviews have been established as central landmarks portraying the evolution of research fields, summarizing, structuring as well as interpreting a field’s main contributions and definitions, and frequently highlighting avenues for further research (Furrer, Thomas, & Goussevskaia, 2007; Rorissa & Yuan, 2012). However, in recent years, traditional review papers based on an interpretive coding have been criticized for portraying foremost the authors’ subjective sense-making (e.g., Ding, Chowdhury, & Foo, 2001; Ramos-Rodriguez & Rui-Navarro, 2004). A number of authors have therefore turned to bibliometrical strategies to investigate and represent the intellectual structure of academic fields (e.g., Ding et al., 2001; McCain, 1990; Nerur, Rasheed, & Natarajan, 2007; White, 2003) – particularly, in more mature fields with hundreds of publications establishing researchers’ core understanding of central concepts.

In this study, we use bibliometrical methods to reveal and analyze the hitherto implicit intellectual structure of the advanced and diverse research field that is concerned with the management of transportation for the first time. On the basis of a systematic review of 900 scholarly articles published between 1946 and the end of 2012, we identify 55 topical clusters that delineate and weight the dominant associations with the term “transportation management” represented in the analyzed body of knowledge. Moreover, based on recent developments in (general) management research, we identify white spots on the map which warrant future transport-specific research.

2 Conceptual background

The comprehensive review of journal articles, which the subsequent sections will detail, revealed that there have been no previous attempts to define the intellectual structure of research on transportation management. Moreover, there are only a very limited number of definitions that specify transportation management as a subject in its own right. These deliberate definitions serve as a point of reference to compare the implicit conceptual understanding to (also termed "structural definition"), which researchers create when they associate their publications with transportation management.

Bardi and colleagues (2006) as well as the Transportation Research Thesaurus (TRT) provide two comprehensive and exemplary definitions of transportation management:

> "The management of transportation is concerned with the overall purchase and control of this movement service [i.e., moving freight and passengers] used by a firm in achieving its logistics objectives" (Bardi et al., 2006, p. 4).

> "The planning, direction, and control of the entire activity of a transportation supplier, including the formulation of objectives, policies, programs, and strategy and product development; organizing and staffing to carry out plans; supervising operations; and controlling performance" (TRB, 2014).

The two definitions posit that transportation management assumes a dual meaning: First, the management of a *specific function* concerned with physically moving freight and/ or passengers between spatial locations in an economic system (e.g., national economy, inter-organizational network, organization) to a certain end (cf. Bardi et al., 2006; Cowie & Ison, 2010); secondly and more broadly, an *executive function* (Barnard, 1938) concerned with the management of an organization whose main purpose is to provide transportation services. In addition, both definitions seem to comprehend management as teleological activity (Van de Ven & Poole, 1995) in Henri Fayol's (1949) categories: "plan, organize, coordinate, command, and control". However, while the second meaning spans the domains of normative, strategic, as well as operational management (Bleicher, 1994), transportation management as a specific function seems to focus predominantly on operational aspects in the above definitions.

Judging on the basis of literature reviews from our sample, we, in general, expect operational themes to dominate the intellectual structure of transportation management, which self-reference transportation management as a subject. The sample at hand includes a total of 36 literature reviews. A considerable number of these reviews address sub-topics of supply chain management, which integrates the management of transportation from a mostly functional perspective: sustainability (Aronsson & Brodin, 2006; Carter & Easton, 2011; Carter & Rogers, 2008; Sarkis, 2012), international logistics (Babbar & Prasad, 1998; Goetschalckx, Vidal, & Dogan, 2002), human resources and knowledge management (Cantor, 2008; Chow, Choy, & Lee, 2007; Defee & Fugate, 2010; Gravier & Farris, 2008; Keller & Ozment, 2009), strategic issues such as collaboration, planning and product development (Ellram, Tate, & Carter, 2007; Nair, 2005; Power, 2005; Simatupang & Sridharan, 2002; Thomas & Griffin, 1996; Yazdanparast, Manuj, & Swartz, 2010), innovation and technology management (Forman & Lippert, 2005; Grawe, 2009) as well as risk management (Williams, Lueg, & LeMay, 2008).

The remaining reviews also emphasize transportation as a specific function and mainly operational aspects, however, they consider these matters from multiple angles including those of regulators, transportation service operators, shippers, and transportation customers: intermodal freight transportation (Bontekoning, Macharis, & Trip, 2004; Meixell & Norbis, 2008), adoption of information and communication technology (Perego, Perotti, & Mangiaracina, 2011), behavioral aspects of parking policies (Marsden, 2006), means to influence choice of transportation mode (Fujii & Taniguchi, 2006), air transportation (Ginieis, Sánchez-Rebull, & Campa-Planas, 2012), fleet management (Dejax & Crainic, 1987), routing and scheduling (Giaglis, Minis, Tatarakis, & Zeimpekis, 2004), simulation and modelling (Taylor, Eldabi, Riley, Paul, & Pidd, 2009), and operations research (Daniel, Diakoulaki, & Pappis, 1997; Luss & Rosenwein, 1997).

In the subsequent methodology section, we elaborate how we aim to differentiate the present understanding of transportation management as both a specific and broader executive function covering management at different levels (i.e., operational, strategic, and normative) by identifying the intellectual structure of transportation management research.

3 Methodology

3.1 Research objective

By means of a co-word analysis (Ding et al., 2001), we reveal and analyze the implicit intellectual structure of the research field that is concerned with transportation management to three ends: First, we aim to identify the implicit structural definition of transportation management that researchers create with their publication whenever they associate the term “transportation management” with other keywords (e.g., supply chain management, routing, or crew scheduling). Secondly, we investigate dominant topical clusters in transportation management research to retrospectively understand what the dominant issues in transportation management research have been. Finally, we contribute an agenda of suggestions for further research based on transportation management research’s white spots with regard to the four key challenges of transportation management elaborated in the previous section.

The methodological design to investigate these research objectives is based on two key assumptions: First, research fields are subject to social construction (Astley, 1985; Gioia, 2003; Kuhn, 1962). Communities of scholars engage in knowledge creation on a subject under study (e.g., “transportation management”) whereby they develop and use a shared technical vocabulary and common identity (Nag et al., 2007). While the shared language enables these communities to engage in social construction, the shared “word system” (Astley, 1985, p. 499) does neither imply a static consensus on nor an unambiguous understanding of key concepts. Despite the importance of a shared core of essential meaning to scientific communities (Cole, 1983; Nag et al., 2007), social sciences fail to produce ever more specific and consistent definitions. Instead, our understanding of core concepts evolves on the basis of a constant interaction between abstract ideas and the specific empirical cases studied (Tsoukas, 2009). Moreover, connotations of key terms change as research priorities shift to accommodate new empirical phenomena, as knowledge accumulates, and as new methodologies allow for novel insights. The evolution of research fields and this pattern of knowledge creation result in parallel progressions, contested and blurry definitions, and complicate identifying dominant notions of particular fields (Ghaziani & Ventresca, 2005; Nag et al., 2007).

Secondly, it assumes that keywords adequately represent the content and main ideas of publications (Ding et al., 2001; Ghaziani & Ventresca, 2005). These keywords are either defined by the authors of a publication and/or a literature database provider (e.g., Business Source Premier). Two ideas or themes are linked by a publication whenever two keywords co-occur (Ding et al., 2001; Ronda-Pupo & Guerras-Martin, 2012) – or for some cases even when keywords are co-absent (Ronda-Pupo & Guerras-Martin, 2012). Given scholarly conventions, norms, and academic incentive schemes, we maintain that academic authors optimize the keyword section of their publications to be found, read, and cited. In addition, we expect database providers to optimize the utility of selected keywords with reference to search queries in their database catalogues, indices, and via aggregator services. Finally, in defining keywords, both authors and databases adhere to the dual tendency to use familiar as well as unique terms. Familiar vocabulary associates a publication with the existing body of knowledge as well as the respective scientific community the paper is addressing. Unique terms, in contrast, signal a publication's unique value and contribution.

3.2 Overview of the method

This study of the literature associated with the keyword "transportation management" deploys a bibliometrical research design (Pritchard, 1969). Bibliometrical designs use a mostly quantitative approach "to uncover the essence of a research field" (Samiee & Chabowski, 2012, p. 367) based on the characteristics of written documents. Specifically, we use co-word analysis (Bhattacharya & Basu, 1998; Wang, Li, Li, & Li, 2012) to identify the intellectual structure and conceptual space (Ding et al., 2001) of transportation management research.

In essence, co-word analysis mathematically and statistically analyzes the co-occurrence patterns of keywords that appear in written documents (e.g., articles, reports, book chapters, etc.) (Samiee & Chabowski, 2012). It thereby assumes that the main themes of any written publication can be adequately reduced to and inferred from a publication's keywords (Ding et al., 2001; Wang et al., 2012). This assumption is reflected in the three analytical steps through which the co-word analysis proceeds: First, the researcher creates a co-occurrence matrix based on a set of relevant publications. This matrix identifies the topics linked to the research field and how these topics link to each other (Ronda-Pupo & Guerras-Martin, 2012). Second, cluster analysis and multidimensional scaling point to topical clusters (i.e., themes frequently researched together) and allow to visualize the intellectual structure of the research field (Ding et al., 2001; McCain, 1990). In the final step, the map of the intellectual structure and topical clusters needs to be interpreted on the basis of interpretive coding. Each step is detailed for this particular study in the subsequent sections.

As a bibliometrical research design, co-word analysis offers three distinct advantages[1] in assessing the intellectual structure of research fields: First, it is reproducible and believed to produce more objective results than some purely interpretive literature reviews because of its data-driven nature and quantification focus (Nerur et al., 2007; Samiee & Chabowski, 2012). Secondly, it provides a systematic approach to mapping the conceptual space of research fields in terms of topical clusters and frequencies (Ding et al., 2001). These maps seem more memorable than purely textual representations. However, while these maps' frequencies and clusters can almost always be interpreted, the interpretation of distances between keywords is subject to limitations inherent in the heterogeneity and skewedness of the underlying data (Hair, Black, Babin, & Anderson, 2010). Finally, co-word analysis avoids a number of biases that its bibliometrical sibling co-citation analysis is subject to such as unequal weight attached to older versus more recent publications or trouble in identifying citation motives (e.g., critique, endorsement, establishing topical links, h-index, etc.) (Nerur et al., 2007; Ramos-Rodriguez & Rui-Navarro, 2004).

3.3 Identifying and sampling transportation management publications

To identify publications relevant to transportation management, we ran a systematic search of the big five online literature databases (i.e., ISI Web of Knowledge, EBSCO, Science Direct, Emerald, and ProQuest) with the keywords "Transportation Management" and "Management of Transportation"[2] for scholarly journal articles written in English and published until the end of December 2012. Articles published in journals ranked "C" or higher in the "Excellence for Research in Australia (ERA) 2010" list were arranged in a comprehensive literature database and duplicates removed. Data was sorted and scanned for false positives (i.e., non-articles and articles whose content did not pertain to transportation management such as articles from medical journals pertaining to transportation of blood cells in the human body). In addition, we cleaned keywords for computational manipulation (i.e., hyphenation of compounds, expanded abbreviations) (Ding et al., 2001; Samiee & Chabowski, 2012). Table 1 summarizes these activities and how they affected the number of publications in the sample: In total, our set of relevant publication included 900 ranked, scholarly journals articles containing a total of 4,686 original keywords.

---

[1] We discuss the inevitable limitations of our selected methodology in the final section.

[2] The term "transport" was treated as a synonym of "transportation" and was included as a key word in the search.

Table 1: Sample of transportation management publications

		number of publications in considered set
Total search results		1,316
Removal of non-ranked publications	(-231)	1,085
Removal of duplicates	(-101)	984
Removal of false positives	(-84)	**900**

Source: Own representation.

The sampling strategy aims to get as close as possible to the total population of certified scholarly articles in the transportation management field (Ramos-Rodriguez & Rui-Navarro, 2004) to maximize the representation adequacy of the intellectual structure. We therefore sampled inclusively rather than drawing an exclusive sample of a limited number of, for example, most cited articles in order to limit the subjectivity of publication coverage (Samiee & Chabowski, 2012). In doing so, the reliance on scholarly, peer-reviewed journals and on those publication outlets ranked “C” and higher serves as a minimum quality control and assumes that these English journals are an adequate reflection of the scientific discourse in the research field in question (Ghaziani & Ventresca, 2005; Nag et al., 2007).

3.4 Step 1: Building a dictionary of transportation management keywords

Two coders independently created hierarchical dictionaries in WordStat 6.0 based on the set of original keywords from relevant publications. Following the vocabulary standardization advice by Ding and colleagues (2001), synonymous and antonymous terms as well as broad and narrow terms referring to the same object were summarized in broader categories. Where a keyword’s meaning was ambiguous, coders referred back to abstracts and original publications to identify a keyword’s meaning in context. Each category (termed “dictionary keyword” or DKW) was named to represent either major entities or activities.

Overall, coders followed a two-step, two-level approach to determine the final set of DKW: First, they compared the independently coded dictionaries and discussed differences in sorting (i.e., the associations created between original keywords and DKW) as well as DKW naming. The resulting unified dictionary was subsequently scrutinized top-down and bottom-up. Bottom-up, the sorting of original keywords was reconsidered for every single DKW. Top-down, we compared the list of DKW with key terms and definitions from the strategic management domain (i.e., Academy of Management and Strategic Management Society) and with the Transportation Research Thesaurus curated by the Transportation Research Board to limit the danger of idiosyncratic DKW labeling and address indexer effects (Ding et al., 2001).

This procedure resulted in 160 dictionary keywords. In total, the original keywords summarized under each DKW account for ≥5 publication occurrences. In addition, we created two residual DKW categories: a category labeled “residual” for all the leftover oneoff keywords that did not fit any other category (2.9 percent of original keywords) and a “delete” category for all the original keywords that referred to paper characteristics (e.g., research strategies, analytical procedures, and research discipline identifiers) rather than a paper’s main themes (26.5 percent of original keywords). Finally, the 160 dictionary keywords were arranged in an occurrence matrix (DKW x Publications) that associates the set of relevant publications with the DKW based on the dictionary specified above.

Two main reasons justify running co-word analysis on the basis of a dictionary of aggregated keyword categories (i.e., DKW) rather than the original keywords themselves: First, original keywords pertaining to a single theme may feature different spellings, word forms, antonyms and synonyms (Wang et al., 2012). Table 2 summarizes the totals for original keywords, words, word forms, and DKW. For example, about 73 percent of words featured in our sample occurred just in a single publication. Aggregating those original keywords that refer to a single theme in a DKW brings themes more clearly to the fore.

Table 2: Original keywords, words, word forms, and dictionary keywords

		# of words
Total number of	original keywords (KW)	4,686
	words	2,268
	word forms	460
	dictionary keywords (DKW)	160

Note: Number of words and word forms indicated after exclusion processing (e.g., removing pronouns and conjunctions), lemmatization and spelling correction.
Source: Own representation.

Secondly, original keywords may be homonyms or ambiguous in their use (Ding et al., 2001; Wang et al., 2012). We were able to more clearly distinguish the underlying intellectual structure by sorting original keywords in clearly delineated DKW, which were based on the intended meaning of the original keyword as inferred from the context of the original publication.

3.5 Step 2: MDS and cluster analysis

WordStat 6.0’s clustering and multidimensional scaling routine provided a first descriptive indication of the data structure for the 900 publications and 160 DKW. The descriptive results are based on Jaccard’s coefficient for the binary input from the occurrence matrix (Backhaus, Erichson, Plinke, & Weiber, 2006) and include all DKW with ≥5 publication occurrences. The MDS’s stress and R^2 values run for 60 different clustering solutions are both below acceptable values (Backhaus et al., 2006; Hair et al., 2010). The results indicate that the heterogeneity of the relevant set of publications will not allow interpreting the distance and dimension based on a two-dimensional MDS map (McCain, 1990; Samiee & Chabowski, 2012). Nonetheless, the graphical representation selected on the basis of the best clustering solution is helpful as it portrays the individual clusters and the respective frequencies of DKW within these.

To determine the number of clusters in the final solution, we reran WordStat’s weighted average linkage clustering for Jaccard’s coefficient on the occurrence matrix (DKW x

Publications) in Stata 11. This agglomerative procedure is less susceptible to the influence of extreme values than comparative hierarchical clustering procedures and tends to produce solutions “with approximately equal within-group variance” (Hair et al., 2010, p. 531).

Table 3: Reduced agglomeration schedule

# of clusters	hgt_coefficient	Δ coefficient	pseudo-F
2	0.00857698	-0.036436	1.06
3	0.13333333	0.124756	0.99
4	0.04374222	-0.089591	0.97
5	0.055	0.011258	1.06
6	0.00514972	-0.049850	1.25
7	0.13333333	0.128184	1.21
…	…	…	…
15	0.09429825	0.045710	1.44
16	**0.00825393**	**-0.086044**	**1.38**
17	0.02262649	0.014373	1.35
18	0.27272727	0.250101	1.33
19	**0.01209374**	**-0.260634**	**1.5**
20	0.1	0.087906	1.49
21	0.11111111	0.011111	1.46
…	…	…	…
55	**0.00799656**	**-0.121633**	**1.28**
56	0.0652381	0.057242	1.28
57	0.03703704	-0.028201	1.28
…	…	…	…
66	0.10126187	-0.065405	1.4
67	**0.00103612**	**-0.100226**	**1.41**
68	0.01890083	0.017865	1.42
69	0.11363636	0.094736	1.4
…	…	…	…

Source: Own representation.

Across the two programs, the final cluster solution is stable at a level of 0.84 (Hair et al., 2010). Given the heterogeneity of our input data and that the set of relevant publications represents a population of transportation management articles specified according to the above considerations rather than a subjective sample (Samiee & Chabowski, 2012), we referred to change in heterogeneity (1-Jaccard) as well as Caliński and Harabasz pseudo-F index to select the preliminary cluster solutions (Caliński & Harabasz, 1974; Milligan & Cooper, 1985). The four preliminary cluster solutions considered for the next step are marked in bold letters in Table ***3*** (cf. p. 10) and share three common features: a 1-similarity coefficient of ≤ 0.0121 (i.e., smaller than the one of the solution with the highest pseudo-F index), a decline in the coefficient as compared to the previous solution of ≥ 90 percent, and a pseudo-F index of ≥1.28.

3.6 Step 3: Interpretive coding of cluster solutions

Two coders independently interpreted and labeled the four preliminary cluster solutions: One started top-down with the solution that entailed the highest number of clusters; the other, bottom up. Overall, the labels that coders attached to the DKW groups that had resulted from the clustering algorithm matched in 74 percent of the cases, which is acceptable given the exploratory nature of this study (Lombard, Snyder-Duch, & Bracken, 2002). Differences were discussed and labels finally merged for cluster solution 55, which proved the most meaningful to both coders (Afifi, May, & Clark, 2012; Hair et al., 2010).

To validate that the cluster labels attached adequately represented the underlying data, we finally screened the abstracts and titles of all papers associated with the 55 clusters that feature >50 percent[3] of DKW associated with any given cluster. As papers are multifaceted in terms of their content and thus in the keywords that refer to their main themes, it is not surprising that many papers are associated with multiple clusters and do not perfectly fit any single one. Overall, we found the labels to adequately represent the papers that best fit each cluster.

In sum, the three steps outlined above resulted in 55 topical clusters that represent the intellectual structure of the transportation management field and which we will analyze and discuss in the subsequent section.

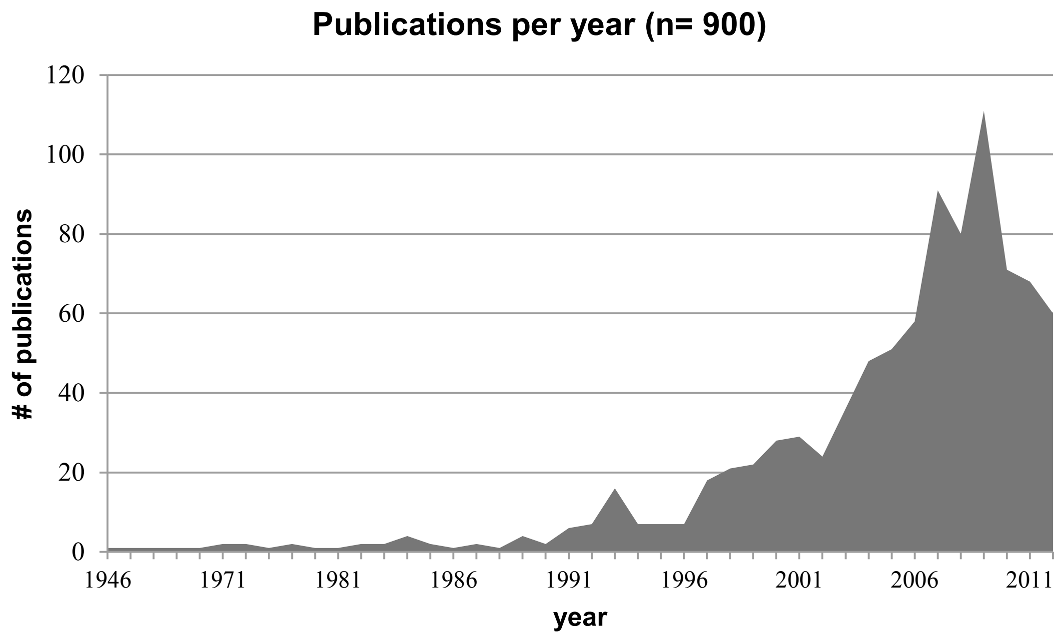
[3] We relaxed this condition for three clusters to ≥50 percent to include any paper whose abstract represented the cluster's DKW.

4 Analyses and results

4.1 Descriptive results

The year-of-publication distribution of scholarly articles in the relevant set ranges from 1946 to 2012. Only 84 publications (i.e., 9.3 percent) were published in the first 50 years since 1946. Since the mid-1990s, however, the number of yearly publications has significantly increased with annually more than 50 new transportation management publications after 2005 and a noteworthy peak of 111 new articles in 2009 (i.e., 12.3 percent). Accordingly, the median publication year dates back to just 2007. ***Figure 1*** illustrates these trends.

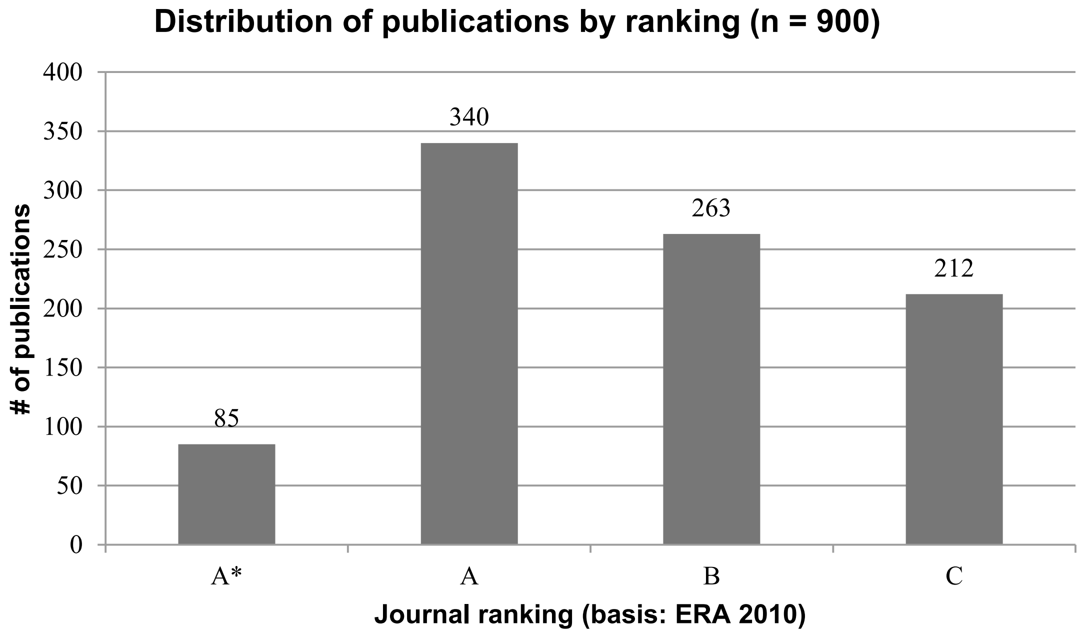
Figure 1: Number of transportation management articles published annually



Source: Own representation.

Nearly half of all articles included (i.e., 47.2 percent) were published in A- or A*-ranked publications according to the “Excellence for Research in Australia (ERA) 2010” list. B-ranked journals accounted for 29.2 percent and C-ranked for 23.6 percent of articles in the relevant set respectively (cf. Figure ***2***).

Figure 2: Distribution of publications by journal ranking



Source: Own representation.

Table 4 lists the titles of the 21 publication outlets that feature 10 and more publications from the relevant sample. In total, these 21 journals account for 575 publications from the relevant set (i.e., 63.9 percent). Four out of the top five journals featuring publications associated with transportation management focus on physical distribution, logistics, and supply chain management. Together, these four journals account for 22.7 percent of articles in the relevant set. Of the remainder, two journals are dedicated to policies and practices (i.e., “Transportation Research Part A: Policy and Practice” and “Transportation Policy”), four to operations research (i.e., “European Journal of Operational Research”, “Journal of the Operational Research Society”, “International Journal of Operations & Production Management”, and “Operations Research”), and four to information systems (i.e., “Journal of Transportation Systems Engineering and Information Technology”, “Interfaces”, “Industrial Management & Data Systems”, and “Management Science”).

Table 4: Journals with ≥ 10 publications

Journal title	# of publications	% of total
European Journal of Operational Research (Category: Mathematical Sciences)	84	9.3
International Journal of Physical Distribution & Logistics Management (Category: Business and Management)	78	8.7
Supply Chain Management: An International Journal (Category: Business and Management)	48	5.3
International Journal of Logistics Management, The (Category: Business and Management)	43	4.8
Transportation Research Part E: Logistics and Transportation Review (Category: Transportation and Freight Services)	36	4.0
Transportation Research Part A: Policy and Practice (Category: Transportation and Freight Services)	27	3.0
Journal of Transportation Systems Engineering and Information Technology (Category: Transportation and Freight Services)	26	2.9
Interfaces (Category: Information Systems)	25	2.8
Journal of Transport Geography (Category: Transportation and Freight Services)	25	2.8
Transport Policy (Category: Transportation and Freight Services)	22	2.4
Journal of the Operational Research Society (Category: Mathematical Sciences)	19	2.1
International Journal of Operations & Production Management (Category: Business and Management)	18	2.0
Industrial Management & Data Systems (Category: Computer Software)	17	1.9
Management Science (Category: Information Systems)	16	1.8
Transportation Research Part B: Methodological (Category: Transportation and Freight Services)	16	1.8
Transportation Science (Category: Transportation and Freight Services)	16	1.8
Journal of Air Transport Management (Category: Transportation and Freight Services)	13	1.4
Transportation Research: Part C (Category: Civil Engineering)	13	1.4
Tourism Management (Category: Tourism)	12	1.3
Operations Research (Category: Computation Theory and Mathematics)	11	1.2
Journal of Business Logistics (Category: Business and Management)	10	1.1

Source: Own representation.

Overall, this distribution of articles across journals provides an indication that goods' transportation, operational issues, and information and communication systems are likely to be dominant themes in the intellectual structure of transportation management.

Table 5 provides an overview of dictionary keywords, number of publications, mean, mode, and standard deviation for the average year of publication for publications associated with every cluster. On average, clusters contain three dictionary keywords, with cluster 28 featuring the most, i.e., 8 DKW, and clusters 53 and 15 being single DKW clusters. While cluster solutions are generally selected to avoid single clusters (Hair et al., 2010), we tolerate them here in favor of interpretability across all clusters for the selected solution – not least because both single clusters represent independent themes.

Table 5: DKW, publications, mean, mode, and standard deviation by cluster

Cluster	# of DKW	# of publ.	Mean	Mode	Std. dev.	Cluster	# of DKW	# of publ.	Mean	Mode	Std. dev.
1	3	19	2004	2006	7.015			*(continued)*			
2	3	27	2005	2007[a]	8.806	***29***	2	17	2003	2009	12.784
3	3	68	2005	2009	6.943	***30***	3	64	2006	2007[a]	5.985
4	5	22	2003	1997[a]	6.491	***31***	2	18	2004	2009	5.472
5	3	47	2003	2010	9.923	***32***	2	21	2002	2008[a]	10.269
6	6	95	2003	2008	8.732	***33***	3	22	2007	2009	4.820
7	2	10	2007	2010[a]	5.438	***34***	3	38	2003	2007[a]	11.548
8	5	31	2004	2007	6.756	***35***	6	47	2001	2009	10.722
9	2	10	2009	2011	3.190	***36***	2	11	2001	2002[a]	13.449
10	3	74	2006	2011	6.433	***37***	3	27	2001	2005	13.588
11	3	37	2003	2008	9.194	***38***	3	24	2005	2009	5.853
12	3	30	2005	2003[a]	7.156	***39***	2	15	2003	2011	6.349
13	2	13	2007	1997[a]	5.562	***40***	2	35	2006	2007[a]	3.911
14	2	32	2007	2009	5.081	***41***	3	21	2006	2008	4.094
15	1	12	2003	2007[a]	7.732	***42***	2	15	2006	2011	6.800
16	2	12	2008	2005[a]	2.708	***43***	2	12	2009	2005[a]	2.570
17	3	25	2005	2007	6.144	***44***	2	31	2006	2007	3.822
18	4	27	2005	2009	6.974	***45***	2	20	2005	2008	5.973
19	3	83	2005	2009	7.009	***46***	4	33	2007	2007	3.855
20	7	392	2005	2009	6.098	***47***	2	31	2007	2007	3.175
21	2	22	2001	2009	12.450	***48***	2	16	2003	2007	5.095
22	3	92	2006	2011	9.543	***49***	3	26	2000	2005[a]	14.392
23	2	9	2008	2009	2.242	***50***	2	12	2005	2010	7.620
24	4	50	2002	2010	11.909	***51***	3	41	2003	2000[a]	7.390
25	2	16	2006	2009	5.134	***52***	2	14	2001	2009	11.882
26	3	30	2003	2012	10.716	***53***	1	11	2006	2010[a]	6.294
27	3	70	2004	2010	8.122	***54***	2	10	2003	2009	9.911
28	8	142	2004	2009	9.085	***55***	2	25	2007	2010	3.473

Note: [a] denotes solutions for which multiple modes exist; the smallest value is displayed.
Source: Own representation.

On average, 16 publications are associated with every cluster; however, associations vary between 9 publications for cluster 23 to 392 publications for cluster 20. The mean age distribution of publications in clusters reflects the surge in new articles since the mid-1990s. Cluster 49 aggregates the oldest publications with 2000 as average publication year and the highest standard deviation. Clusters 9 and 43, in contrast, join the youngest publications from the relevant set, with average publication in 2009 and considerably lower standard deviations.

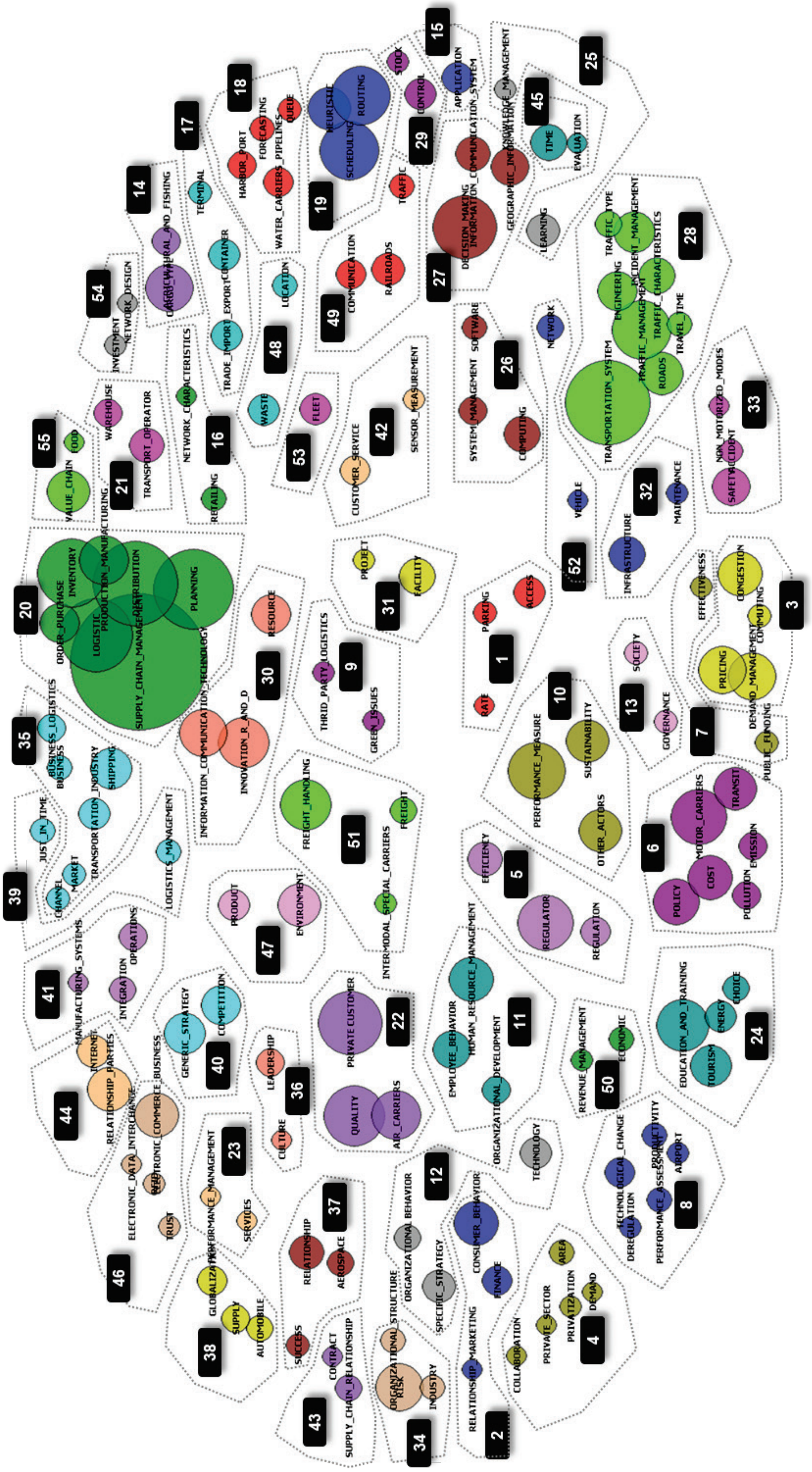
Finally, Figure ***3*** (cf. p. 17) illustrates the distribution of DKW across clusters weighted by the number of DKW occurrence (i.e., circle diameter) for the identified 55 theme clusters based on WordStat6's MDS routine. Despite the stress (0.446380) and R^2 value (0.0652) not reaching satisfactory levels (McCain, 1990), the graphical representation helpfully portrays the individual clusters and the respective frequencies of DKW within them.

4.2 Cluster labels

Table 6 (cf. p. 18) details the labels and definitions of all 55 clusters. To provide a structured overview of these clusters, we describe them in nine groups:

The first group of clusters is universally concerned with *moving freight and passengers*, i.e., the core of transportation management as a specific function. Clusters 51 ("Freight transportation and handling"), 14 ("Cargo-type-based contingencies"), 17 ("Foreign trade of containerized freight"), 21 ("Warehousing and transportation"), and 29 ("Control of stock") address freight transport and storage in a range of different settings (e.g., Hafliðason, Ólafsdóttir, Bogason, & Stefánsson, 2012; Kleywegt & Papastavrou, 2001; Mason, Mauricio Ribera, Farris, & Kirk, 2003; Murty et al., 2005; Thill & Lim, 2010). Clusters 54 ("Network design"), 32 ("Infrastructure maintenance"), and 31 ("Facility management") focus on the infrastructure and facilities that enable freight and passenger transportation (e.g., Durango-Cohen & Sarutipand, 2009; Ukkusuri & Patil, 2009; Ye & Yezer, 1992). In contrast, the publications in the subsequent clusters (e.g., Andersen, Crainic, & Christiansen, 2009; Chu, Tsai, & Hu, 2012; Desrosiers, Lasry, McInnis, Solomon, & Soumis, 2000; Janson, Anderson, & Sterne, 1989; Jasen, 2005; Lee & Ueng, 1999; Smith, Sweeney, & Campbell, 2009; Zhan & Noon, 1998) are more preoccupied with the management of transportation's dynamic aspects: 28 ("Traffic management and engineering"), 26 ("IT-based system management"), 27 ("IT-enabled decision-making"), 19 ("Routing and scheduling"), 45 ("Time evaluation"), 52 ("Vehicle-network co-optimization"), 53 ("Fleet management"), and 18 ("Water transportation"). Finally, cluster 33 ("Transportation safety") comprises publications that deal with safety issues and practices (e.g., Grant & Rutner, 2004).

Figure 3: MDS map for 55 clusters based on 160 DKW and 900 publications



Note: Stress = 0.446380; R2=0.0652; ≥5 occurrence per depicted DKW; same colors across clusters do not signify similarity. Source: Own representation.

Table 6: Cluster labels and descriptions

#	Cluster name	Cluster description (papers dealing with …) [DKW]
1	***Behavioral effects of pricing***	the effect of prices set for transportation resources (e.g., modes, parking) and accessibility on resource selection and consumption. [RATE, PARKING, ACCESS]
2	***Consumer behavior***	understanding the behavior of transportation services consumers, responses of consumers and co-producers to relationship marketing, and financial implications. [CONSUMER_BEHAVIOR, RELATIONSHIP_MARKETING, FINANCE]
3	***(Peak) Demand management***	effect of demand management measures addressing demand peaks (e.g., commuting) and affecting congestion. [CONGESTION, DEMAND_MANAGEMENT, PRICING, COMMUTING]
4	***Private sector transportation demand***	understanding the effect of private sector demand for transportation and its engagement in providing transportation services (e.g., from a spatial perspective). [COLLABORATION, PRIVATE_SECTOR, PRIVATIZATION, DEMAND, AREA]
5	***Regulation and regulator efficiency***	assessing the efficiency of publicly operated or government-sponsored public transportation as well as the regulatory efficiency in delineating and deciding on transportation policy and regulation. [EFFICIENCY, REGULATOR, REGULATION]
6	***(External) Cost of motorized transportation***	evaluating the external cost (e.g., pollution, congestion) of motorized modes of transportation (e.g., taxis) and the associated policies. [POLICY, COST, POLLUTION, TRANSIT, MOTOR_CARRIERS, EMISSION]
7	***Effective public funding***	optimizing public funding for effectiveness with regard to specific outcomes and discerning the (un-/intended) effects of public funding. [PUBLIC_FUNDING, EFFECTIVENESS]
8	***Performance and change management***	understanding productivity and performance measures as well as the antecedent implications of changes in industry contexts (e.g., deregulation, technological change). [DEREGULATION, AIRPORT, TECHNOLOGICAL_CHANGE, PRODUCTIVITY, PERFORMANCE_ASSESSMENT]
9	***Green (third party) logistics***	understanding the implications and benefits of green logistics practices, particularly for the case of third party logistics operators. [GREEN_ISSUES, THRID_PARTY_LOGISTICS]
10	***Socially sustainable transportation***	assessing welfare effects and sustainability of transportation as well as understanding the effect of stakeholder group involvement in dealing with the sustainability of transportation services and infrastructures. [SUSTAINABILITY, PERFORMANCE_MEASURE, OTHER_ACTORS]
11	***Human resource management***	the determinants of employee (dis-)satisfaction, performance, and tenure (e.g., implications of employee qualification levels and profiles). [ORGANIZATIONAL_DEVELOPMENT, EMPLOYEE_ BEHAVIOR, HUMAN_RESOURCE_MANAGEMENT]
12	***Technology and organizational behavior***	the effect of specific strategies (e.g., dissemination or manufacturing strategies) and technology on the behavior of organizations and organizational actors (e.g., adopting certain technical innovations). [SPECIFIC_STRATEGY, ORGANIZATIONAL_BEHAVIOR, TECHNOLOGY]
13	***Governance***	understanding the institutions and effects of transportation governance in society. [GOVERNANCE, SOCIETY]
14	***Cargo-type-based contingencies***	assessing the contingent effects of specific cargo types (e.g., perishable goods, livestock) on transportation operations. [AGRICULTURAL_AND_FISHING, CARGO_TYPE]
15	***Application***	describing and assessing applications of concepts, systems, strategies, practices (e.g., dynamic allocation, simulation, fee system). [APPLICATION]

(table continued on next page)

16	***Network management (in retailing)***	optimizing retail supply chains based on certain network characteristics (e.g., flows, infrastructure location). [RETAILING, NETWORK_CHARACTERISTICS]
17	***Foreign trade of containerized freight***	understanding the freight handling practices and external effects at terminals related to containerized freight transportation across national borders. [TRADE_IMPORT_EXPORT, TERMINAL, CONTAINER]
18	***Water transportation management***	optimizing water transportation flow and infrastructure use. [WATER_CARRIERS_PIPELINES, HARBOR_PORT, FORECASTING, QUEUE]
19	***Routing and scheduling***	understanding and optimizing schedules and routes for transportation resources based on different heuristic approaches. [SCHEDULING, HEURISTIC, ROUTING]
20	***Supply chain management***	optimizing inventories, transportation, and procurement for competitive advantages from a manufacturing and producer stance. [PLANNING, DISTRIBUTION, SUPPLY_CHAIN_ MANAGEMENT, LOGISTIC, PRODUCTION_MANUFACTURING, INVENTORY, ORDER_PURCHASE]
21	***Warehousing and transportation***	understanding the effects of transportation on warehousing and optimizing the integration of transportation and inventory functions. [WAREHOUSE, TRANSPORT_OPERATOR]
22	***Quality management (in aviation)***	assessing service quality of transportation services (i.e., mostly in aviation industry) based on different conceptualizations and analyzing its effects on performance and behavioral outcomes. [AIR_CARRIERS, PRIVATE CUSTOMER, QUALITY]
23	***Service performance management***	describing performance management techniques for transportation service organizations and (third party) transportation services purchasing [PERFORMANCE_MANAGEMENT, SERVICES]
24	***Energy efficiency of mode choice & Tourism education***	assessing the energy efficiency of tourists transportation mode choice on the one hand, and practices in tourism education and training programs on the other. [EDUCATION_AND_TRAINING, ENERGY, TOURISM, CHOICE]
25	***Knowledge management***	understanding the benefits, processes, and effectiveness of organizational learning and knowledge management (e.g., competitive advantage, innovation capacity, build-to-order) as well as the effects of traveler's learning ability on behavior. [KNOWLEDGE_MANAGEMENT, LEARNING]
26	***IT-based system management***	describing the challenges in implementing software and IT-applications to management transportation operations and systems. [SOFTWARE, SYSTEM_MANAGEMENT, COMPUTING]
27	***IT-enabled decision-making***	describing and evaluating information technology applications (e.g., sensors, new data, improved algorithms) to solve transportation problems (e.g., network layouts, workforce scheduling, and shipment and order processing). [DECISION_MAKING, GEOGRAPHIC_INFORMATION, INFORMATION_COMMUNICATION_SYSTEM]
28	***Traffic management and engineering***	the effects of traffic management strategies, practices, and technologies (e.g., departure time assignments, flow prediction algorithm) as well as traffic engineering (e.g., dedicated lanes) for different kinds of traffic (e.g., mixed, non-motorized). [TRAFFIC_CHARACTERISTICS, TRAFFIC_TYPE, ROADS, TRANSPORTATION_SYSTEM, ENGINEERING, TRAFFIC_ MANAGEMENT, INCIDENT_MANAGEMENT, TRAVEL_TIME]
29	***Control of stock***	understanding and optimizing the control of stock for different outcomes (e.g., cost, revenues, order fulfillment). [CONTROL, STOCK]

(table continued on next page)

31	***Facility management***	optimizing transportation facilities and their management in terms of location, usage, productivity, and capacity as well as understanding facilities' performance implications (e.g., profits, customer satisfaction). [PROJECT, FACILITY]
32	***Infrastructure maintenance***	optimizing maintenance of transportation infrastructure to maximize service performance and minimize hazards. [MAINTENANCE, INFRASTRUCTURE]
33	***Transportation safety***	understanding safety issues (e.g., crash frequencies, danger perception, fatigue) and the implications of new technologies (e.g., vehicular communication) as well as evaluating the effects of different safety management practices and policies (e.g., bicycle helmet legislation). [ACCIDENT, SAFETY, NON_MOTORIZED_MODES]
34	***Risk management***	understanding risk management across transportation industry contexts and in supply chain management as well as its implementation in organizational structures (e.g., public-private partnerships). [RISK, ORGANIZATIONAL_STRUCTURE, INDUSTRY]
35	***Business logistics management***	understanding the role and optimizing the performance of transportation operators services in business logistics (e.g., shipper-carrier integration, auctioning tenders). [CHANNEL, SHIPPING, MARKET, BUSINESS, BUSINESS_ LOGISTICS, TRANSPORTATION_INDUSTRY]
36	***Leadership (in culturally diverse contexts)***	the effect of leadership on transportation organizations and services (e.g., development, implementation of safety standards) in different cultural settings. [LEADERSHIP, CULTURE]
37	***Relationship management (in aviation)***	understanding the determinants of success in (strategic) alliances among transportation service providers and between shippers and carriers. [RELATIONSHIP, AEROSPACE, SUCCESS]
38	***Global supply chains***	the effects of globalized supply chains for manufacturing (e.g., automobiles) on logistics requirements and evaluation of associated concepts (e.g., supplier parks). [GLOBALIZATION, SUPPLY, AUTOMOBILE]
39	***Just-In-Time Logistics***	assessing the effectiveness just-in-time practices as part of manufacturing and service firms' logistics management (e.g., for lean manufacturing or competitiveness). [LOGISTICS_MANAGEMENT, JUST_IN_TIME]
40	***Strategic management***	understanding and evaluating competitive positioning, competitive advantage (e.g., SCM capabilities, intermodal solutions, sustainability), competitor interaction (e.g., co-opetition, predatory pricing), and strategic use of transportation resources. [COMPETITION, GENERIC_STRATEGY]
41	***Operations management***	optimization of business operations of manufacturers and transportation service providers as well as determining the effects of integrating transportation in manufacturing and supply systems. [MANUFACTURING_SYSTEMS, OPERATIONS, INTEGRATION]
42	***Customer service***	the effect of different practices to improve transportation and related services on (e.g., aftermarket support, sensor-based estimates and optimization) customer service perception. [SENSOR_MEASUREMENT, CUSTOMER_SERVICE]
43	***Collaboration and cooperation***	evaluating and explaining the inter-firm relationships along the supply chain (e.g., tradeoffs, relational factors, trust). [CONTRACT, SUPPLY_CHAIN_RELATIONSHIP]
44	***Internet-enabled transactions***	assessing how the internet has changed the interactions of parties interacting along supply chains and in transportation networks. [INTERNET, RELATIONSHIP_PARTIES]
45	***Time evaluation***	the time-dependent optimization of transportation, the use of real time data to improve forecasting and planning (e.g., lane-changing behavior), and assessing time efficiency of plans and practices (e.g., traffic management). [TIME, EVALUATION]

(table continued on next page)

46	***Electronic commerce & cargo tracking***	assessing the effects of using electronic data interchange (e.g., RFID) for e-commerce supply chains and understanding the role of trust in both adopting these technologies from a customer and employee perspective. [TRUST, ELECTRONIC_COMMERCE_BUSINESS, ELECTRONIC_DATA_INTERCHANGE, RFID]
47	***Green product lifecycle***	the environmental impact of forward and reverse supply chain logistics activities across the lifecycle of a product. [PRODUCT, ENVIRONMENT]
48	***Waste management***	optimizing waste disposal systems (e.g., collection, cost, landfill location) and reverse logistics. [WASTE, LOCATION]
49	***Communication & Railroads***	understanding transportation-related communication (e.g., vehicle-to-vehicle, risk) and rail-specific transportation issues. [COMMUNICATION, RAILROADS, TRAFFIC]
50	***Revenue Management***	understanding and optimizing revenue management systems and practices. [REVENUE_MANAGEMENT, ECONOMIC]
51	***Freight transportation and handling***	understanding and optimizing freight handling (e.g., elastic capacity, ICT adoption, loading optimization) particularly related to intermodal and special carriers. [FREIGHT, FREIGHT_HANDLING, INTERMODAL_SPECIAL_CARRIERS]
52	***Vehicle-network co-optimization***	assessing systems and practices aimed at increasing transportation performance (e.g., delays, connections) by matching network and vehicle characteristics [VEHICLE, NETWORK]
53	***Fleet management***	optimizing fleets and their management (e.g., for size, replacement, and routing). [FLEET]
54	***Network design***	understanding and optimizing investment in transportation networks and its relationship with investments in network infrastructure and transportation. [NETWORK_DESIGN, INVESTMENT]
55	***Value chain structure***	the effect of outsourcing the logistics function on the value chains and value creation of particular industries (e.g., food) [FOOD, VALUE_CHAIN]

Note: Parts of cluster names in brackets indicate frequent cases or contexts (e.g., "(in retailing)"); "&" signifies compound cluster names. Source: Own representation.

The second group includes three clusters that address the *regulatory and governance* side of transportation systems that encompasses both normative and operational matters: Clusters 13 ("Governance"), 5 ("Regulation and regulator efficiency"), and 7 ("Effective public funding") deal with issues such as the impact of transportation governance in society, the efficiency of government-sponsored public transportation or transportation policies, and the effects of public funding (e.g., Kim & Dickey, 2006; McKinnon, 2009; Pina & Torres, 2001; Sciara, 2012).

The subsequent third group of clusters deals with assessing and mitigating the negative *external effects* of transportation. Cluster 6 ("(External) Cost of motorized transportation") deals directly with issues like pollution and congestion (e.g., An, Hu, & Wang, 2011), while clusters 9 ("Green (third party) logistcs"), 47 ("Green product lifecycle"), and 48 ("Waste management") focus on optimizing logistics for environmental sustainability (e.g., Adamides, Mitropoulos, Giannikos, & Mitropoulos, 2009; Blengini, 2008; Perotti, Zorzini, Cagno, & Micheli, 2012). Finally, cluster 10 ("Socially sustainable transportation") is concerned with the welfare effects of transportation and the role of stakeholder involvement connected with sustainability issues (e.g., Gil, Calado, & Bentz, 2011).

The fourth group of clusters relates to all the publications that investigate transportation as a function in *manufacturing, production, and sales*. The subject of publications associated with the following clusters is understanding and optimizing the practices of different supply chains in various industries and at different scales (e.g., Hsiao, Van Der Vorst, Kemp, & Omta, 2010; Liao, Marsillac, Johnson, & Liao, 2011; Randall, Gibson, Defee, & Williams, 2011; Sahin & Robinson Jr, 2005): Clusters 20 ("Supply chain management"), 16 ("Network management (in retailing)"), 38 ("Global supply chains"), and 55 ("Value chain structure"). In addition, clusters 35 ("Business logistics") and 39 ("JIT logistics") deal with the role of transportation operators' services in business logistics – particularly for time-critical manufacturing processes (e.g., Nair, 2005; Neuschel, 1987; Wu, 2003). Finally, cluster 41 ("Operations management") deals with process optimization and the integration of transportation into manufacturing systems (e.g., Kumar & Petersen, 2006).

The fifth group of clusters takes a broader stance and refers to transportation management mostly as an *executive function*. It focuses on themes traditionally associated with management and business studies. Clusters 40 ("Strategic Management") and 36 ("Leadership (in culturally diverse contexts)") address strategic management issues such as competitive advantage, strategic use of transportation resources, and the effect of leadership on transportation organizations and services in different cultural settings (e.g., Flint & Golicic, 2009; Hazen & Byrd, 2012; Hiller, Day, & Vance, 2006). In contrast, clusters 34 ("Risk management") and 11 ("Human resource management") focus on operational support functions that cover risks in transportation organizations and supply chain management as well as determinants of employee satisfaction, performance, and tenure (e.g., Fielding, Lo, & Yang, 2010; Morrow, McElroy, & Scheibe, 2011; Suzuki, 2007). Innovation, knowledge management, and the effects of technology on organizational behavior are of particular interest to publications (e.g., Carayannis, 1999; Grawe, 2009; Hazen & Byrd, 2012) linked to clusters 30 ("Innovation"), 25 ("Knowledge management"), and 12 ("Technology and organizational behavior"). Finally, clusters 37 ("Relationship management") and 43 ("Collaboration and cooperation") center on determinants of success in alliances that involve transportation operators and explaining inter-firm relationships along the supply chains (e.g., Gunasekaran & Ngai, 2003; Noonan & Wallace, 2006; Vowles, 2000).

The sixth group includes two clusters that focus on transportation management's link with *performance outcomes*. Clusters 8 ("Performance and change management") and 23 ("Service performance management") span publications that detail performance management techniques and performance measures for transportation services purchasing and operators as well as the antecedent effects of changes in industry contexts (e.g., Gillen & Lall, 1997:Stefansson, 2008 #3463; Holter, Grant, Ritchie, & Shaw, 2008).

The seventh group of clusters pertains to publications that relate to transportation's aspects of *marketing and consumer behavior*. Clusters 2 ("Consumer behavior"), 4 ("Private sector transportation demand"), 3 ("(Peak) Demand management"), and 1 ("Behavioral effects of pricing") deal with transportation demand patterns and demand management (e.g., Koppelman, Bhat, & Schofer, 1993; Mahmassani, 1999; Marsden, 2006; Pogue, 1997). In addition, clusters 22 ("Quality management (in aviation)"), 42 ("Customer service"), and 50 ("Revenue management") cover service quality management for transportation services (e.g., Rhoades & Waguespack Jr, 2008), the effects of different practices to improve transportation and related services on customer service perception (e.g., Bertini & Lovell, 2009), and revenue management practices and systems (e.g., Kuhlmann, 2004).

The eighth group refers to two clusters that are preoccupied with the *internet and e-commerce* as dedicated influence and field of application. Publications aggregated in cluster 44 (“Internet-enabled transactions”) assess how the internet has changed the interaction of parties along the supply chain (e.g., Lancioni, Smith, & Oliva, 2000). In contrast, cluster 46 (“Electronic commerce & cargo tracking”) is more preoccupied with the effects of electronic data interchange (e.g., RFID) for e-commerce (e.g., Wamba, 2012).

The ninth and final cluster group includes three *residual* clusters: Cluster 15 (“Application”) is very generic and includes publications that describe and assess applications of concepts, systems, strategies, and practices (e.g., Bertini & Rufolo, 2004). In contrast, clusters 24 (“Energy efficiency of mode choice & tourism education”) and 49 (“Communication & Railroads”) are both very specific and heterogeneous. Cluster 24 deals with energy efficiency of tourists’ transportation mode choices on the one hand, and practices in tourism education and training, on the other hand (e.g., Becken, Simmons, & Frampton, 2003; Stear & Griffin, 1993). Finally, cluster 49 encompasses publications that try to understand transportation-related communication as well as rail-specific transportation issues (e.g., Galetzka, Gelders, Verckens, & Seydel, 2008; Luguang, 2006).

5 Discussion

Based on the introductory discussion of transportation management as both a specific and executive function at different levels (i.e., normative, strategic, and operational), we assigned the 55 clusters to the six cells of the matrix displayed in ***Figure 4.*** Fourteen clusters (printed in italics) fall into more than one cell as clusters are not perfectly homogeneous in terms of the two-by-three dimensions.

Figure 4: Distribution of clusters across management levels and functions

	Specific	Executive
Normative	*5 Regulation and regulator efficiency* *7 Effective public funding* 13 Governance	*10 Socially sustainable transportation* *36 Leadership (in culturally diverse contexts)*
Strategic	*8 Performance and change management* *9 Green (third party) logistics* *16 Network management (in retailing)* *20 Supply chain management* *30 Innovation* *43 Collaboration and cooperation* *44 Internet-enabled transactions*	*10 Socially sustainable transportation* *30 Innovation* *34 Risk management* *36 Leadership (in culturally diverse contexts)* 37 Relationship management (in aviation) 40 Strategic management
Operational	1 Behavioral effects of pricing 2 Consumer behavior 3 (Peak) Demand management 4 Private sector transportation demand *5 Regulation and regulator efficiency* 6 (External) Cost of motorized transportation *7 Effective public funding* *8 Performance and change management* *9 Green (third party) logistics* 14 Cargo-type based contingencies *15 Application* *16 Network management (in retailing)* 17 Foreign trade of containerized freight 18 Water transportation management 19 Routing and scheduling *20 Supply chain management* 21 Warehousing and transportation 22 Quality management (in aviation) 23 Service performance management 24 Energy efficiency of mode choice & tourism education 26 IT-based system management 27 IT-enabled decision-making 28 Traffic management and engineering 29 Control of stock *30 Innovation* 31 Facility management 32 Infrastructure maintenance 33 Transportation safety *34 Risk management* 35 Business logistics management 38 Global supply chains 39 Just-In-Time Logistics 41 Operations management 42 Customer service *43 Collaboration and cooperation* *44 Internet-enabled transactions* 45 Time evaluation 46 Electronic commerce & cargo tracking 47 Green product lifecycle 48 Waste management 49 Communication &railroads *50 Revenue management* 51 Freight transportation and handling 52 Vehicle-network co-optimization 53 Fleet management 54 Network design 55 Value chain structure	11 Human resource management 12 Technology and organizational behavior *15 Application* 25 Knowledge management *30 Innovation* *34 Risk management* *50 Revenue management*

Note: Italics indicate that cluster appears in more than one cell. Source: Own representation.

Even upon visual inspection only, it is apparent that the intellectual structure of transportation management research is clearly dominated by themes that refer to transportation management as a specific function at an operational level. In total, 85 percent of clusters fall into this category – 35 out of 47 clusters are even solely in this cell (i.e., 63 percent of all clusters). The diversity of clusters and represented themes even within this single cell points to the underlying heterogeneity of papers in the relevant set. In addition, seven out of ten clusters (i.e., clusters 3, 6, 19, 20, 22, 27 and 28) with the most associated papers (i.e., all ≥ 50 publications) fall into this category. For six clusters (i.e., clusters 8, 9, 16, 20, 43, and 44), there is also a strategic component to the specific transportation issues addressed. Finally, normative management matters are of relevance to the three clusters that address regulatory matters (i.e., clusters 5, 7, 13). However, only the "Governance" cluster is primarily focused on transportation management as the normative management of a specific function.

Transportation management as a broader executive function is the subject of only a minority of clusters and publications (i.e., just 7 clusters exclusively fall into these three cells). While publications referring to transportation management as a specific function assume a multiplicity of perspectives (e.g., regulator, manufacturer, passenger, carrier, etc.), transportation as an executive function is clearly limited to the perspective of transport services suppliers. Here as well, themes relating to operational management concerns seem to dominate research. However, the difference in weights attached to strategic versus operational concerns is by far less distinguished and there is even overlap in terms of the "Innovation" and "Risk management" clusters. In addition, there are no purely normative matters since both clusters 10 ("Socially sustainable transportation") and 36 ("Leadership (in culturally diverse contexts)") refer to normative and strategic management aspects.

A likely explanation for the overwhelming dominance of publications and themes that relate to transportation management as a specific function at an operational level ties back to researchers' motivation to publish transportation research. Transportation-specific rather than general management research efforts are warranted and relevant for those aspects of management that are specific to the transportation subject, i.e., the physical movement of freight and passengers between spatial locations as specified, for example, according to Bardi and colleagues' (2006) definition. This includes the management of transportation as a specific function from the perspective of governmental and national economies and is part of strategic considerations in supply chain management. Moreover, for most clusters that dwell on aspects of transportation management as a specific function, there are dedicated literature reviews (e.g., Ellram et al., 2007; Giaglis et al., 2004; Perego et al., 2011) – which can scarcely be found for transportation management as an executive function (e.g., Keller & Ozment, 2009).

Given the limited research on transportation management as an executive function, the question is whether the characteristics and peculiarities of organizations that supply transportation services would not legitimize more research dedicated to these kinds of organizations – specifically at a normative and strategic level. We believe that there are three dominant interpretations to the underrepresentation of this type of research: First, transportation suppliers might be too diverse a pool of organizations to draw conclusions that generalize to a sufficiently large population; second, insights from general management research apply to transportation suppliers to such an extent that dedicated research in the transportation domain is not appropriate; or third, transportation organizations have slipped management and organization researchers' attention for a lack of unifying research challenges that generalize across transportation suppliers.

Most likely, there is a grain of truth in all three explanations, which is why we consider them all to legitimize the subsequent research agenda that aims to stimulate more research on transportation management as an executive function. The agenda revolves around two central issues: (1) network effects and (2) ownership and public interest.

First, most transportation services providers rely on *network* infrastructure and other institutions, firms, or actors to create value for their different types of customers (e.g., shippers, authorities, passengers, etc.) and capture value from these activities (Katz &

Shapiro, 1994). While there is transportation-specific research on alliances and cooperation (e.g., Evans, 2001; Li & Chan, 2012), transportation management research seems to be lacking studies that investigate the co-specialization of network infrastructure and transportation services along the lines of organizational and conglomerate structures and business models from a strategic perspective. This is relevant to transportation organizations considering, for example, the privatization of transportation network infrastructure and regulatory changes in the railway industry throughout Europe (e.g., Jupe, 2010; Laperrouza & Finger, 2009) and might potentially enable new taxonomies of contingent system configurations optimized for different performance outcomes.

Second, while *ownership and public interest* are considered outside-in from a regulator's perspective (cf. clusters 5, 7, and 13), there is surprisingly little research on how transportation organizations in regulated contexts and at different levels of public ownership may handle the goal conflicts and actors' converging interests while planning for sustainable service performance – both economically and environmentally. A recent surge in management and organization research drawing on new institutional theory and concepts to explain and predict actor and organizational behavior (Greenwood, Raynard, Kodeih, Micelotta, & Lounsbury, 2011; Thornton, Ocasio, & Lounsbury, 2012) might benefit transportation organizations with regard to both normative and strategic matters on the one hand, and provide a valuable context to generate new insights that can be generalized to a broader set of pluralist industries (Denis, Langley, & Rouleau, 2007).

6 Conclusions and limitations

Transportation industries and practices have provided some important early stimuli for reasoning about management and organizational concepts (Bucheli, Mahoney, & Vaaler, 2010; Chandler, 1962). However, despite these early impulses, research that associates itself with transportation management only started to rise in the mid-1990s. This study sheds light on the implicit structural definition of transportation management in the field, identifies dominant topics and suggests two avenues for further research.

By means of a bibliometrical literature review, we identify 55 topical clusters based on 900 scholarly articles published in the big five databases between 1946 and 2012. These relevant articles do not represent a sample but rather the nearest approximation to the entire population of peer-reviewed writing on the subject. Together, these 55 clusters represent the hitherto implicit intellectual structure of the body of knowledge on transportation management research.

We demonstrate that transportation management can be viewed as both a specific function focused on physically moving freight and passengers as well as an executive function. Overall, the intellectual structure is dominated by themes that refer to transportation management as a specific function at an operational level such as supply chain management as well as traffic management and engineering. This is not surprising given that transportation-specific rather than general management research efforts are warranted and relevant for those aspects of management that are specific to the transportation subject. In contrast, however, we identified little research on transportation management as an executive function at any level (i.e., normative, strategic, or operational management). This is surprising because there are management challenges that can be generalized across transportation services suppliers and might even be generalizable to other industry contexts. Particularly, more research on the strategic issues of co-specializing network infrastructures and transportation services along the lines of organizational and conglomerate structures as well as business models and research into dealing with institutional complexity might benefit both practitioner and academic communities.

Finally, this study is subject to three major limitations that might provide clues for further research into the structure of transportation management research: First, we consider all publications in the relevant set as additive contributions to the body of knowledge on transportation management research. Future studies may want to identify thresholds and identify shifts of clusters and dominant associations across consecutive time periods (e.g., Ronda-Pupo & Guerras-Martin, 2012). Second, we base our co-word analysis on author- and/ or database-supplied keywords. This avoids indexer biases (Ding et al., 2001) but is prone to suffer from quality differences in the way supplied keywords adequately reflect content. We tried to mitigate these effects by referring to titles, abstracts, and original texts to understand keywords in contexts (Ramos-Rodriguez & Rui-Navarro, 2004). And finally, systematically including expert panel suggestions (Wang et al., 2012) might address the fact that co-word analysis is backward oriented (Samiee & Chabowski, 2012).

7 References

Adamides, E. D., Mitropoulos, P., Giannikos, I., & Mitropoulos, I. (2009). A multi-methodological approach to the development of a regional solid waste management system. *Journal of the Operational Research Society, 60*(6), 758-770.

Afifi, A., May, S., & Clark, V. A. (2012). *Practical Multivariate Analysis* (5 ed.). Boca Raton (FL): Taylor & Francis Group.

An, S., Hu, X., & Wang, J. (2011). Urban taxis and air pollution: a case study in Harbin, China. *Journal of Transport Geography, 19*(4), 960-967.

Andersen, J., Crainic, T. G., & Christiansen, M. (2009). Service network design with management and coordination of multiple fleets. *European Journal of Operational Research, 193*(2), 377-389.

Aronsson, H., & Brodin, M. H. (2006). The environmental impact of changing logistics structures. *International Journal of Logistics Management, The, 17*(3), 394-415.

Astley, W. G. (1985). Administrative Science As Socially Constructed Truth. *Administrative Science Quarterly, 30*(4).

Babbar, S., & Prasad, S. (1998). International purchasing, inventory management and logistics research: an assessment and agenda. *International Journal of Physical Distribution & Logistics Management, 28*(6), 403-433.

Backhaus, K., Erichson, B., Plinke, W., & Weiber, R. (2006). *Multivariate Analysemethoden* (11 ed.). Berlin: Springer.

Bardi, E. J., Coyle, J. J., & Novack, R. A. (2006). *Management of transportation*: Thomson/South Western.

Barnard, C. (1938). *The functions of the executive*. Cambridge, MA: Harvard University Press.

Becken, S., Simmons, D. G., & Frampton, C. (2003). Energy use associated with different travel choices. *Tourism management, 24*(3), 267-277.

Bertini, R. L., & Lovell, D. J. (2009). Impacts of sensor spacing on accurate freeway travel time estimation for traveler information. *Journal of Intelligent Transportation Systems, 13*(2), 97-110.

Bertini, R. L., & Rufolo, A. M. (2004). Technology considerations for the implementation of a statewide road user fee system. *Research in Transportation Economics, 8*, 337-361.

Bhattacharya, S., & Basu, P. K. (1998). Mapping a research area at the micro level using co-word analysis. *Scientometrics, 43*(3), 359-372.

Bleicher, K. (1994). Integrative management in a time of transformation. *Long Range Planning, 27*(5), 136-144.

Blengini, G. A. (2008). Applying LCA to organic waste management in Piedmont, Italy. *Management of Environmental Quality: An International Journal, 19*(5), 533-549.

Bontekoning, Y. M., Macharis, C., & Trip, J. J. (2004). Is a new applied transportation research field emerging?—A review of intermodal rail–truck freight transport literature. *Transportation Research Part A: Policy and Practice, 38*(1), 1-34.

Bucheli, M., Mahoney, J. T., & Vaaler, P. M. (2010). Chandler's Living History: The Visible Hand of Vertical Integration in Nineteenth Century America Viewed Under a Twenty-First Century Transaction Costs Economics Lens. *Journal of Management Studies, 47*(5), 859-883.

Caliński, T., & Harabasz, J. (1974). A dendrite method for cluster analysis. *Communications in Statistics-theory and Methods, 3*(1), 1-27.

Cantor, D. E. (2008). Workplace safety in the supply chain: a review of the literature and call for research. *International Journal of Logistics Management, The, 19*(1), 65-83.

Carayannis, E. G. (1999). Knowledge transfer through technological hyperlearning in five industries. *Technovation, 19*(3), 141-161.

Carter, C. R., & Easton, P. L. (2011). Sustainable supply chain management: evolution and future directions. *International Journal of Physical Distribution & Logistics Management, 41*(1), 46-62.

Carter, C. R., & Rogers, D. S. (2008). A framework of sustainable supply chain management: moving toward new theory. *International Journal of Physical Distribution & Logistics Management, 38*(5), 360-387.

Chandler, A. (1962). *Strategy and Structure*. Cambridge: MIT Press.

Chow, H. K. H., Choy, K. L., & Lee, W. B. (2007). Knowledge management approach in build-to-order supply chains. *Industrial management & data systems, 107*(6), 882-919.

Chu, C.-P., Tsai, J.-F., & Hu, S.-R. (2012). Optimal starting location of an HOV lane for a linear monocentric urban area. *Transportation Research Part A: Policy and Practice, 46*(3), 457-466.

Cole, S. (1983). The hierarchy of the sciences? *American Journal of Sociology*, 111-139.

Cowie, J., & Ison, S. (2010). *The economics of transport: a theoretical and applied perspective*: Routledge.

Daniel, S. E., Diakoulaki, D. C., & Pappis, C. P. (1997). Operations research and environmental planning. *European Journal of Operational Research, 102*(2), 248-263.

Defee, C. C., & Fugate, B. S. (2010). Changing perspective of capabilities in the dynamic supply chain era. *International Journal of Logistics Management, The, 21*(2), 180-206.

Dejax, P. J., & Crainic, T. G. (1987). Survey paper-a review of empty flows and fleet management models in freight transportation. *Transportation Science, 21*(4), 227-248.

Denis, J. L., Langley, A., & Rouleau, L. (2007). Strategizing in pluralistic contexts: Rethinking theoretical frames. *Human Relations, 60*(1), 179-215.

Desrosiers, J., Lasry, A., McInnis, D., Solomon, M. M., & Soumis, F. (2000). Air Transat uses ALTITUDE to manage its aircraft routing, crew pairing, and work assignment. *Interfaces, 30*(2), 41-53.

Ding, Y., Chowdhury, G. G., & Foo, S. (2001). Bibliometric cartography of information retrieval research by using co-word analysis. *Information processing & management, 37*(6), 817-842.

Durango-Cohen, P. L., & Sarutipand, P. (2009). Maintenance optimization for transportation systems with demand responsiveness. *Transportation Research Part C: Emerging Technologies, 17*(4), 337-348.

Ellram, L. M., Tate, W. L., & Carter, C. R. (2007). Product-process-supply chain: an integrative approach to three-dimensional concurrent engineering. *International Journal of Physical Distribution & Logistics Management, 37*(4), 305-330.

Evans, N. (2001). Collaborative strategy: an analysis of the changing world of international airline alliances. *Tourism management, 22*(3), 229-243.

Fayol, H. (1949). *General and industrial management*. London: Pitman Publishing Limited.

Fielding, E., Lo, A. W., & Yang, J. H. (2010). The National Transportation Safety Board: A model for systemic risk management. *Available at SSRN 1695781*.

Flint, D. J., & Golicic, S. L. (2009). Searching for competitive advantage through sustainability: a qualitative study in the New Zealand wine industry. *International Journal of Physical Distribution & Logistics Management, 39*(10), 841-860.

Forman, H., & Lippert, S. K. (2005). Toward the development of an integrated model of technology internalization within the supply chain context. *International Journal of Logistics Management, The, 16*(1), 4-27.

Fujii, S., & Taniguchi, A. (2006). Determinants of the effectiveness of travel feedback programs—a review of communicative mobility management measures for changing travel behaviour in Japan. *Transport Policy, 13*(5), 339-348.

Furrer, O., Thomas, H., & Goussevskaia, A. (2007). The structure and evolution of the strategic management field: A content analysis of 26 years of strategic management research. *International Journal of Management Reviews, 10*(1), 1-23.

Galetzka, M., Gelders, D., Verckens, J. P., & Seydel, E. (2008). Transparency and performance communication: a case study of Dutch Railways. *Corporate Communications: An International Journal, 13*(4), 433-447.

Ghaziani, A., & Ventresca, M. (2005). Keywords and cultural change: Frame analysis of business model public talk, 1975 to 2000. *Sociological Forum, 20*(4), 523-559.

Giaglis, G. M., Minis, I., Tatarakis, A., & Zeimpekis, V. (2004). Minimizing logistics risk through real-time vehicle routing and mobile technologies: Research to date and future trends. *International Journal of Physical Distribution & Logistics Management, 34*(9), 749-764.

Gil, A., Calado, H., & Bentz, J. (2011). Public participation in municipal transport planning processes–the case of the sustainable mobility plan of Ponta Delgada, Azores, Portugal. *Journal of Transport Geography, 19*(6), 1309-1319.

Gillen, D., & Lall, A. (1997). Developing measures of airport productivity and performance: an application of data envelopment analysis. *Transportation Research Part E: Logistics and Transportation Review, 33*(4), 261-273.

Ginieis, M., Sánchez-Rebull, M.-V., & Campa-Planas, F. (2012). The academic journal literature on air transport: Analysis using systematic literature review methodology. *Journal of Air Transport Management, 19*, 31-35.

Gioia, D. A. (2003). Give it up! Reflections on the interpreted world (a commentary on Meckler and Baillie). *Journal of Management Inquiry, 12*(3), 285-292.

Goetschalckx, M., Vidal, C. J., & Dogan, K. (2002). Modeling and design of global logistics systems: A review of integrated strategic and tactical models and design algorithms. *European Journal of Operational Research, 143*(1), 1-18.

Grant, D., & Rutner, S. M. (2004). The effect of bicycle helmet legislation on bicycling fatalities. *Journal of Policy Analysis and Management, 23*(3), 595-611.

Gravier, M. J., & Farris, M. T. (2008). An analysis of logistics pedagogical literature: past and future trends in curriculum, content, and pedagogy. *International Journal of Logistics Management, The, 19*(2), 233-253.

Grawe, S. J. (2009). Logistics innovation: a literature-based conceptual framework. *International Journal of Logistics Management, The, 20*(3), 360-377.

Greenwood, R., Raynard, M., Kodeih, F., Micelotta, E. R., & Lounsbury, M. (2011). Institutional complexity and organizational responses. *The Academy of Management Annals, 5*(1), 317-371.

Gunasekaran, A., & Ngai, E. W. T. (2003). The successful management of a small logistics company. *International Journal of Physical Distribution & Logistics Management, 33*(9), 825-842.

Hafliðason, T., Ólafsdóttir, G., Bogason, S., & Stefánsson, G. (2012). Criteria for temperature alerts in cod supply chains. *International Journal of Physical Distribution & Logistics Management, 42*(4), 355-371.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis - A global perspective* (7 ed.). Boston: Pearson.

Hazen, B. T., & Byrd, T. A. (2012). Toward creating competitive advantage with logistics information technology. *International Journal of Physical Distribution & Logistics Management, 42*(1), 8-35.

Hiller, N. J., Day, D. V., & Vance, R. J. (2006). Collective enactment of leadership roles and team effectiveness: A field study. *The Leadership Quarterly, 17*(4), 387-397.

Holter, A. R., Grant, D. B., Ritchie, J., & Shaw, N. (2008). A framework for purchasing transport services in small and medium size enterprises. *International Journal of Physical Distribution & Logistics Management, 38*(1), 21-38.

Hsiao, H. I., Van Der Vorst, J., Kemp, R. G. M., & Omta, S. W. F. O. (2010). Developing a decision-making framework for levels of logistics outsourcing in food supply chain networks. *International Journal of Physical Distribution & Logistics Management, 40*(5), 395-414.

Janson, B. N., Anderson, R. B., & Sterne, R. B. (1989). Managing transportation during highway reconstruction: A recommended process. *Transportation, 16*(1), 47-79.

Jasen, J. F. S. (2005). Program Controls/Integrated Transportation Management Systems (ITMS). *AACE International Transactions*, 01.01-01.10.

Jupe, R. (2010). A model or a policy muddle? An evaluation of rail franchising in the UK. *Public Money & Management, 30*(6), 347-354.

Katz, M. L., & Shapiro, C. (1994). Systems competition and network effects. *Journal of Economic Perspectives, 8*, 93-93.

Keller, S. B., & Ozment, J. (2009). Research on personnel issues published in leading logistics journals: what we know and don't know. *International Journal of Logistics Management, The, 20*(3), 378-407.

Kim, K. S., & Dickey, J. (2006). Role of urban governance in the process of bus system reform in Seoul. *Habitat International, 30*(4), 1035-1046.

Kleywegt, A. J., & Papastavrou, J. D. (2001). The dynamic and stochastic knapsack problem with random sized items. *Operations Research, 49*(1), 26-41.

Koppelman, F. S., Bhat, C. R., & Schofer, J. L. (1993). Market research evaluation of actions to reduce suburban traffic congestion: Commuter travel behavior and response to demand reduction actions. *Transportation Research Part A: Policy and Practice, 27*(5), 383-393.

Kuhlmann, R. (2004). Why is revenue management not working? *Journal of Revenue and Pricing Management, 2*(4), 378.

Kuhn, T. S. (1962). *The structure of scientific revolutions*: University of Chicago press.

Kumar, S., & Petersen, P. (2006). Impact of e-commerce in lowering operational costs and raising customer satisfaction. *Journal of Manufacturing Technology Management, 17*(3), 283-302.

Lancioni, R. A., Smith, M. F., & Oliva, T. A. (2000). The role of the internet in supply chain management. *Industrial Marketing Management, 29*(1), 45-56.

Laperrouza, M., & Finger, M. (2009). *Regulating Europe's single railway market: Integrating performance and governance.* Paper presented at the Second Annual Conference on Competition and Regulation in Network Industries. Brussels.

Lee, T.-R., & Ueng, J.-H. (1999). A study of vehicle routing problems with load-balancing. *International Journal of Physical Distribution & Logistics Management, 29*(10), 646-657.

Li, J., & Chan, F. T. S. (2012). The impact of collaborative transportation management on demand disruption of manufacturing supply chains. *International Journal of Production Research, 50*(19), 5635-5650.

Liao, K., Marsillac, E., Johnson, E., & Liao, Y. (2011). Global supply chain adaptations to improve financial performance: Supply base establishment and logistics integration. *Journal of Manufacturing Technology Management, 22*(2), 204-222.

Lombard, M., Snyder-Duch, J., & Bracken, C. C. (2002). Content analysis in mass communication: Assessment and reporting of intercoder reliability. *Human communication research, 28*(4), 587-604.

Luguang, Y. (2006). Progress of the maglev transportation in China. *IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY ASC, 16*(2), 1138.

Luss, H., & Rosenwein, M. B. (1997). Operations Research applications: Opportunities and accomplishments. *European Journal of Operational Research, 97*(2), 220-244.

Mahmassani, H. S. (1999). Traveler behavior and intelligent transportation systems. *Transportation Research Part C: Emerging Technologies, 7*(2), 73-74.

Marsden, G. (2006). The evidence base for parking policies—a review. *Transport Policy, 13*(6), 447-457.

Mason, S. J., Mauricio Ribera, P., Farris, J. A., & Kirk, R. G. (2003). Integrating the warehousing and transportation functions of the supply chain. *Transportation Research Part E: Logistics and Transportation Review, 39*(2), 141-159.

McCain, K. W. (1990). Mapping authors in intellectual space: A technical overview. *Journal of the American society for information science, 41*(6), 433-443.

McKinnon, A. C. (2009). Benchmarking Road Freight Transport: review of a government-sponsored programme. *Benchmarking: An International Journal, 16*(5), 640-656.

Meixell, M. J., & Norbis, M. (2008). A review of the transportation mode choice and carrier selection literature. *International Journal of Logistics Management, The, 19*(2), 183-211.

Milligan, G. W., & Cooper, M. C. (1985). An examination of procedures for determining the number of clusters in a data set. *Psychometrika, 50*(2), 159-179.

Morrow, P. C., McElroy, J. C., & Scheibe, K. P. (2011). Work unit incivility, job satisfaction, and total quality management among transportation employees. *Transportation Research Part E: Logistics and Transportation Review, 47*(6), 1210-1220.

Murty, K. G., Wan, Y.-w., Liu, J., Tseng, M. M., Leung, E., Lai, K.-K., & Chiu, H. W. C. (2005). Hongkong International Terminals gains elastic capacity using a data-intensive decision-support system. *Interfaces, 35*(1), 61-75.

Nag, R., Hambrick, D. C., & Chen, M. J. (2007). What is strategic management, really? Inductive derivation of a consensus definition of the field. *Strategic Management Journal, 28*(9), 935.

Nair, A. (2005). Emerging internet-enabled auction mechanisms in supply chain. *Supply Chain Management: An International Journal, 10*(3), 162-168.

Nerur, S. P., Rasheed, A. A., & Natarajan, V. (2007). The intellectual structure of the strategic management field: an author co-citation analysis. *Strategic Management Journal, 29*(3), 319-336.

Neuschel, R. P. (1987). The New Logistics Challenge - Excellence in Management. *Journal of Business Logistics, 8*(2).

Noonan, J., & Wallace, M. (2006). Improved optimisation through advanced relationship planning. *Supply Chain Management: An International Journal, 11*(6), 483-490.

Perego, A., Perotti, S., & Mangiaracina, R. (2011). ICT for logistics and freight transportation: a literature review and research agenda. *International Journal of Physical Distribution & Logistics Management, 41*(5), 457-483.

Perotti, S., Zorzini, M., Cagno, E., & Micheli, G. J. L. (2012). Green supply chain practices and company performance: the case of 3PLs in Italy. *International Journal of Physical Distribution & Logistics Management, 42*(7), 640-672.

Pina, V., & Torres, L. (2001). Analysis of the efficiency of local government services delivery. An application to urban public transport. *Transportation Research Part A: Policy and Practice, 35*(10), 929-944.

Pogue, T. D. (1997). The transportation management district: a tool to engage private sector support in meeting energy, environmental, and transportation goals. *Energy Policy, 25*(14), 1227-1234.

Power, D. (2005). Supply chain management integration and implementation: a literature review. *Supply Chain Management: An International Journal, 10*(4), 252-263.

Pritchard, A. (1969). Statistical bibliography or bibliometrics. *Journal of documentation, 25*(4), 348-349.

Ramos-Rodriguez, A. R., & Rui-Navarro, J. (2004). Changes in the intellectual structure of strategic management research: a bibliometric study of the Strategic Management Journal, 1980-2000. *Strategic Management Journal, 25*(10), 981-1004.

Randall, W. S., Gibson, B. J., Defee, C. C., & Williams, B. D. (2011). Retail supply chain management: key priorities and practices. *International Journal of Logistics Management, The, 22*(3), 390-402.

Rhoades, D. L., & Waguespack Jr, B. (2008). Twenty years of service quality performance in the US airline industry. *Managing Service Quality, 18*(1), 20-33.

Ronda-Pupo, G. A., & Guerras-Martin, L. Á. (2012). Dynamics of the evolution of the strategy concept 1962–2008: a co-word analysis. *Strategic Management Journal, 33*(2), 162-188.

Rorissa, A., & Yuan, X. (2012). Visualizing and mapping the intellectual structure of information retrieval. *Information processing & management, 48*(1), 120-135.

Sahin, F., & Robinson Jr, E. P. (2005). Information sharing and coordination in make-to-order supply chains. *Journal of Operations Management, 23*(6), 579-598.

Samiee, S., & Chabowski, B. R. (2012). Knowledge structure in international marketing: a multi-method bibliometric analysis. *Journal of the Academy of Marketing Science, 40*(2), 364-386.

Sarkis, J. (2012). A boundaries and flows perspective of green supply chain management. *Supply Chain Management: An International Journal, 17*(2), 202-216.

Sciara, G.-C. (2012). Financing congressional earmarks: Implications for transport policy and planning. *Transportation Research Part A: Policy and Practice, 46*(8), 1328-1342.

Simatupang, T. M., & Sridharan, R. (2002). The collaborative supply chain. *International Journal of Logistics Management, The, 13*(1), 15-30.

Smith, L. D., Sweeney, D. C., & Campbell, J. F. (2009). Simulation of alternative approaches to relieving congestion at locks in a river transportion system. *Journal of the Operational Research Society, 60*(4), 519-533.

Stear, L., & Griffin, T. (1993). Demythologizing the nexus between tourism and hospitality: Implications for education. *Tourism management, 14*(1), 41-51.

Suzuki, Y. (2007). Truck driver turnover: what rate is good enough? *International Journal of Physical Distribution & Logistics Management, 37*(8), 612-630.

Taylor, S. J. E., Eldabi, T., Riley, G., Paul, R. J., & Pidd, M. (2009). Simulation modelling is 50! Do we need a reality check&quest. *Journal of the Operational Research Society*, S69-S82.

Thill, J.-C., & Lim, H. (2010). Intermodal containerized shipping in foreign trade and regional accessibility advantages. *Journal of Transport Geography, 18*(4), 530-547.

Thomas, D. J., & Griffin, P. M. (1996). Coordinated supply chain management. *European Journal of Operational Research, 94*(1), 1-15.

Thornton, P. H., Ocasio, W., & Lounsbury, M. (2012). *The institutional logics perspective: A new approach to culture, structure, and process*: Oxford University Press.

TRB. (2014). Transportation Research Thesaurus (Thesaurus). Retrieved January 21, 2014, from Transportation Research Board of the National Academies http://trt.trb.org/trt.asp?NN=Ca

Tsoukas, H. (2009). Craving for Generality and Small-N Studies: A Wittgensteinian Approach towards the Epistemology of the Particular in Organization and Management Studies. In D. A. Buchanan & A. Bryman (Eds.), *The Sage handbook of organizational research methods* (pp. 285-301). London: SAGE Publications Ltd.

Ukkusuri, S. V., & Patil, G. (2009). Multi-period transportation network design under demand uncertainty. *Transportation Research Part B: Methodological, 43*(6), 625-642.

Van de Ven, A. H., & Poole, M. (1995). Explaining development and change in organizations. *Academy of Management Review, 20*(3), 510-540.

Vowles, T. M. (2000). The geographic effects of US airline alliances. *Journal of Transport Geography, 8*(4), 277-285.

Wamba, S. F. (2012). Achieving supply chain integration using RFID technology: the case of emerging intelligent B-to-B e-commerce processes in a living laboratory. *Business Process Management Journal, 18*(1), 58-81.

Wang, Z.-Y., Li, G., Li, C.-Y., & Li, A. (2012). Research on the semantic-based co-word analysis. *Scientometrics, 90*(3), 855-875.

White, H. D. (2003). Pathfinder networks and author cocitation analysis: A remapping of paradigmatic information scientists. *Journal of the American Society for Information Science and Technology, 54*(5), 423-434.

Williams, Z., Lueg, J. E., & LeMay, S. A. (2008). Supply chain security: an overview and research agenda. *International Journal of Logistics Management, The, 19*(2), 254-281.

Wu, Y. C. (2003). Lean manufacturing: a perspective of lean suppliers. *International Journal of Operations & Production Management, 23*(11), 1349-1376.

Yazdanparast, A., Manuj, I., & Swartz, S. M. (2010). Co-creating logistics value: a service-dominant logic perspective. *International Journal of Logistics Management, The, 21*(3), 375-403.

Ye, M. H., & Yezer, A. M. (1992). Location and spatial pricing for public facilities. *Journal of Regional Science, 32*(2), 143-154.

Zhan, F. B., & Noon, C. E. (1998). Shortest path algorithms: an evaluation using real road networks. *Transportation Science, 32*(1), 65-73.

Zott, C., Amit, R., & Massa, L. (2011). The Business Model: Recent Developments and Future Research. *Journal of Management, 37*(4), 1019.