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The structure and evolution of business-to-business marketing: A citation and co-citation analysis

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ABSTRACT

The field of business-to-business (B2B) marketing has grown considerably in the past four decades. However the state of knowledge about its structure and evolution remains limited. Who are the key players and what are the key papers in B2B marketing? What main research topics have been investigated over time? This article answers these questions by applying bibliometric methods for the first time to the existing body of scholarly B2B research. The key findings reveal a highly dynamic discipline in the 1970s and 1980s, when new knowledge was being intensively exchanged among an increasing number of B2B researchers. Since that time, the pace of development has slowed, and diversification in the discipline manifested itself in a distinctive number of core research subfields. Yet initial research topics such as organizational buying behavior, where much research is still undone, are to a large extent not addressed by modern B2B scholars.

1. Introduction

Almost every scholar active in business-to-business (B2B) marketing holds intuitive beliefs about the evolution of the field, the development and connections across its main research fronts, and the most influential publications, authors, and journals. Yet these insights tend to be subjective, supported by virtually no confirmation with objective, data-based bibliometric approaches such as citation and co-citation analyses. Unlike other disciplines of similar maturity, literature generated by the scientific B2B community has not yet been analyzed systematically to reveal its intellectual development. This gap is astonishing, because a better understanding of a field's past enables researchers to assess its current structure and define avenues for research with greater sophistication (Culnan, 1986).

In the case of B2B marketing, retrospective studies are limited to general literature reviews, such as those published in a special issue of Journal of Business Research that outline the accomplishments of four B2B research outlets: Industrial Marketing Management (IMM), Advances in Business Marketing and Purchasing (ABMP), Journal of Business and Industrial Marketing (JBIM), and Journal of Business-to-Business Marketing (JBBM) (Johnston & Lewin, 1997; LaPlaca, 1997; Lichtenthal, Wilson, & Long, 1997; Plank, 1997). Some more comprehensive reviews, such as those provided by Webster (1978), Reid and Plank (2000), and LaPlaca and Katrichis (2009), examine the contents of B2B articles and classify them into topic areas, which again depends to a certain extent on the subjective views of their authors (Ramos-Rodriguez & Ruiz-Navarro, 2004). These studies show that the most frequently published research area in B2B marketing is organizational buying behavior (OBB), a primary focus of research activity when the field began (LaPlaca & Katrichis, 2009). Since then, various lines of B2B research have emerged to enlarge the field so much that investigations based solely on B2B publications cannot describe it accurately. For example, B2B researchers might draw regularly on publications that appear outside the discipline or on authors who function in parallel fields, yet these sources do not appear in literature reviews (White & McCain, 1998), despite their potential influence. This article focuses on how intra- and extra-disciplinary publications and their authors have influenced the growth of B2B marketing; therefore, it enhances prior research based on literature reviews and provides greater objectivity.

2. Literature review and research objectives

To attain a more in-depth analysis of the structure and evolution of B2B marketing, the present article applies citation and co-citation analyses for the first time to this particular subfield of marketing. To date there have been only a few bibliometric studies in marketing, including Hamelmann and Mazze (1973), who investigated the citation patterns among Journal of Marketing (JM), Journal of Marketing Research (JMR), and several other selected business and economics journals. Subsequent studies continued the examination of the field of marketing (e.g., Goldmann, 1979; Jobber & Simpson, 1985; Tellis, Chandy, & Ackerman, 1999), though the only subfields primarily investigated were advertising and consumer research (Cote, Leong, &

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Cote, 1991; Hoffman & Holbrook, 1993; Pasadeos, Phelps, & Kim, 1998; Pasadeos & Renfro, 1985). Studies dealing with the latter were the first to alter the unit of analysis, from journals to single articles, and conducted the first author co-citation analysis in marketing research (Cote et al., 1991; Hoffman & Holbrook, 1993). Yet only two other co-citation analyses are known to the authors to have appeared in the field of marketing to date (Pasadeos et al., 1998; Roth & Gmür, 2004). Not only does the present study extend the overall usage of this type of analysis within marketing, but it also offers a distinctive focus on the uninvestigated subfield of B2B marketing. The goals of the paper are thus twofold: to detect the most influential articles (and implicitly the most influential authors) and journals within the field, and to identify the main research fronts of B2B marketing and their interrelations, from the perspective of its members.

3. Methodology and data

3.1. Stepwise bibliometric approach

Citation and co-citation analyses are widely used bibliometric methods that support empirical investigations of the structure and scholarly activity of various disciplines (Üsdiken & Pasadeos, 1995). In line with this study's research objectives, the method featured a stepwise approach, similar to McCain's (1990), together with a previously conducted citation analysis. First, the reference lists of B2B articles from general marketing journals (Theoharakis & Hirst, 2002) and of all articles from the three leading B2B journals (IMM, JBIM, and JBBM; LaPlaca, 2008) were obtained from the Social Science Citation Index or collected manually for four multi-year periods (1972–1978, 1987–1991, 1998–2000, and 2007–2009 [through July]). Second, a citation analysis of these data revealed the publications, authors, and journals most cited by B2B scholars (objective 1). Third, co-citations across the 300 most cited authors were measured and weighted to detect their affinity as perceived by the citers (Gmür, 2003; White & Griffith, 1981). The outcome was an author × author similarity matrix, which served as the basis for further multivariate and social network analyses. Fourth, to depict the structure of the discipline (objective 2), the results of the analyses were mapped, such that clusters of co-citations represented different B2B subject areas (McCain, 1990; Small, 1973; White & Griffith, 1981). In contrast with literature reviews, such an analysis can reveal interrelations across different schools of thought and offers greater objectivity, because it is the outcome of a composite judgment of many citing authors (Bayer, Smart, & McLaughlin, 1990; White & Griffith, 1981). Therefore the analysis itself does not influence the outcome, because the allocation of authors to research areas is no longer based on the subjective, single views of the study authors (Ramos-Rodriguez & Ruiz-Navarro, 2004).

3.2. Citation analysis

The basic assumption underlying citation analysis is that citations reveal an influence of the cited paper on the citing paper (Culnan, 1987). Thus the sum of citations to a certain paper, author, or journal from a representative sample (i.e., B2B articles) offers an acceptable surrogate of that paper's, author's, or journal's influence on a corresponding research subject or field (Culnan, 1986). The comparison of the four periods investigated relies on a citation value (CV), calculated as the ratio of individual citations to the total citations in a specified period. Because publications are normally cited once per article,[3] the denominator for this unit of analysis equals the total number of investigated works. For authors or journals, the total number of citations equals the sum of all references, because multiple citations are possible in this case. Such multiple citations may distort assessments of their influence, so the analysis includes only authors for which the number of citing articles represents at least 30% of the sum of received citations (see also Waugh & Ruppel, 2004). For example the author Locke was eliminated in the first period, because his 12 citations result from only two articles. In total, 5 (9, 17, 27) authors were excluded from the analysis in the first (second, third, fourth) period. Although self-citations were not omitted from the calculations (Üsdiken & Pasadeos, 1995), they were weighted by 0.5 to limit the loss of information that would accompany their elimination (Glänzel & Thijs, 2004).

3.3. Co-citation analysis

A co-citation analysis is a form of bibliometric network analysis that, according to White (1990) and McCain (1990), can reveal the intellectual structure of scholarly research fields. It records the frequency with which two authors are cited together by a citing sample paper and thereby indicates their perceived affinity (Bellardo, 1980; Small, 1973). Clusters of closely related co-cited authors epitomize certain subject areas, research specialties, or schools of thought within the discipline (McCain, 1990) and can be interpreted as the field's view of itself (White & Griffith, 1981). Consequently this analysis provides an appropriate means of exploring the intellectual structure of a scientific discipline (Nerur, Rasheed, & Natarajan, 2008; White & Griffith, 1981). Many studies have validated the results of co-citation analyses as the structure they provide largely corresponds with the judgments of researchers in the field and other experts, such as research price committees (for assessments of citation analyses, see Gordon, 1982; Summers, 1984; Wade, 1975; for co-citation analyses, see Lenk, 1983; McCain, 1986; Mullins, Hargens, Hecht, & Kick, 1977; Small & Greenlee, 1980).

The determination of co-citation clusters can rely on various methods, which differ mainly in terms of the applied similarity value. Possible values include absolute co-citation counts, Pearson's correlation coefficients, and factor loadings (Nerur et al., 2008; Small & Griffith, 1974; White & McCain, 1998). In line with the research objectives of this study, it employs a similarity value introduced by Gmür (2003) that, compared with other values, offers especially well-balanced networks with distinctive clusters. To obtain a macroscopic view on the discipline, the single author was selected as the unit of analysis; by notating several publications according to their author, it becomes possible to reveal more information within the limited space of a network picture. Each author's name then represents all or part of his or her body of work and thus the major conceptual theme that this author (together with his or her co-authors) adopts (McCain, 1986; Nerur et al., 2008; White & Griffith, 1981). This approach offers broader insight into the field's structure than would an equal number of single publications (as the unit of analysis) depicted in a network picture.

To facilitate the comparison, the input for the co-citation analysis in all four periods is a similar absolute number of authors. Based on the CV the 300 most cited authors are selected. This threshold has proven sufficient as input for co-citation analyses in prior studies of similarly sized research fields, such as accounting, to identify the five to ten most influential lines of research per period (Chen & Paul, 2001; Meyer, Schäffer, Gmür, & Perrey, 2006). In case of a tied ranking of the 300th author, the cutoff value is altered to best match the threshold. Therefore the numbers of authors for the four periods are 304 (1972–1978), 320 (1987–1991), 293 (1998–2000), and 312 (2007–2009). Regarding the similarity value, Gmür (2003) has shown that absolute co-citation counts between authors are not suitable for generating clearly defined clusters; therefore this study uses a relative co-citation value, the CoCit score, as the measure of similarity between authors A and B. The absolute co-citation count is put in relation to each author's individual citation counts as follows:

$$CoCit_{AB} = \frac{(Cocitation_{AB})^2}{Minimum\,(Citation_A : Citation_B) \times Mean\,(Citation_A : Citation_B)}$$

where A = Author A and B = Author B.

[3] Negligible exceptions include different editions of a single monograph.

Two sparsely cited authors (both cited 40 times) with an equal absolute co-citation count (20 co-citations) compared with two heavily cited authors (both cited 100 times) with similar absolute values would thus receive a higher CoCit score (0.25 vs. 0.04), because the former are likely more closely related in terms of the content they publish. The CoCit score ranges between 0 and 1; multiple citations and co-citations of authors within one reference list are counted only once. On the basis of the CoCit score, the top 1.25% of the investigated co-citation relationships (i.e., author pairs) with a minimum of at least three absolute co-citations provided the input for further investigation. Because the number of author pairs in the early periods is significantly lower than in later periods (see Appendix A), a minimum input threshold of 175 pairs per period was applied to ensure sufficient insights into the intellectual structure for each period.[4] The selected co-citation relationships were visualized using UCINET 6 (Borgatti, Everett, & Freeman, 2002), with authors as nodes and lines between them representing respective co-citation relationships. The proximity of authors in the maps relates algorithmically (Fruchterman–Reingold algorithm) to their perceived affinity. The algorithm assumes that all nodes repel each other, yet between connected nodes there is an additional attractive force that ties together the diverging nodes. Starting with a random positioning, a stable system can be created through iterations (Fruchterman & Reingold, 1991), which position heavily co-cited authors nearer one another. They form a cluster if at least four authors are linked by at least five co-citation relationships. Authors linked to only one other author, so-called isolates, were eliminated. To confirm the detected structure of B2B marketing within the maps, a single-linkage cluster analysis also was conducted.

3.4. Database

The data used for the analysis came from the Social Science Citation Index (SSCI) (Garfield, 1979a) and consist of the bibliographies of 1392 B2B articles[5] published in IMM, JBBM, and JBIM and the leading marketing journals (MJ) (Theoharakis & Hirst, 2002). The selection of the B2B journals reflected their frequent characterization as leading journals in the field and their coverage of both applied and theoretical research (LaPlaca, 2008; Lichtenthal & Mummalaneni, 2009). Similar to LaPlaca's (2008) study, all articles from these journals appear in the investigation. Articles from the selected general marketing journals were classified as B2B-related according to a two-phase search: (1) the title, abstract, author keyword, or keyword plus included at least one of the following terms: *B2B, business-to-business, industrial marketing, business marketing* or (2) the title, abstract, author keyword, or keyword plus featured at least one topic-based keyword (i.e., *buyer–seller, business relation*, product development, buy*, behav*, supplier relation**)[6] together with at least one (truncated) B2B synonym (i.e., *organization*, industrial market*, B2B, business-to-business, business market**) (LaPlaca, 2008).[7] Thus B2C articles would not appear among the results of the second search. Only dedicated research contributions were included, thereby excluding letters to editors or book reviews.

To achieve a longitudinal study of the evolution of B2B marketing, the time frame was divided into four periods, each with a minimum length of approximately three years. The distance between periods was a minimum of six years, to reduce random short-term variations (Van Raan, 1996). The starting point of 1972 marked the beginning of a period of substantial growth for the discipline and the inaugural year of *IMM* as the first journal with a special focus on B2B topics (Reid & Plank, 2000). Comparable periods demand at least 200 B2B articles to be available and suitable for investigation, which led to the enlargement of the first two periods, for several reasons. First, the number of B2B articles published annually between 1972 and 1991 was considerably less than in the subsequent periods, after additional publication outlets had been introduced. Second, a significant proportion of articles in these periods did not cite any other article and thus could not be included in the study. Most of those articles were case-related studies; due to their applied focus, no references were needed, as was characteristic of the early stages of the case research tradition in B2B marketing (Lichtenthal & Mummalaneni, 2009). Any references without a specified author were removed from the analysis, such as statistical documents, publications by institutions, or articles in popular magazines. The final database thus consists of reference lists from 1106 articles published in three B2B journals and 286 B2B articles[8] published in other marketing journals, as summarized in Table 1.

Prior to the data analysis, a semi-automatic procedure checked for and corrected consistency and input errors, such as misspellings of names or missing volume or page numbers. Preceding editions of a single monograph also were updated to the most recent one in each period, and modifications to journal titles were recorded when evident. If very similar author names appeared, they were checked manually for homonyms to prevent biased results.

3.5. Major assumptions and drawbacks

The basic assumption of citation and co-citation analyses is that authors cite their influences, so that citations are appropriate surrogates for the influence of the cited work (Smith, 1981). Yet citing motives can differ tremendously (Üsdiken & Pasadeos, 1995); some authors cite other researchers not according to the content they publish but explicitly in a mutual agreement to increase citation counts (Garfield, 1979b) or to meet a quota set by the target journal (e.g., cite articles previously published in that journal). Because it is impossible to distinguish citations by motivation, such citing behavior may affect the study outcomes. However, the share of citations motivated by some factor other than actual influence is relatively small; most non-scientific motives also are controlled somewhat by review processes implemented by journals (Ramos-Rodriguez & Ruiz-Navarro, 2004). Regarding the unit of analysis, the main drawback is that only the first mentioned author of a reference gets recorded in the SSCI database and included in the co-citation analysis. The influence of co-authors thus may be underestimated (Garfield, 1979a), and some authors, depending on the rationale they use for ordering their names on an article, may be under- or overrepresented. Thus the names of the authors in the network pictures represent conceptual themes rather than the person him- or herself (Culnan, 1987; Nerur et al., 2008; White & Griffith, 1981).

4. Results of citation analysis

A citation analysis answers the question of how dynamically B2B knowledge gets generated and transferred over time (e.g. Osareh, 1996). The evaluation of knowledge transfer processes involved (1) citing behaviors, (2) origins of the references cited, and (3) characteristics of the key references.

First, the average number of citations serves as an indicator of the dynamics and state of a discipline's development. In Table 2, the average number of references per article increased steadily from 10.92 for 1972–1978 to 58.53 (+436%) for 2007–2009. This finding is consistent for both the B2B journals and the major marketing journals and indicates the significant growth of a B2B-specific knowledge base that has stimulated and differentiated ongoing knowledge generation. Furthermore, the expansion of electronic databases considerably

[4] Analyses for other thresholds are available on request.

[5] *JBBM* and *JBIM* were not listed in the SSCI in all time periods; 188 articles with 6393 references published in these journals thus were manually collected.

[6] These terms are the most frequently encountered keywords listed by *IMM* articles between 2005 and 2009.

[7] The * symbol indicates that the search results include different endings of these words.

[8] The distribution of articles according to origin is available on request.

Table 1
Database.

		1972–1978	1987–1991	1998–2000	2007–2009	Total	
No. of B2B articles published		294	299	367	562	1522	
No. of analyzed articles		218	263	359	552	1392	(100%)
Articles of database	IMM	207	185	139	212	743	(53.38%)
	JBIM		62	84	132	278	(19.97%)
	JBBM			42	43	85	(6.10%)
	MJ	11	16	94	165	286	(20.55%)
No. of analyzed references		2381	4493	15,955	32,454	55,283	(100%)
References in database	IMM	2250	3271	5223	13,446	24,190	(43.76%)
	JBIM		715	3090	6363	10,168	(18.39%)
	JBBM			2588	1714	4302	(7.78%)
	MJ	131	507	5054	10,931	16,623	(30.07%)

facilitated both the acquisition and diffusion of B2B knowledge, which likely explains the disproportionate increase between 1987–1991 and 1998–2000 (+144%). In contrast, the aging of cited references, such that their average age increased from 7.64 to 13.02 (+70.4%), implies stagnation in the discipline's evolution. However, through the appearance of classic works with persistent impact on a discipline's knowledge base such aging effects are relatively common in scientific disciplines. The self-citation ratio offers another indicator for exploring research dynamics. The lack of alternative references pushes authors from younger research areas to cite themselves more than do authors from established research areas (Garfield, 1979b; Porter, 1977). Thus the decrease in the self-citation ratio, from 6.88% in the first period to 2.99% in the fourth, indicates the maturation of B2B marketing as a scientific discipline.

Second, the origin of the references cited indicates knowledge transfer and generation processes. From the 1972–1978 to the 2007–2009 period, the influence of journals increased constantly, from 46.28% to 78.71% (see Appendix B). However, this development reflects the general importance of scientific journals for knowledge generation, not a trend specific to B2B marketing. Against this background, seven journals emerged with a CV greater than 2.0% for all investigated periods (see Appendix B); of these seven journals, JM (9.83%), JMR (4.85%), and IMM (4.50%) influenced B2B marketing most. In the three latest periods, the journals received approximately one out of five citations. Thus it seems reasonable to assume that the high reputation and broad thematic focus of the two general marketing journals favored their leading positions. In this context, it is noteworthy that IMM as a specialized B2B journal receives almost as many citations as JMR. However, an analysis that considers only citations from B2B authors that have published in general marketing journals reveals that IMM is considerably lower ranked (see Table 3), though compared with other specialized B2B journals, it is clearly the leading B2B research outlet. This status might partly reflect its comparatively longer publication history (JBIM since 1986; JBBM since 1993) and resulting first-mover advantage. Furthermore, psychology-oriented journals, such as Journal of Applied Psychology (0.63%) and Psychological Bulletin (0.45%), have minor impacts on B2B research, which indicates that the influence of psychological research on general marketing research (Johnson, 2006) may not apply to the B2B discipline.

Third, the characteristics of key references, including the identification of each period's most cited publications, reveals prominent scholars and key subjects driving the discipline at different points in time. Tables 4 and 5 list the ten most cited publications; no publication spans more than two periods, though the differences in their fluctuations between certain periods are instructive. Other than books published by Kotler (1976) and (1988); Robinson, Faris, and Wind (1967); and Webster and Wind (1972), the first three periods contain unique references; i.e. no other publications were ranked among the top ten in one of the preceding periods. In contrast, in 2007–2009, six of ten references also appeared in the 1998–2000 period, which implies some reduction in innovativeness and establishment of classics.

The key reference analysis also provides evidence of a change in subject focus. Buying behavior and marketing classics such as Porter's competitive strategy dominate the two initial periods, but a shift toward relationship marketing, especially buyer–seller relationships, becomes clear in the third and fourth periods. As in other marketing areas, these periods feature increasing interest in statistics and methodological foundations (e.g., Anderson & Gerbing, 1988; Nunnally & Bernstein, 1994).

Table 2
Citing behavior.

	Period			
	1972–1978	1987–1991	1998–2000	2007–2009
Average number of references	10.92	17.15	41.86	58.53
Average age of references (years)	7.64	8.80	11.64	13.02
Self reference ratio	6.88%	5.36%	4.15%	2.99%

Note:
Reid and Plank (2000) have not been included, because their 966 citations would bias the results.

Table 3
Division of journal citations according to the origin of the citing article over all periods.

Cited journal	Citing journal(s) (based on origin of the citing articles of the database)									
	Total		IMM		JBIM		JBBM		MJ	
Name	CV	#	CV	#	CV	#	CV	#	CV	#
JM	9.83%	1	9.36%	1	9.95%	1	11.46%	1	10.02%	1
JMR	4.85%	2	4.44%	3	4.52%	3	4.98%	2	5.37%	2
IMM	4.50%	3	6.91%	2	5.18%	2	4.59%	3	1.85%	11
SMJ	2.40%	4	1.77%	7	1.29%	10	1.50%	8	3.60%	4
HBR	2.36%	5	2.65%	4	2.12%	6	2.55%	5	2.15%	7
JPIM	2.21%	6	1.13%	12	0.72%	18	0.67%	20	4.07%	3
JAMS	2.07%	7	1.81%	5	2.30%	4	2.43%	6	2.18%	6
…	…	…	…	…	…	…	…	…	…	…
JBIM	0.96%	16	0.83%	16	2.29%	5	1.50%	8	0.47%	31
JBBM	0.42%	29	0.26%	40	0.36%	31	3.83%	4	0.17%	63

Note:
Reid and Plank (2000) and Lichtenthal, Mummalaneni, and Wilson (2008) were excluded to prevent bias; these articles analyze the body of literature and thus cite particular journals more than is average (IMM 362 times, JBBM 163 times). Abbrevations can be found in the Appendix.

Table 4
Key references (1).

1972–1978			1987–1991		
Rank	Author(s)	CV	Rank	Author(s)	CV
1	Robinson et al. (1967)	11.93%	1	Kotler (1988) (3)	11.79%
2	Webster and Wind (1972)	10.01%	2	Ames and Hlavacek (1984)	6.08%
3	Kotler (1976)	7.80%	3	Robinson et al. (1967) (1)	5.32%
3	Sheth (1973)	7.80%	4	Porter (1980)	4.94%
5	Buckner (1967)	5.05%	5	Hutt and Speh (1985)	4.56%
5	Green and Tull (1975)	5.05%	5	Webster (1984)	4.56%
7	Webster (1965)	4.13%	5	Webster and Wind (1972a) (2)	4.56%
8	Cardozo and Cagley (1971)	3.67%	8	Johnston and Bonoma (1981)	4.18%
8	Cyert and March (1963)	3.67%	8	Webster and Wind (1972b)	4.18%
8	Howard and Sheth (1969)	3.67%	8	Wind and Cardozo (1974)	4.18%

Table 5
Key references (2).

1998–2000			2007–2009		
Rank	Author(s)	CV	Rank	Author(s)	CV
1	Dwyer et al. (1987)	15.88%	1	Morgan and Hunt (1994) (2)	22.55%
2	Morgan and Hunt (1994)	15.04%	2	Dwyer et al. (1987) (1)	19.20%
3	Armstrong and Overton (1977)	10.86%	3	Fornell and Larcker (1981)	16.30%
4	Anderson and Narus (1990)	9.75%	4	Armstrong and Overton (1977) (3)	15.76%
5	Ganesan (1994)	9.33%	5	Yin (2003)	15.04%
6	Nunnally and Bernstein (1994)	9.19%	6	Nunnally and Bernstein (1994) (6)	13.77%
6	Webster (1992)	9.19%	7	Anderson and Gerbing (1988)	13.59%
8	Hakansson (1982)	8.08%	7	Anderson and Narus (1990) (4)	13.59%
8	Pfeffer and Salancik (1978)	8.08%	9	Ganesan (1994) (5)	11.18%
10	Williamson (1985)	7.80%	10	Doney and Cannon (1997)	10.33%

5. Results of co-citation analysis

The co-citation analysis reveals the main research fronts within the field of B2B marketing. This section starts with an overview of the size and composition of the research networks arising from co-citation relations among the most cited authors in each period. Afterwards we visualize each co-citation network, with the clusters described according to their structure and content. By comparing the networks across four periods, the co-citation analysis responds to the question of how B2B knowledge has developed structurally over time.

5.1. Size and composition of research networks

As Appendix A shows, from the first to the fourth periods, the number of co-cited author pairs (3) and authors within each period's network (6 and 8) increases steadily. This development correlates with the growth of the discipline and indicates a widening of the B2B knowledge base. The large increase of connectivity (4) between 1987–1991 (12.67%) and 1998–2000 (54.15%) moreover suggests stronger interrelations between researchers and their topics of interest in the later periods. The assessment of the composition and structure of the identified research networks relies on three measures, size, ties, and pairs, which are frequently used in social network analyses (see Van den Bulte & Wuyts, 2007; Wasserman & Faust, 2007). The figures, calculated for each author (including isolates) within the network, characterize the role and position that a focal researcher represents. The summarized values for the various authors in each period in Appendix C can be calculated as follows: Size is the number of other authors with whom a focal author has a co-citation relationship; they form his or her ego network (Wasserman & Faust, 2007). The derived research networks then consist of series of ego networks, in which ties is the number of actual links and pairs is the number of contingent links across all authors (with whom the focal author has been co-cited) in an ego network (Morlacchi, Wilkinson, & Young, 2005). The research network for 1987–1991 is characterized by authors with comparatively few co-citation relationships (size) and ego networks with only a few links (ties) (Appendix C). Therefore, isolated pairs, two authors only co-cited with each other, and co-citation chains (i.e., strings of co-citations with no significant cross-links) are likely to occur often in this period, which implies a less concentrated or interrelated research field (Gmür, 2003). Because these pairs and chains are irrelevant according to the cluster requirements, they get eliminated, which explains the high rate of elimination (7) in this period (Appendix A). In the first and, to some extent, last period, the high value of the pairs' measure suggests multiple connected ego networks, which result in rather large or multi-linked clusters of co-cited authors.

In general the size of a cluster, measured by the number of authors, indicates the significance of the corresponding research field. Its density, or the relation of the number of actual and possible links between authors, shows the proximity of authors and the cluster's coherence (Gmür, 2003). In the networks in Figs. 1–4, the relative size of the nodes indicates the centrality of each respective author, increasing according to the number of other authors co-cited with that focal author. A large node also implies that the author's works play a major role for the topical orientation of the cluster. Thus the node often serves as a starting point for detecting the cluster's thematic points of focus and can be examined, along with the other authors' basic sources. Those authors who have already appeared in a map in the previous period are marked by gray rhombuses. The lines between authors represent co-citation relationships, based on the CoCit score. Thicker lines indicate higher CoCit scores and thus closer relationships between the co-cited authors.

5.2. Co-citation network 1972–1978

The first co-citation network comprises 46 of the 304 most cited authors of the period, which is the fewest authors of all periods. It consists of two clusters and one triplet, all unconnected.

Cluster I is considerably larger in size than Cluster II, with its 35 authors. Despite its rather low density of 22.35%, it has a distinctive topical focus: organizational buying behavior. The cluster's dominant authors are Cardozo, Sheth, Wind, Webster, and Robinson, who propose different structural models of buying behavior (e.g., Robinson et al., 1967; Sheth, 1973; Webster & Wind, 1972). The size of the cluster and the finding that all central authors also appear among the top ten most cited publications in this period (see Table 4) reflects the outstanding significance of this subtopic for B2B researchers in the 1970s. Cluster II is essentially the opposite of Cluster I in terms of size (8 authors) and density (64.29%). Its main focus is personal selling and sales force performance, especially detailing the characteristics and success factors for personal interactions in sales processes.

5.3. Co-citation network 1987–1991

Compared with the previous network, there are more authors and clusters in this era, in line with the general growth of B2B research activity in the 1980s and its more differentiated structure. The corresponding network includes 64 authors spread over six clusters and three triplets. Both organizational buying behavior (Cluster I) and personal selling and sales force performance (Cluster V) again emerge in this period, though with mostly different authors. That is, these research areas were developed further by new, upcoming researchers, who replaced the previously dominant authors.

According to the size of Cluster I, organizational buying behavior research continued to have a significant influence on B2B researchers during 1987–1991. In Cluster V, the change in authors was even more dramatic, in that none of the authors from previous Cluster II appeared anymore. This fluctuation reflects the research dynamic in play during this time period, which prompted a change in the research objectives for personal selling and sales force performance literature. The eight authors in this cluster deal primarily with fluctuations in the sales force, examining the influence of organizational and personal factors on the satisfaction and loyalty of sales personnel.

All other clusters in this network emerged for the first time, including the large, homogeneous Cluster III, focused on response rates in industrial mail surveys and market research through questionnaires. Cluster IV is the smallest cluster, according to the clustering routine, which matches Frazier, Spekman, and O'Neal's (1988) assertion that just-in-time exchange relationships have not

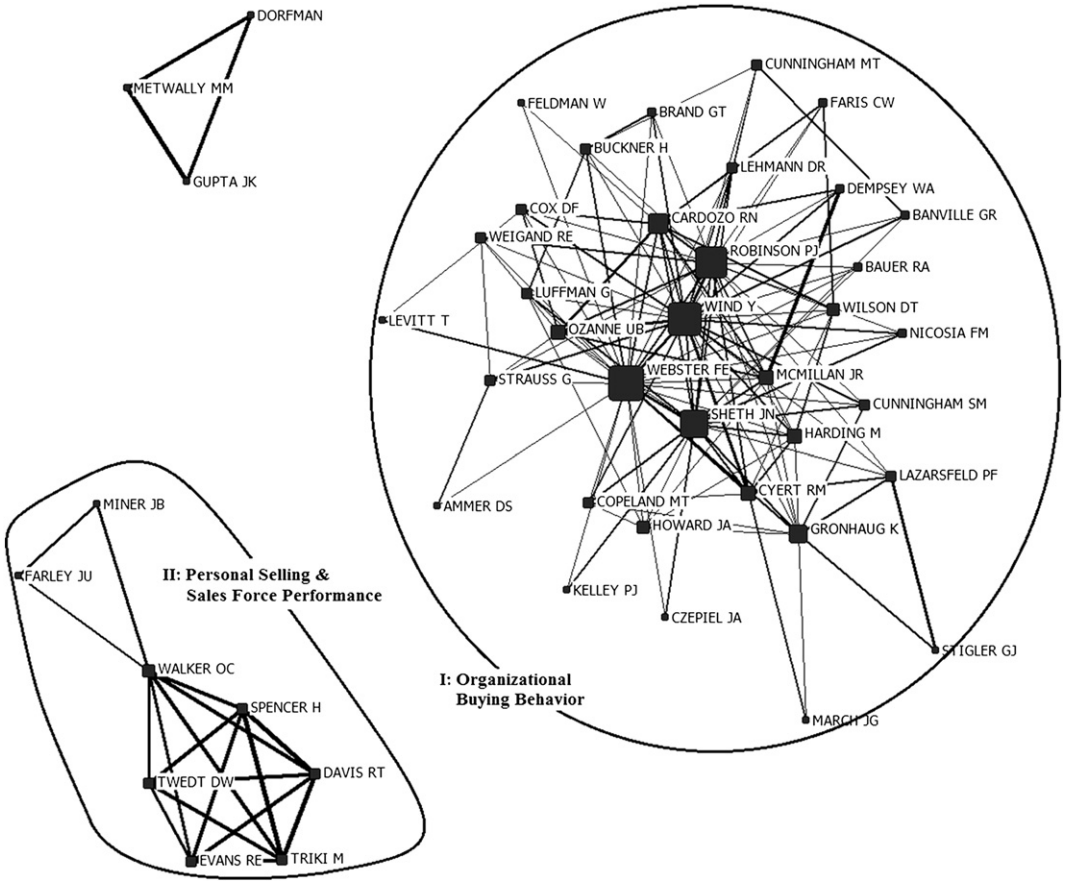

Fig. 1. Co-citation network 1972–1978.

received much attention in marketing literature. The seven authors in Cluster VI deal with research objectives pertaining to channel (and distribution) management, a core aspect of B2B marketing. The key authors of this cluster, Narus and Stern, tend to analyze management issues, such as the motivation of intermediaries, as essential to the value chain for B2B firms. Through Porter, this channel management subfield links to Cluster II, where the central author Monroe, along with the other six authors of this cluster, address pricing strategies and practices. Because pricing and channel management are both integral to the marketing mix in B2B selling processes, the interrelation is comprehensible. Nonetheless, it is noteworthy that this link marks the first time that clusters are not isolated but connected by co-citation relationships between particular members.

5.4. Co-citation network 1998–2000

The co-citation network for 1998–2000 is significantly larger, with 112 authors, only 16 of whom were present in the third period's network. These many new researchers often deal with new lines of research, so the topical structure of the focal period has changed considerably. The number of connected clusters, compared with the previous period, also has increased; for example, Clusters IV and VII and Clusters III and VI are interlinked. In addition, subgroups (G-I to G-III) — which do not meet the requirements for a true cluster but still indicate an interrelation in the cluster analysis — form a chain in the network together with Cluster II. The interrelation of the linked subfields indicates either a common research orientation or a common methodological grounding for the citing publications. Clusters III and VI for example are linked by authors such as Churchill, Armstrong, Gerbing, Bentler, Bagozzi, and Joreskog that engage in quantitative research. The research orientation of these two clusters also is somewhat similar and, together with the subgroups G-II and G-III, devoted to special research subfields related to the newly emerging topic of relationship marketing. Whereas in prior periods, such subfields were represented by particular groups of authors within one large cluster, the scientific discussion in the third period became so differentiated that more specialized research subfields possess a sufficient number of co-citations to form individual clusters. Moreover, the linkages between content-related clusters point to synergies and interactions across certain B2B research activities, during the process of comprehensive knowledge creation.

Regarding lines of research within this network, relationship marketing as a research paradigm for business markets is a focal topic. In contrast with former B2B research, it is not the discrete transaction but the establishment of long-term business relationships with transaction partners that is the subject of investigation (Mattson, 1997) and the topical focus of Cluster III (buyer–seller and channel relationships). This field also features research on channel selection and channel management (Payne & Frow, 2004). The accompanying Cluster VI consists of six authors dealing with personal selling issues, such as salesperson motivation and commitment. As indicated by the recurrence of Johnston as an author, the cluster has a long research tradition that can be traced back to the first co-citation network, 1972–1978. The interconnected subgroups G-II and G-III are also topically related to relationship marketing. Specifically, the scope of G-II centers on business networks, with six IMP members who represent the IMP Group's network and interaction approach. Its mean density is 46.67%, and Hakansson is the dominant author in terms of the absolute number of co-citation relationships with other cluster members. The network is linked through Pardo (another IMP member) to G-III, which deals with key account management as a basis for long-term customer relationships, and through Bello to Cluster II, which focuses on export strategy.

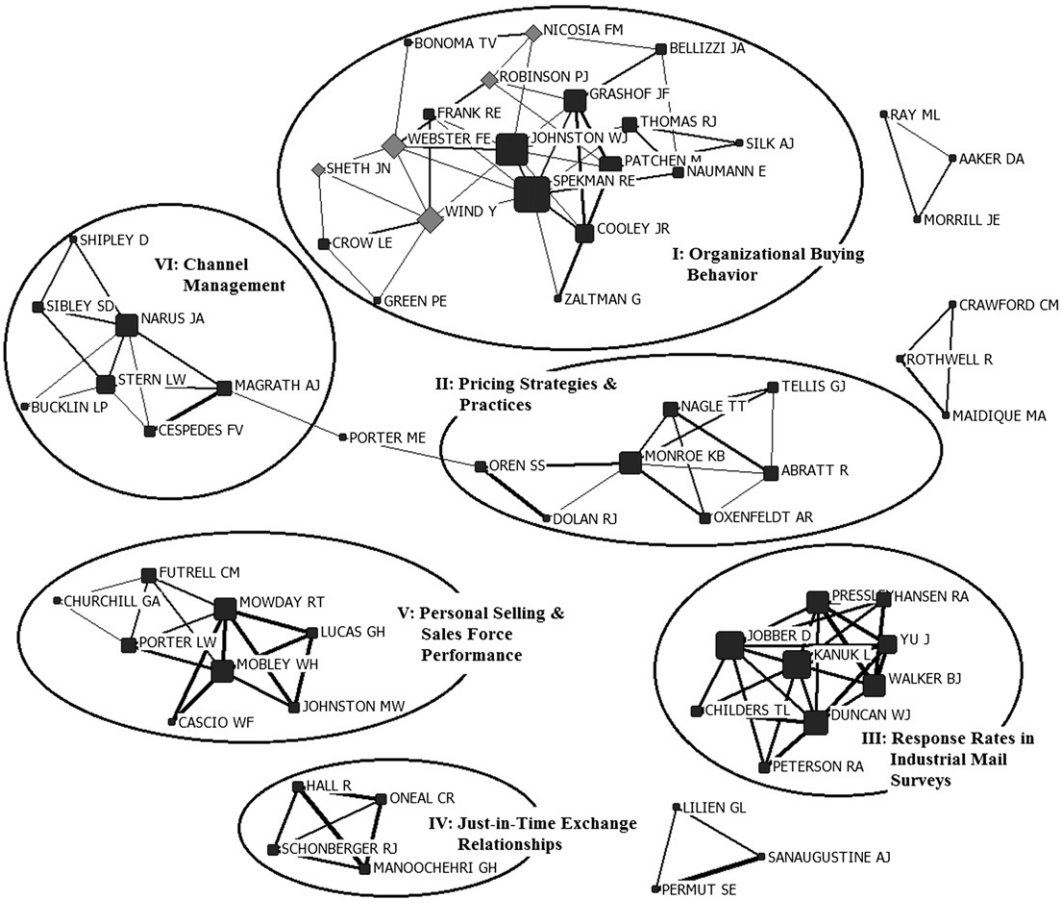

Fig. 2. Co-citation network 1987–1991.

Beyond relationship marketing, research in the third period is heavily influenced by new product development (NPD) research; the corresponding Cluster IV contains 30 authors and is the largest cluster in the network. Compared with the previous period, when this line of research was represented by only three authors, the cluster has increased tenfold, emphasizing the significant growth of research in this particular field and the growing importance of NPD in industrial markets. Through Sinkula and Zaltman it is connected to Cluster VII, market orientation, where eight authors deal with the interfunctional processing of market information as a means to improve firm adaption to consumer needs and other market conditions (Jaworski & Kohli, 1993; Jaworski & Kohli, 1996). The remaining two clusters are both isolated but possess different sizes and histories. Cluster V is medium-sized; its topic, services marketing, appears for the first time in the co-citation maps. Cluster I is the second-largest cluster for this period and has existed since the first co-citation network. Thus, organizational buying behavior has had a steady impact on the discipline and its authors. Despite this cluster's long history, many authors appear for the first time, so the dynamism in this field is still high.

5.5. Co-citation network 2007–2009

In the co-citation network of the fourth period, the number of authors (117) is similar to that in the previous period, but the number of clusters and subgroups decreases slightly. In particular, after three consecutive, consistent periods, no cluster deals with organizational buying behavior in the 2007–2009 network. Apparently authors interested in this topic are no longer sufficiently co-cited, which suggests the declining research activity in this field compared with other B2B research areas since the 1990s (LaPlaca & Katrichis, 2009). Nevertheless the topic remains underresearched; for example, the field lacks general information about preference building processes within the buying center. The personal selling topic has undergone a similar development, in that it does not appear in this co-citation map.

The key results for this last network include the increased number of linkages between the research subfields, the large number of reappearing authors, and the first formation of methodological clusters. First, the clusters in the current network link to one another directly or indirectly, forming a coherent array, in which only subgroup G-I is not connected. Therefore, modern B2B researchers regularly draw on ideas from different schools of thought and apply a combination of them to modern research questions. Second, 51 of the 117 authors have not changed compared with those listed in the previous period, and accordingly, the majority of the eight identified lines of research continue to focus on topics that were present already in the third period network. The minor fluctuation in the topical orientation and composition of the clusters indicates decelerating research dynamism for B2B marketing, consistent with the results of the citation analysis. Third, authors who use clearly related methodologies, whether quantitative or qualitative, form their own clusters (IV and VI) for the first time, which indicates the growing use of such methods (e.g., structural equation modeling, case studies). The connection of Cluster VI through the author Yin to a group of IMP Group researchers, who frequently draw on case methods (e.g., Halinen & Törnroos, 2005), makes it reasonable to assume that the two methodology clusters are positioned near other thematic clusters to which they are predominantly related or applied. In case of Cluster IV (quantitative methods) these are the topics market orientation and, as in the previous period, buyer–seller relationship marketing. General conclusions about the influence of methodology on B2B research need further validation though.

Finally, it is noteworthy that in this network many clusters clearly increased in size, such as Cluster III, business networks, which

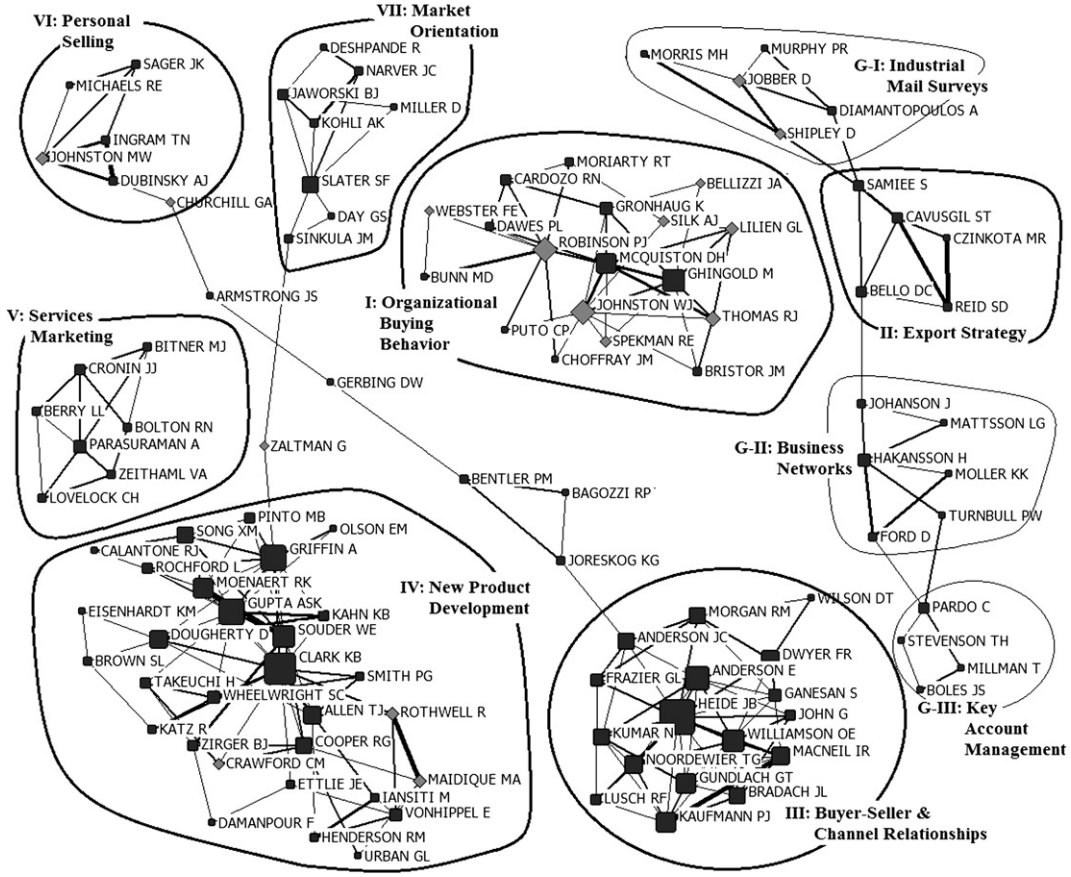

Fig. 3. Co-citation network 1998–2000.

underwent duplication and became a true cluster rather than a subgroup (G-II). This development reveals the increasing influence of the network approach for citing authors in 2007–2009 and the strong role of the IMP Group within the B2B marketing discipline.

6. Conclusion

Cronin (1998, p. 48) calls citations "frozen footprints in the landscape of scholarly achievement" that reveal interaction patterns among researchers and thus evidence of a discipline's structure (Üsdiken & Pasadeos, 1995). A few studies have described the state and evolution of B2B marketing, but no study has used the vast amount of citation data available for this purpose. To enhance prior research and assess the intellectual structure of B2B marketing through a different perspective, this article applies bibliometric methods for the first time to this research field.

Regarding the first research question, the findings of the citation analysis reveal a picture of B2B marketing that is characterized by continuous growth and an increasing number of cited publications and authors. The initially low age of sources and the high fluctuation within the rankings of the most cited articles in each period depict a highly dynamic field with short research cycles in the initial analysis periods. Among the cited works, Robinson et al. (1967) and Webster and Wind (1972a) emerge as classics that provide the foundation for the field. Over time citations of these publications decline as the thematic differentiation of the discipline increases and their basic concepts become universally accepted (Ramos-Rodriguez & Ruiz-Navarro, 2004). Other works, such as those by Morgan and Hunt (1994) and Dwyer, Schurr, and Oh (1987), with a more distinctive research focus take their place in terms of citations and contribute to the coming of age of the discipline. Such increasing maturity occurs together with reduced research dynamism since the most cited articles in the last two periods are quite similar. Moreover, the growing use of articles published in journals and the decreasing level of self-citations, as are common in younger disciplines, supports the notion of maturation in this era.

The subsequent co-citation analysis traced the evolution of B2B marketing, as summarized in Fig. 5, by detecting and comparing different research fronts in each period. The size of the labels represents the size of the clusters in the co-citation networks.

In this context, four key findings emerge. First, the increasing number of authors and clusters into the last period reflects the growth and diversification of the discipline. Second, its fading research dynamism, as also detected by the citation analysis, is supplementary confirmed by the decreasing fluctuation of cluster members and topics within the networks over time. Third, the increasing interaction of B2B subfields over time suggests convergence in the core B2B subfields, resulting in the establishment of a common knowledge base. Isolated approaches thus get replaced increasingly by combined research designs. Synergies across core research directions enable the joint application of different schools of thought to special research issues by contemporary authors. Fourth, considering the topical breadth of B2B marketing research, it becomes obvious that personal selling and organizational buying behavior were the initial focus of the discipline, in compliance with LaPlaca and Katrichis's (2009) literature review findings. Over time though, these research areas have been deserted by B2B researchers, although they remain underresearched. In the past 20 years, interactions among industrial transaction partners, as expressed by the period-spanning buyer–seller relationship topic, came to dominate scientific discussions. More and more specialized approaches, including some with methodological backgrounds, additionally become the focus of scientific efforts in the field of B2B marketing.

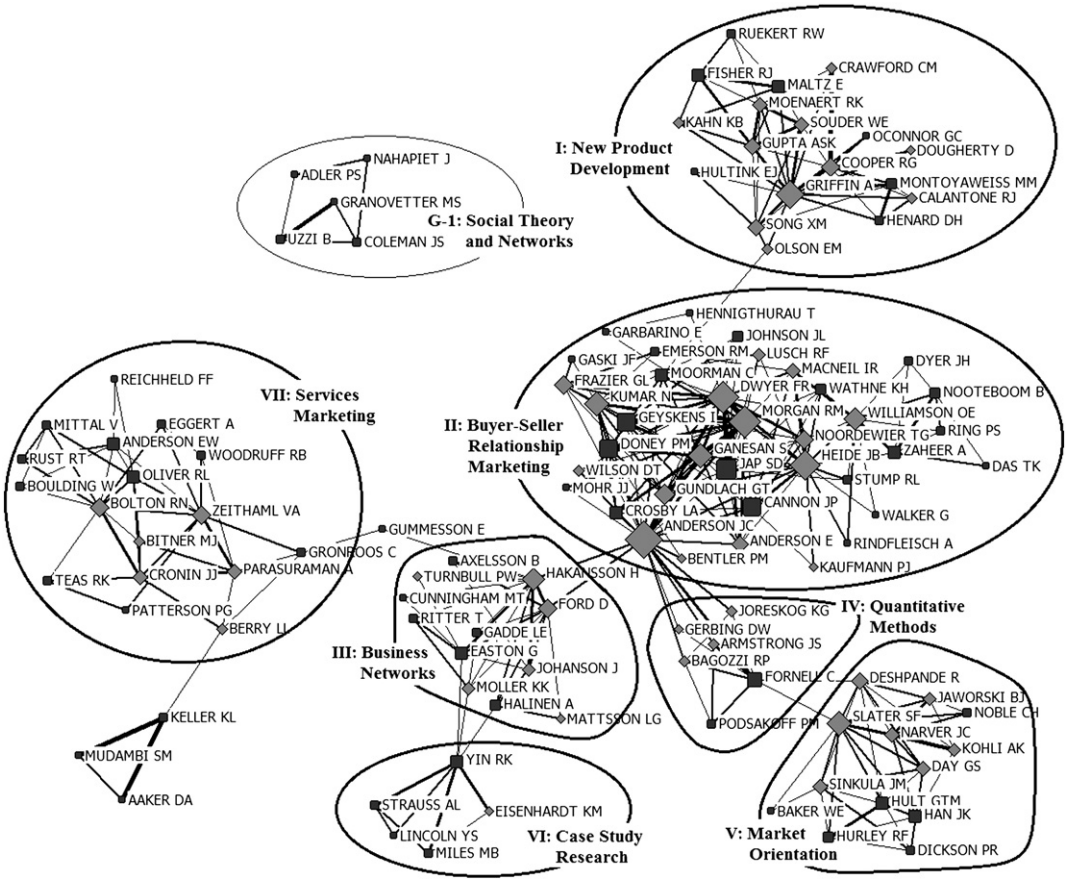

Fig. 4. Co-citation network 2007–2009.

Thus the diversification of the discipline parallels an increasing connectivity of core B2B research areas and more comprehensive exchanges of relevant knowledge. However, the true degree of diversification in the discipline is hard to assess, because upcoming and specialized research fields usually lack sufficient co-citation relationships to compose their corresponding clusters. This trend may be fostered by deviations in the topical orientation of the articles in both B2B and general marketing journals. Because articles in a particular group of journals might focus on different sets of topics, with their unique references, such distinctive issues probably do not become manifest in the results of a cross-journal citation analysis. Furthermore, the share of B2B articles from general marketing journals increased to 30% of the data population in the last period, so it is likely that only the core B2B research fields receive enough citations from both groups to be revealed in a co-citation analysis.

7. Limitations and further research

Inevitably, the findings of this study are limited by certain caveats that deserve mention. Such limitations result from the research design

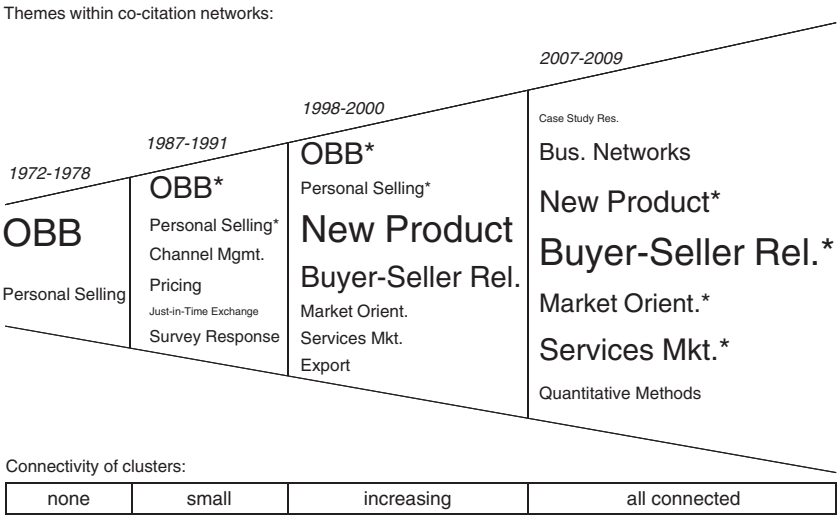

Fig. 5. Overview on the evolution of B2B marketing. Note: The size of the letters reflect the size of the clusters; the asterisk (*) indicates reappearing themes. OBB = organizational buying behavior, Mgmt. = Management, Rel. = Relationships, Orient. = Orientation, Mkt. = Marketing, Res. = Research.

and the data set, as well as from the applied bibliometric methods. Regarding the data set, the main drawback is multi-authorship, as previously noted. Moreover, orthographic errors, inconsistencies, and homonyms (i.e., two different authors with the same name) could be distinguished only with further investigation (Baker, 1990; Smith, 1981). Baird and Oppenheim (1994) estimate that approximately 20% of the records in the ISI database are erroneous; however, to prevent possible bias, the data set for this study was thoroughly checked and corrected. Regarding the research design, the selection of B2B articles relied on the choice of the three B2B journals and keywords searches of other marketing journals, so the scope of the investigation is automatically limited. Other keywords or a wider selection of journals might alter the results — and the picture of B2B research thus developed. However, it is reasonable to assume that the articles analyzed herein represent the main research efforts in the discipline, because the results are largely congruent with those from existing literature reviews. The investigative division into four periods also influences the study outcomes, though this split accords with the example of prior citation studies (e.g. Pasadeos et al., 1998; White & McCain, 1998) and ensures a sufficient population.

This study also is subject to limitations inherent to the bibliometric methods. The applied analyses are retrospective in nature, so developments in the discipline appear in the citation and co-citation structures only after some time has passed; a publication must be exposed to the scientific community for a while before it will be cited enough times to appear in the results (McCain, 1986). Works published toward the end of a certain investigation period have had less time to be cited, so they tend to have lower citation counts compared with previously published works (Ramos-Rodriguez & Ruiz-Navarro, 2004). Even taking these restrictions into account though, the picture of B2B marketing research drawn herein is unlikely to change radically. Another drawback of co-citation analysis is important to mention though: In contrast with its composition, which is based solely on the consensual judgment of the citing authors, interpretations of the co-citation networks are subjective, yet based on the body of writing provided by the mapped authors. Therefore the results of this study are intended to enhance prior research about the evolution of B2B marketing and need to be reflected accordingly.

On the whole, citation and co-citation analyses create valid representations of the intellectual structure of a field. Further research could increase the focus of this picture, such as by broadening the scope of investigation by compiling the citations of all authors of a publication, not just the first mentioned one. The CV of certain co-authors is likely to increase in this case, which would affect the composition of the co-citation clusters (Gmür, 2003). However, the topical structure of the discipline should remain mostly unchanged, because the research orientation of co-authors already has been subsumed under the first author's name (Culnan, 1987). Moreover, to detect even small structural changes in the topical orientation of B2B marketing research, the analysis could focus on a more detailed level, such as choosing single documents instead of authors as the unit of analysis (White & Griffith, 1981). This more microscopic view of the discipline (Bayer et al., 1990) would use nodes in each network's cluster equal to only one publication. For cluster formation, solid co-citation relationships between single works are sufficient, so smaller subfields or different streams of research contained within one major topic could be investigated to reveal niche fields.

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Appendix A. Size of research networks

		1972–1978	1987–1991	1998–2000	2007–2009
(1)	Authors included in co-citation analysis [Top 300]	304	320	293	312
(2)	Contingent number of co-cited author pairs $[(1)\times((1)-1)/2]$[a]	46,056	51,040	42,778	48,516
(3)	Actual number of pairs	3951	6469	23,162	30,728
(4)	Connectivity [(3)/(2)]	8.56%	12.67%	54.15%	63.34%
(5)	Pairs in network [Top 1.25% (min. Top 175 pairs) and min. 3 absolute co-citations]	175	177	290	385
(6)	Authors in network	70	129	173	181
(7)	Eliminated isolates (share of (6))	24 (34.3%)	65 (50.4%)	61 (35.3%)	64 (35.4%)
(8)	Visualized authors [(6)–(7)]	46	64	112	117

Note:
[ ] = Threshold or Calculation.
[a]Calculation based on combinatorial analysis $\binom{n}{k} = \frac{n!}{k!\cdot(n-k)!}$ with n = number of authors and k = 2.

Appendix B. Origin of references

	Period				
	1972–1978	1987–1991	1998–2000	2007–2009	Total
References from journals	46.28%	67.35%	69.26%	78.71%	73.73%
Top 10 journals cited	JM (6.76%)	IMM (8.72%)	JM (10.05%)	JM (10.07%)	JM (9.83%)
	JMR (5.00%)	JM (8.21%)	JMR (4.86%)	IMM (4.69%)	JMR (4.85%)
	HBR (5.74%)	JMR (4.87%)	IMM (4.20%)	JMR (4.52%)	IMM (4.50%)
	IMM (2.56%)	HBR (4.72%)	HBR (2.56%)	SMJ (2.87%)	SMJ (2.40%)
	ASQ (1.76%)	BH (1.58%)	JPIM (2.16%)	JAMS (2.54%)	HBR (2.36%)
	JSCM (1.64%)	MS (1.14%)	SMJ (1.73%)	JPIM (2.15%)	JPIM (2.21%)
	RTM (0.92%)	JSCM (1.07%)	JAMS (1.53%)	HBR (1.88%)	JAMS (2.07%)
	MS (0.80%)	JBR (1.05%)	ASQ (1.51%)	JBR (1.88%)	JBR (1.59%)
	JAPPSY (0,76%)	JAR (1.02%)	JPSSM (1.41%)	ACAMR (1.81%)	ACAMR (1.56%)
	AMSOR / CMR / EJM / JB (0.63%)	JPIM (0.93%)	JBR (1.39%)	ACAMJ (1.60%)	ASQ (1.52%)

Abbreviations:
ACAMJ: Academy of Management Journal, ACAMR: Academy of Management Review, AMSOR: American Sociological Review, ASQ: Administrative Science Quarterly, BH: Business Horizons, EJM: European Journal of Marketing, HBR: Harvard Business Review, IMM: Industrial Marketing Management, JAMS: Journal of the Academy of Marketing Science, JAPPSY: Journal of Applied Psychology, JAR: Journal of Advertising Research, JB: Journal of Business, JBR: Journal of Business Research, JM: Journal of Marketing, JMR: Journal of Marketing Research, JPIM: Journal of Product and Innovation Management, JPSSM: Journal of Personal Selling and Sales Management, JSCM: Journal of Supply Chain Management [former: International Journal of Purchasing and Materials Management resp. European Journal of Purchasing and Supply Chain Management], MS: Management Science, RTM: Research Technology Management [former: Research Management], SMJ: Strategic Management Journal.
Note:
Reid and Plank (2000) and Lichtenthal et al. (2008) were excluded to prevent bias; these articles analyze the body of literature and thus cite particular journals more than is average (IMM 362 times, JBBM 163 times).

Appendix C. Ego network measures including isolates

		1972–1978	1987–1991	1998–2000	2007–2009
Size	Mean	5.0	2.74	3.35	4.24
	Standard deviation	5.89	2.36	2.75	4.29
Ties	Mean	10.16	2.05	2.83	6.35
	Standard deviation	18.61	3.65	5.39	12.49
Pairs	Mean	27.13	5.15	7.72	16.03
	Standard deviation	75.28	11.23	15.67	39.73

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