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Social networks in marketing research 2001–2014: a co-word analysis

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Abstract This article aims to explore the evolution of social network in marketing research by analyzing the co-occurrence index and network structures of keywords. We find that the number of articles which subjective tittle consist of social networks within 19 marketing journals and 9 UTD (Utdallas list of top journals) management journals increase significantly and the number of keywords whose frequency are no less than two also grow dramatically since 2010, the network structures of keywords 2010–2014 become more dispersed shows as most of keywords' centralities are between 0.32 and 0.63, and more keywords have strong relationships (Higher Cosine Index) with social networks or networks than 2001–2009. We also conclude that social network analysis has been mainly applied to study relationships, diffusion, influence, customer analysis, and enterprise management five subfields. Since mobile internet, intelligent devices, new media and digital technology are developing rapidly, social networks will be a powerful tool to study the related research fields.

Keywords Social networks · Marketing research · Social network analysis · Co-word analysis · Evolution

Introduction

Social network analysis has been used in innovation management (Obstfeld 2005), alliance collaboration strategy (Lazzarini 2007), organizational structure analysis (Park and Luo 2001), social influence analysis (Lowrey et al. 2004; Watts and Dodds 2007) and other

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research fields. Previous research has studied the social networks characteristics relations, ties, and composition (Garton et al. 1997), centrality in social networks (Freeman et al. 1980), the difference between social networks and other types of networks (Newman and Park 2003). Furthermore, prior study provides several methods for measuring social networks (Bernard et al. 1990), and models of social networks (Anderson et al. 1999; Hunter 2007; Pattison and Robins 2002; Robins et al. 2007).

As the number of social networking sites increases dramatically, more and more people create online profiles and share personal information with network-friends(Gross and Acquisti 2005). That provides more chance for marketing researchers to understand consumers. Social network analysis is one of the major paradigms in contemporary sociology (Wikipedia 2014), which has been used in marketing research frequently, but no research has studied the evolution of social networks in marketing research, so this article try to analyze the changes of social networks used in marketing research since 2001–2014, and find out the main research points and the development tendency.

This article is organized as follows: Part 2, we introduce the theoretical background. Part 3, we address the explanation of method and data collection. Part 4, we compare the changes of social network structures between 2001–2009 and 2010–2014, and point out the hot research topics in the past 14 years. Part 5, we discuss the conclusions and the limitations.

Literature review

Social networks and marketing

Social networks are familiar to marketing researchers and have been widely used in marketing research. They have been applied to study consumer behaviors e.g. customer preference (Yang and Allenby 2003), leadership influence (Kratzer and Lettl 2009; Godes 2011), new production adoption (Hu and Van den Bulte 2014), individual behavior prediction (Goel and Goldstein 2013) etc. social network reflects the connections and relationships among different ties, it evolves with new ties' generation and old ties' disappearance, and the changes of social network structures also have effects on ties' movements. Marketing activities usually put more emphasis on relationships effectiveness, e.g. peer to peer (Bhatia and Wang 2011; Lin et al. 2013; Aral and Walker 2011), virtual communities (Dholakia et al. 2004; Bélisle and Bodur 2010), and B2B relationships (Wuyts et al. 2009) etc.

Social networks often appear in marketing research; they not only reflect the social structure of relationships, but also a research paradigm of social analysis. With the growth of social networking websites, social communities, and non-profit organizations, the social relationships will become more and more complex, and this must have a great effect on marketing activities and research.

Marketing research

Marketing research is one of the most important parts of marketing; it attracts both academy researchers and marketing directors' attentions. Several hot citied books and journal articles provide strategy and tactics of marketing research (Green and Tull 1970), principles of marketing research (Bagozzi 1994), methodological foundations (Iacobucci and Churchill 2009). In the book Marketing Research, Aaker et al. (2008) summary the marketing research methodologies, point out their limitations, and analyze the relevance between marketing intelligence and research forefront, such as the Internet power.

There are so many methods have been used in marketing research, for example structural equation modeling (SEM) which is widely used in marketing and consumer research (Baumgartner and Homburg 1996), Hair et al. (2012) assess the use of partial least squares structural equation modeling (PLS-SEM) and provide guidance on preventing common pitfalls. Prior research also shows that the applications of SEM are popular and have formed standard criteria. Conversely, although social networks has been widely used in marketing research, little attention has been paid to summary the development process and no articles have analyze the changes of research topics of social networks applied in marketing research. So we want to fill this gap, compare the research topics changes, summary the development trends, find out the relative degree of different research points and social networks, and predict the future research tendency and hot topics.

Method and data collection

Method

Co-word analysis

Co-word analysis is a quantitative technique to comb literatures and find the interrelationships of science (He 1999). Since last century, co-word analysis has already been implemented by lots of researchers and research groups. As it is easy to operate, it has been used to evaluate R&D impacts (Kostoff 1993), examine the trends of technological development (Wu and Leu 2014), analyze the research trends (Dehdarirad et al. 2014), find hotpots of research (Wang et al. 2014a) and summary research topics evolution (Wang et al. 2014b). Co-word, like co-citation and co-author analysis is carried by exploring co-occurrence and co-absence of keywords (Ronda-Pupo and Guerras-Martin 2012). We use co-word analysis to analyze the evolution of social networks used in marketing research, and find out the interrelationships of keywords.

Co-word analysis uses co-occurrence matrix of keywords as input (Salton and McGill 1983; Ronda-Pupo and Guerras-Martin 2012). We also use co-occurrence matrix as input data, and then calculate the inclusion index of each pair of keywords, but a little different from the way of Ronda-Pupo and Guerras-Martin (2012) calculate the inclusion index as formula $I_{ij} = C_{ij}/\text{Min}\ (C_i, C_j)$. We calculate cosine index I_{ij} the same as Salton and McGill (1983) and Leydesdorff (2008) as formula $I_{ij} = C_{ij}/\sqrt{C_i \times C_j}$ which consists of both the number of keywords i and j not the minimum one (I_{ij} is the times of co-occurrence of keywords i and j, C_i is the appearing times of keyword i, C_j is the appearing times of keyword j, Min (C_i, C_j) is the minimum of the appearing times of keywords i and j).

Social network analysis

Based on the co-occurrence matrixes, we use social network analysis method to map the network structures and analyze the interrelationships evolution of keywords between the two stages 2001–2009 and 2010–2014. And then, we calculate the centrality of each vector (*keyword*) by the same software (*Pajek*) and the same algorithms as Ronda-Pupo and Guerras-Martin (2012). We also range the centrality value with 0.00–0.95 and choose three thresholds 0.31, 0.63 and 0.95, the network periphery 0.00–0.31, the semi-periphery 0.32–0.63 and the core of the networks 0.64–0.95 (Ronda-Pupo and Guerras-Martin 2012).

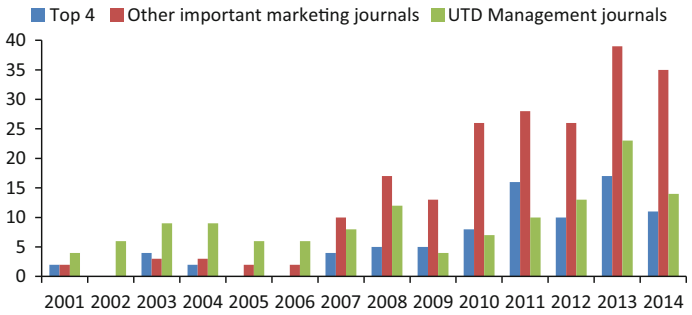

Fig. 1 Number of articles published within 2001–2014

Table 1 Number of appearing times of keywords

Year resource	Top 4	Other important marketing journals	UTD management journals
2001–2009	68	173	459
2010–2014	281	655	437

Next, we locate the all keywords (frequency no less than two) into different thresholds based on the centrality value, and analyze the evolution trends of each keyword in the prior research and compare the changes of hot topics between 2001–2009 and 2010–2014.

Data collection

We collect articles on social networks with top 4 marketing journals Journal of Marketing (JOM), Marketing Science (MS), Journal of Marketing Research (JMR) and Journal of Consumer Research (JCR), and other 15 important marketing related journals International Journal of Research in Marketing (IJRM), Marketing Letters (ML), Industrial Marketing Management (IMM), International Journal of Market Research (IJMR), Journal of Service Management (JSM), Journal of International Marketing (JIM), Psychology and Marketing (PM), Journal of Service Research (JSR), Journal of Advertising Research (JAR), Journal of Services Marketing (JSM), Journal of the Academy of Marketing Science (JAMS), Journal of Consumer Psychology (JCP), Journal of Advertising (JOA), Managing Service Quality (MSQ), Journal of Retailing (JOR). We also collect social networks and marketing-related articles on the journals Management Science (MS), Organization Science (OS), Academy of Management Journal (AMJ), Information Systems Research (ISR), Strategic Management Journal (SMJ), Administrative Science Quarterly (ASQ), Production and Operations Management (POM), MIS Quarterly (MISQ), Journal of Operations Management (JOM). We search the web of science database provided by Thomson Reuters and the published year with 2001 and 2014 and the query result shows as Fig. 1.

We find the number of published articles of marketing journals[1] increased significantly since 2010, so we separate the data into two stages: 2001–2009 and 2010–2014. In order to

[1] That means the total number of top 4 and other 15 important marketing journals, so the number of article increase from around 20 to over 30 and never fell below 30.

Table 2 Frequency distribution of keywords of the two stages

	Top 4		Other important marketing journals		UTD management journals	
	Number	%	Number	%	Number	%
Stage 1						
Appears in one time	54	91.53	132	89.80	198	77.65
Appears in two times	3	5.08	10	6.80	26	10.20
From 3 to 5	2	3.39	5	3.40	18	7.06
From 6 to 10	0	0.00	0	0.00	5	1.96
From 11 to 20	0	0.00	0	0.00	8	3.14
More than 20	0	0.00	0	0.00	0	0.00
Total	59	100	147	100	255	100
Stage 2						
Appears in one time	171	87.69	356	81.28	263	84.57
Appears in two times	11	5.64	48	10.96	26	8.36
From 3 to 5	9	4.62	22	5.02	16	5.14
From 6 to 10	3	1.54	6	1.37	3	0.96
From 11 to 20	0	0.00	5	1.14	3	0.96
More than 20	1	0.51	1	0.23	0	0.00
Total	195	100	438	100	311	100

be consistent with the stages of marketing journals, we segment the management journals with the same time points, although the number of published articles increased to 10 and never fell below since 2011. And then, we calculate the total number of the two stages of top 4, 15 important marketing journals and 9 management journals, the detail shows as Fig. 2.

After the stage separation, we begin to count the number of original keywords which have been processed, and the results list in Table 1.

In order to facilitate the co-word analysis, we use the most frequently occurring keywords as the theme words/phrases to frequency statistics as He (1999) did. We also process the keywords with the same core-word but different forms (nouns, verbs, and adjectives; singular and plural) into unique form, such as we transform networking/network to networks and count the frequency of networks to co-word analysis. After the word processing, we get 59 keywords of top 4, 147 of other important journals and 255 of the 9 UTD management journals in stage 1; and 195 of top 4, 438 of other important journals and 311 of the 9 UTD management journals in stage 2.

Analysis and results

Deconstruction evolution of keywords

In this section, we analyze the frequency of keywords (see Table 2). This shows the dispersion change of keywords in different stages, and the percentages of low frequency keywords are higher than Furrer et al. (2008) and Ronda-Pupo and Guerras-Martin (2012)

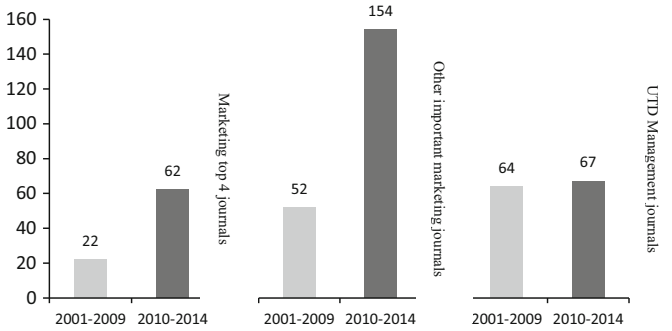

Fig. 2 Number of articles of two stages

who found about 65 % keywords appeared only once. We find that the number of higher frequency keywords increases from stage 1 to stage 2 within marketing journals, but it decreases in UTD management journals. The appearing times of keywords whose frequency are no less than 2 account for 20.59, 23.70 and 56.86 % proportions of the total appearing times in stage 1, and 39.15, 43.05 and 39.83 % in stage 2 of top 4, other important marketing journals and UTD management journals, and the distribution of parts of higher frequency keywords shows in Table 3.

In stage 1 the frequency of keywords is much lower than stage 2 within marketing journals, but for UTD management journals change a little. By analyzing the frequency of keywords, the number of higher frequency keywords increases dramatically within marketing journals which reflects the research fields of social networks in marketing research becomes wider in the last 5 years. Of course, some research topics keep popular since 2001, such as 'innovation' and 'word of mouth'. Furthermore, some new research fields attract more attention of researchers in stage 2 (e.g. social media), consistent with the social media utilization in marketing activities of enterprises, more and more enterprises use social media to practice their marketing plans.

Comparing marketing journals and UTD management journals, we find a significant difference. Marketing journals usually focus on consumer-level research, but UTD management journals mainly aim to study organization/enterprise-level, such as marketing journal published more articles about word of mouth how to affect consumers' behavior (e.g. Kozinets et al. 2010), UTD management journals usually put more emphasis on marketing/market strategy of enterprise-level (e.g. Chellappa and Saraf 2010).

Network structure analysis

Top 4

In stage 1, only five keywords' frequency is no less than two, but the number increases to 24. The number of keywords directly link to social networks changes from 3 to 19, the keywords 'word of mouth', 'social contagion' and 'diffusion of innovations' have a high co-occurrence frequency 5 in stage 2, and the cosine index value are 0.29, 0.36 and 0.40. In stage 1 the cosine index value between 'innovation', 'word of mouth', 'diffusion of innovation', and 'social networks' are 0.25, 0.71, and 0.37, it means '**word of mouth**' and

Table 3 Distribution of higher frequency keywords

Top 4		Other important marketing journals		UTD management journals	
Keywords	Frequency	Keywords	Frequency	Keywords	Frequency
Stage 1					
Social networks/innovation	4.00	Social networks/social capital	5.00	Networks	18.00
		Relationships/networks	4.00	Market	17.00
				Industry	14.00
		Business networks	3.00	Social networks/embeddedness	13.00
				Performance	12.00
				Social-structure/organization	11.00
Game theory/diffusion of innovation/word of mouth	2.00	Chinese/Innovation/word of mouth/China/ business relationships/third places/inter-firm relationships/commercial friendships/social support/trust	2.00	Alliances	9.00
				Innovation	7.00
				Strategic alliances/firm/competition	6.00
				Entrepreneurship/exchange/governance/ structural holes	5.00
				Social capital/ties/knowledge/power	4.00
				Identity/management/venture capital/network effects/strategy/decisions/capabilities	3.00
Stage 2					
Social networks	32.00	Social networks	24.00	Networks	16.00
Social media	10.00	Social capital	14.00	Market	13.00
Word of mouth	9.00	networks	13.00	Social networks	12.00
Social contagion	6.00	Marketing/innovation	11.00	Innovation	9.00
Diffusion of innovation	5.00	Brand	9.00	Performance	7.00
Social influence/e-commerce	4.00	Business networks/interaction/B2B	7.00	**Social media**	6.00
		Word of mouth/**social media**	6.00	Organizations/social-structure/price/ embeddedness	5.00

Table 3 continued

Top 4		Other important marketing journals		UTD management journals	
Keywords	Frequency	Keywords	Frequency	Keywords	Frequency
Social capital/homophily/agent-based models/contagion/user-generated content/opinion leadership	3.00	Relationship marketing	5.00	Social capital/structural holes/brokerage	4.00
		China/business relationships/new product/consumer behaviour	4.00	Inter-organizational relationships/network effects/firms ties/relational embeddedness/peer influence/organizational studies/homophily/marketing	3.00

We just list parts of high frequency keywords in Table 3, and select all of the keywords which frequency are no less 2 as study samples. We underline parts of keywords which frequency is less than 2 in both stage 1 and stage 2 and bold the keywords which appear just in stage 2 among the three kinds of journals

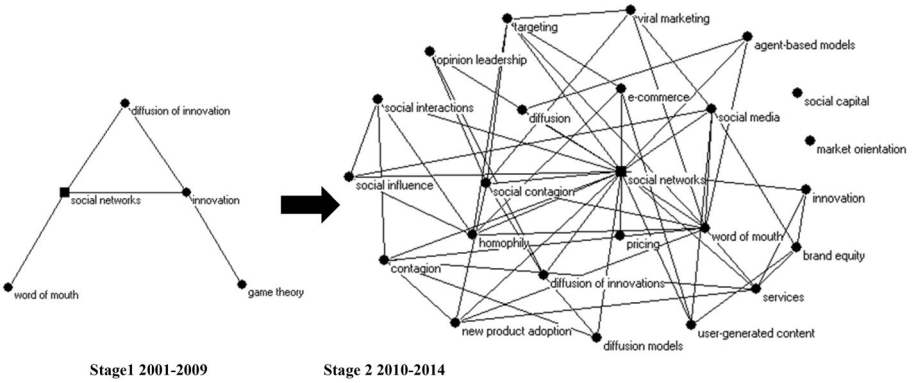

Fig. 3 Network structure evolution of top 4 from 2001–2009 to 2010–2014

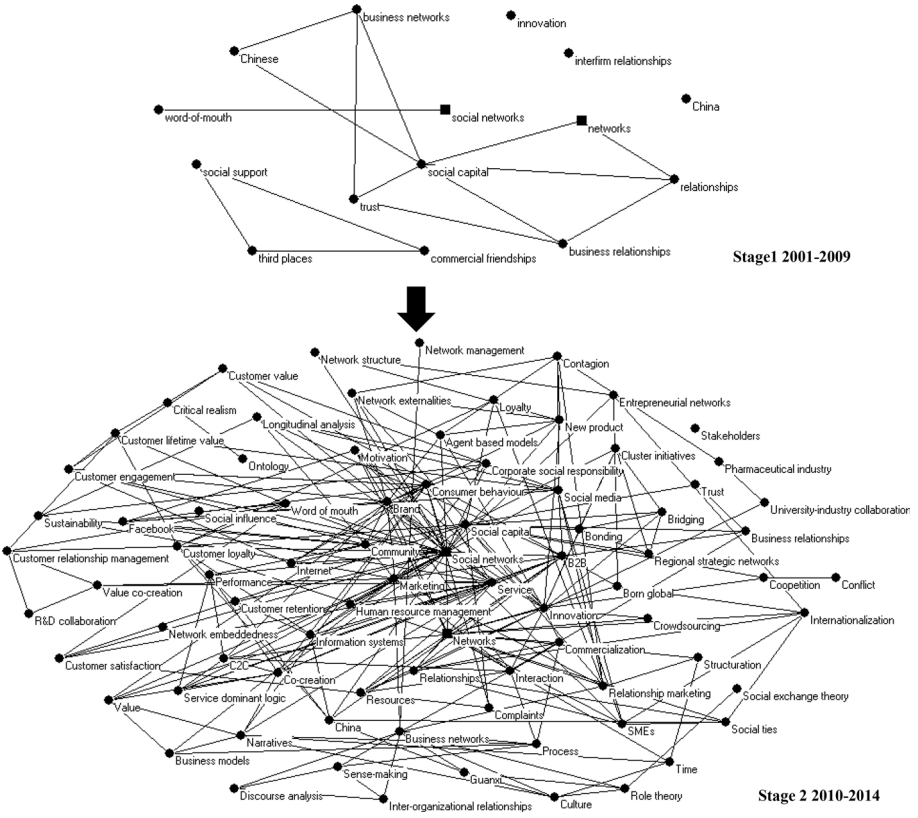

Fig. 4 Network structure evolution of other important marketing journals from 2001–2009 to 2010–2014

Table 4 Cosine Index of social networks/networks and other keywords

Keywords	Social networks	Social capital	Networks	Marketing	Innovation	Brand	Interaction	B2B
Social networks	1.00	0.05	0.06	0.18	0.12	**0.41**	0.00	0.15
Networks	0.06	0.00	1.00	0.00	**0.33**	0.09	**0.31**	0.21

	Word of mouth	Social media	China	New product	Consumer behaviour	Sustainability	Business model	Community
Social networks	0.25	0.25	0.10	0.10	0.10	0.12	0.00	**0.35**
Networks	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00

	Co-creation	Relationships	Customer retention	Performance	Customer loyalty	Customer engagement	SMEs
Social networks	0.12	0.00	**0.35**	0.24	0.12	0.12	0.12
Networks	0.00	**0.48**	0.00	0.00	0.00	0.00	**0.32**

The bold numbers note as the keywords with cosine index are no less than 0.30

'social networks' are strong related in both of the two stages. By analyzing Fig. 3, we find social networks in the core position within stage 1 and stage 2, which becomes more significant in stage 2, and the degrees of vertices are hierarchical, 'social networks' in the center, 'word of mouth', 'service', 'social media', 'homphily', 'contagion' and 'social contagion' whose degrees are no less than 5 are in the second level, the others whose degrees are less than 5 in the third level (e.g. e-commerce, social influence, innovation etc.), the zero degree vertices 'social capital' and 'market orientation' are on the edge. It helps us to grab the hot research points in the last 5 years.

Other important marketing journals

Figure 4 shows that the network structure change dramatically. Firstly, the number of vertices increases from 14 to 82, the number of lines changes from 14 to 258. Secondly, the number of isolated vertices decreases from 3 (China, innovation, and interfirm relationships) to 2 (network embeddedness and stakeholders). The number of vertices which are

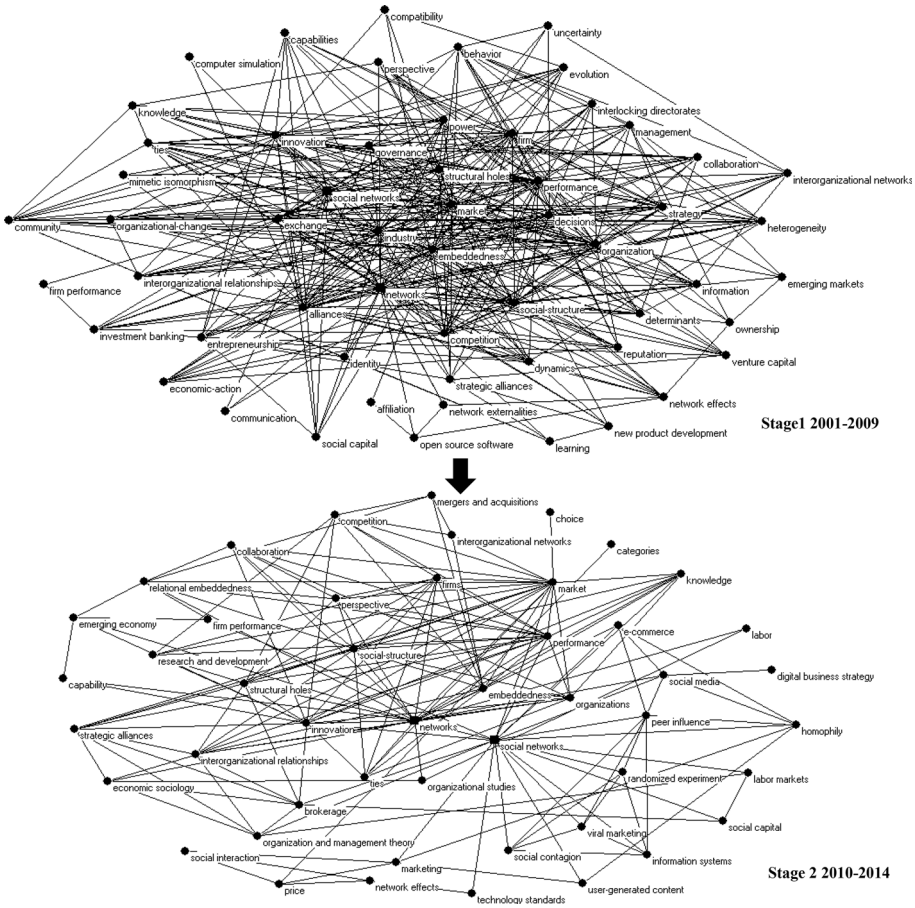

Fig. 5 Network structure evolution of UTD management journals from 2001–2009 to 2010–2014

directly link to social networks/networks grows significantly that to a large extent reflects the related research fields become more and more popular, and 'social networks/networks' takes the central palace, but '**word of mouth**' has a direct link with 'social networks' in the two stages, and the cosine index are no less than 0.2 (0.32 in stage 1, 0.25 in stage 2) which reflects using social network to study word of mouth effects is still a hot research point.

Thirdly, in order to find out the relationships strength of the ties, we calculate the cosine index of stage 2 to analyze the relationships between social networks/networks and the other keywords (see Table 4). The cosine index of seven keyword groups are more than 0.30, they are networks-innovation, social networks-brand, networks-interaction, social networks-community, networks-relationships, social networks-customer retention, and networks-small and medium sized enterprises (SMEs); which shows the invisible strong relationships of the network structure. For the keywords in Table 4 are higher frequency ones, so the strong related keyword groups mean higher focus of researchers. Furthermore, the degree distribution of vertices is also hierarchical, the number of high degree vertices is much more than stage 1 (e.g. service, innovation, brand, and social capital), to a large extent, it explains the change of research topics.

UTD management journals

The result of comparing marketing journals and UTD management journals shows a great difference. First, the number of vertices decreases from 57 to 48, and the total number of lines also decreases from 406 to 174 from stage 1 to stage 2. Second,the network has much more vertices than marketing journals in stage 1, and 10 vertices neither link to social networks nor networks (e.g. governance, management, emerging markets and so on, see Fig. 5, stage 1). Third, the strong related keyword group whose cosine index are more than 0.30 and link directly to social networks or networks in stage 1: *embeddedness-networks* (0.33), *innovation-social networks* (0.42), entrepreneurship-networks (0.32), identity-networks (0.41), capabilities- social networks (0.32); stage 2: market-networks (0.35), *innovation-networks* (0.33), performance-networks (0.38), organizations-networks (0.34), social structure-networks (0.56), *embeddedness-networks* (0.34), ties-networks (0.58), randomized experiment-social networks (0.41), peer influence-social networks (0.50), social contagion-social networks (0.41), homophily-social networks (0.33), viral marketing-social networks (0.41), e-commerce-social networks (0.41); comparing with stage 1, there are more keywords have strong relationships with social networks/networks, which reflects the research topics become dispersed.

Centrality analysis

The centrality reflects the relative importance of vertices within the networks. We study the evolution of networks by comparing the degree centrality of stage 1 and stage 2. In our research, the networks are directed and co-appearance times regard as the value of lines, and the results show three trends:

1. The total number of core position keywords decreases among all of the journals, especially UTD management journals from 10 to 0. It means that the relative importance of vertices falls down; most of the core position keywords lost their central place.
2. The percentage of semi-periphery position keywords grows significantly, from 40.00, 6.67, and 82.46 % to 87.50, 84.15 and 91.67 % among the three kinds of journals. This is mainly due to an increasing number of the subfields of research, e.g. viral marketing,

Table 5 Evolution of the network position of the keywords over the two stages 2001–2009 and 2010–2014

Stages		Top 4	Other important marketing journals	UTD management journals
Stage 1: 2001–2009	Core 0.64–0.95	0.80-Social networks, innovation 0.67-Diffusion of innovation		0.80-Market 0.75-Networks; 0.72-industry, performance; 0.70-embeddedness 0.69-Organization; 0.68-social structure; 0.66-alliances; 0.65-innovation; 0.64-competition.
	Semi-periphery 0.32–0.63	0.50-Word of mouth, game theory.	0.47-Social capital	0.63-Social networks; 0.62-firm, exchange 0.58-Governance, structural holes, ties, power, heterogeneity; 0.57-community 0.56-Decisions, dynamics 0.55-Strategy, organizational change, information, network effects, determinants, inter-organizational relationships, perspective; 0.54-strategic alliances, entrepreneurship, knowledge, behavior, interlocking directorates, collaboration 0.53-Management, venture capital, capabilities, economic action, investment banking 0.51-Social capital, mimetic isomorphism, reputation, identity 0.50-Evolution, inter-organizational networks 0.49-New product development, uncertainty 0.48-Network externalities, compatibility 0.47-Communication, ownership; 0.46-learning, affiliation; 0.45-emerging markets, open source software 0.42-Computer simulation; 0.39-firm performance
	Periphery 0.00–0.31		0.31-Relationships, business networks, trust, business relationships 0.28- Networks, Chinese 0.20-Third places, commercial friendships, social support 0.13-Social networks, word of mouth 0.00-Interfirm relationships, China, innovation	

Table 5 continued

Stages		Top 4	Other important marketing journals	UTD management journals
Stage 2: 2010–2014	Core 0.64–0.95	0.84-Social networks		
	Semi-periphery 0.32–0.63	0.60-Word of mouth 0.53-Social media, social contagion, contagion, services; 0.52-homophily, new product adoption, targeting 0.51-Social influence, e-commerce, user-generated content 0.49-Diffusion of innovations 0.48-Agent-based models, social interactions, innovation, opinion leadership 0.47-Diffusion models; 0.46-diffusion 0.45-Viral marketing, pricing 0.40-Brand equity	0.56-Social networks 0.49-Marketing; 0.48-innovation, brand; 0.47-social capital, networks, service; 0.45-interaction; 0.44-customer loyalty; 0.44-relationship marketing; 0.43-B2B; 0.42-social media, motivation 0.41-China, consumer behavior, information systems, C2C, longitudinal analysis, co-creation, resources 0.40-Customer satisfaction, business networks, relationships, new product, SMEs, human resource management, agent based models, network externalities 0.39-Word of mouth, performance, corporate social responsibility, sustainability, Facebook, customer engagement 0.38-Service dominant logic, value, customer retention, customer value, community, internet 0.37-Business relationships, commercialization, entrepreneurial networks, value co-creation, narratives, network structure 0.36-Social influence, structuration, contagion, time, loyalty; 0.35-bonding, bridging, cluster initiatives, process, coopetition, business models 0.34-Complaints, social ties, customer lifetime value, crowdsourcing, born global; 0.33-guanxi, internationalization, customer relationship management, culture; 0.32-university industry collaboration, trust, regional strategic networks	0.63-Social networks; 0.62-networks 0.59-Market; 0.57-performance 0.55-Innovation; 0.51-knowledge 0.48-Brokerage, social media 0.47-E-commerce, social structure 0.46-Structural holes, inter-organizational relationships; 0.45-embeddedness 0.44-Organizations, firms, strategic alliances, organization and management theory, relational embeddedness, collaboration, perspective; 0.43-ties 0.42-Firm performance, homophily, marketing, peer influence, emerging economy, economic sociology 0.41-Competition, social capital, capability, user generated content, labor markets, technology standards 0.40-Information systems, social contagion, research and development, viral marketing, randomized experiment, organizational studies 0.39-Labor, inter-organizational networks 0.37-Choice; 0.34-mergers and acquisitions 0.33-Digital business strategy
	Periphery 0.00–0.31	0.00-Social capital, market orientation	0.30-Role theory; 0.29-sense-making 0.28-Inter organizational relationships, discourse analysis, network management, R&D collaboration, pharmaceutical industry 0.26-Conflict; 0.23-social exchange theory 0.02-Ontology, critical realism; 0.00-stakeholders, network embeddedness	0.31-Price, social interaction; 0.30-network effects 0.24-Categories

Table 6 Evolution of the networks of the keywords regarding the clustering coefficient and density

	Top 4	Other important marketing journals	UTD management journals
Network clustering coefficient (*transitivity*)			
Stage 1	0.4286	0.5625	0.4981
Stage 2	0.3661	0.3154	0.4908
Density (*loops allowed*)			
Stage 1	0.6000	0.2000	0.2675
Stage 2	0.2396	0.0889	0.1719

brand equity, agent-based model and so on. In addition, it refers to the research fields are becoming diversified.

3. The total number of periphery position keywords changes a little, but the keywords are different between the two stages. Partly because of the emergence of new subfields of research, on the other hand, some keywords move to semi-periphery positions, e.g. China, business networks, business relationships and so on. So the periphery vertices always keep a high speed of changing.

Table 5 depicts the changing process of the keywords' centralities; we can illustrate the evolution of network structures. The keywords 'social networks' or 'networks' own a higher centrality score, which shows that they are more important than other keywords within the networks especially in stage 2. Recent five years, the number of subfields related to social networks in marketing research grows rapidly, and most of them in the semi-periphery area such as viral marketing, brand equity, and agent-based model etc. However, some traditional research topics always attract more attention, e.g. word of mouth, innovation, social capital, relationships and so on. So social networks not only are widely used in new research fields but also traditional ones.

Networks evolution within the two stages

In order to study the evolution of the networks, we use network clustering coefficient and density to analyze the evolution process. Network clustering coefficient and density are used to measure the distance or similarity among the vertices of networks. Network clustering coefficient refers the possibility of two vertices which have a common neighbor are directly linked, density reflects the internal coherence or strengths of the relationships among vertices (Ronda-Pupo and Guerras-Martin 2012). We also use *Pajek* (*info* → *network* → *general*) to calculate the two index (see Table 6). Comparing the two indexes between stage 1 and stage 2, we find both of them are descent, the results are opposite to Ronda-Pupo and Guerras-Martin (2012). The reason why is that Ronda-Pupo and Guerras-Martin used social networks to study the concept evolution of strategy, but we analyze the changing of research fields, one concept will form a more and more consistent understanding, yet one research method or paradigm will be used in more and more research fields. Our results coincide with the cosine index matrix, one hand, the number of high frequency keywords increase; the other hand, the keyword groups with higher cosine index grow significantly.

Conclusion

In the period 2001–2014, social network has been used as a powerful tool in marketing research. Through analyzing the keywords of 421 articles in 28 journals, we find social networks has usually been applied to study relationships (e.g. business relationships, organizational relationships, commercial friendships, and customer relationships), diffusion (e.g. diffusion of innovations, diffusion of knowledge and diffusion models), influence (e.g. social influence and peer influence), customer analysis (e.g. customer value, customer loyalty, customer satisfaction, customer behavior, and customer lifetime value etc.), and enterprise management (e.g. firm performance, strategic alliances, internationalization, R&D, competition, business strategy, marketing, brand management and so on). In addition, with the increasing utility of social media in marketing activities, social networks has formed a strong relationship with social media, and it will be widely applied to study social media effects and activities.

Since mobile internet, intelligent devices, new media and digital technology have a great impact on marketing activities, and they will attract more attention of marketing directors and scholars, as well social networks has great advantages to study how they work and their effects. So in the future, social networks will be popular applied to study media effects, function mechanism of new technology/devices, and social influence of mobile internet. After all, social networks method takes an important place of relationships and influence research, it a good choice for using social networks to study the related fields.

One contribution of our study is using co-word analysis to analyze the evolution of social networks used in marketing research, and this method proves to be effective. Second, we separate the journals into three kinds and compare their similarities and dissimilarities which are different from the prior research (e.g. Liu et al. 2012; Muñoz-Leiva et al. 2012). Third, we point the changing process of hot research topics, and summarize the main research fields of social networks related in marketing research. Finally, we predict some research points which will be popular in the near future.

Of course, our study also has limitations. Firstly, we just select 19 marketing journals and 9 UTD management journals which take a lower proportion of all related journals, so the results maybe neglect some research topics. Secondly, only using keywords to analyze the research trends maybe not enough, next we will use full text analysis to deeply study the research trends of social networks in marketing research. At last, we expect our study can provide giddiness for marketing research with social networks method, and more scholars apply social networks to solve marketing problems.

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