

Visualization Analysis of Dynamic Evolution of the Theme in Improvisation Studies

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Abstract

The field of improvisation is composed of a multiplicity of topics leading to a vast array of management literature. However, the research does not provide a chronological picture of the topics it addresses, making it difficult to develop an overview of the evolution and trends in the literature. To address this issue, co-word analysis was employed to reveal patterns and trends in the improvisation field by measuring the association strengths of keywords of relevant documents. Data were collected from Web of Knowledge database for the period 1997-2012. Using the co-occurrence matrix of keywords, the results of multivariate statistical techniques show that the improvisation research involves many fields including innovation, strategy, learning, change, leadership, metaphor, entrepreneurship, capability. In order to trace the dynamic changes of the improvisation field, the whole period was further separated into three periods: 1997-2002, 2003-2007 and 2008-2012. The strategic diagram and social network analysis was used to trace the dynamic changes of the improvisation research, and results show that improvisation field has some established research themes and it also changes rapidly to embrace new themes.

Keywords: *improvisation, bibliometric study, co-word analysis, multivariate statistical analysis, strategic diagram, social network analysis, emerging trends*

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1. Introduction

The word improvisation can be interpreted to mean unforeseen or to take action in the moment. As a common phenomenon of jazz and theatre, this idea has been a topic to attract many scholars of management fields to study it. A major milestone for research in improvisation occurred at the Academy of Management meeting held in 1995 in Vancouver. Hatch, Barrett and some other scholars explore the use of jazz as a metaphor for understanding organizational and improvisation, these motivated several research studies which, in 1998, resulted in a special issue of Organization Science devoted to organizational improvisation. Since then, a stream of articles has poured into the literature on issues ranging from many fields.

Past research suggests that improvisation has been become a hot research field in recent years and many works should to be done to study deeply into this topic. Cunha et al. (1999) reviewed the growing body of literature on organizational improvisation in order to present an encompassing and systematic perspective on this concept. An integrative definition of its construct was presented together with a new way of measuring this phenomenon in organizational settings. The article further explored this construct by presenting its triggers, necessary conditions, influencing factors and major outcomes [1]. Li et al. (2011) suggested that Improvisation is related to a host of outcome variables, including entrepreneurship, new product development and innovation [2]. Based on the relevant literatures from the year 1990 until 2010, Huang et al. (2012) systematically reviewed the studies of organizational improvisation, including its definitions, characteristics, categories, measurements, trigger, influencing factors and the outcomes. The results indicated that theory-building relied more on metaphors, the concepts were ambiguous, the system was incomplete and the empirical studies were scarce [3]. Although there have been several attempts to generalize findings in improvisation literature, they used literature synthesis techniques, which are more dependent on subjective analysis and couldn't disclose the multiplicity of improvisation research.

Specifically, the aim of this article is to use co-word analysis for detecting and visualizing conceptual subdomains. Quantitative and qualitative measures are used in order to identify the most prominent themes. The study also incorporates bibliometric maps to show, in a

visual way, the associations between the main themes. At the same time, longitudinal maps are used to analyze the changes of themes and forecast emerging trends for a subject domain.

2. Research Method

2.1. Co-word Analysis

The co-word analysis draws upon the assumption that a document's keywords constitute an adequate description of its content. Two keywords co-occurring within the same paper are an indication of a link between the topics to which they refer [4]. The presence of many co-occurrences around the same word or pair of words points to the locus of strategic alliance within papers that may correspond to a research theme. Co-word analysis reveals patterns and trends in a specific discipline by measuring the association strengths of terms representative of relevant publications produced in this area. The main feature of co-word analysis is that it visualizes the intellectual structure of one specific discipline into maps of the conceptual space of this field, and that a time-series of such maps produces a trace of the changes in this conceptual space [5]. In this study, bibliometrics software Bibexcel was used to calculate the number of times two keywords appear together in the same publication. Thus we have formed a co-occurrence matrix of keywords. For subsequent analysis, in order to standardize the data, avoid possible scale effects, and reduce the number of zeros in the matrix, the raw co-citation matrix was converted into a matrix of Pearson's correlation coefficients.

2.2. Multivariate Statistical Analysis

The correlation coefficients were analyzed using the statistical procedures of cluster analysis, multidimensional scaling (MDS), and factor analysis. Hierarchical clustering involves creating clusters that are hierarchically nested within clusters at earlier iterations, in that each cluster can be included as a member of a larger, more comprehensive cluster at a higher level of similarity. Among agglomerative hierarchical methods, we select the Ward Method. This procedure is designed to optimize the minimum variance within clusters, and it works by joining those groups or clusters that result in the minimum increase in the variance [6]. The correlation data were also analyzed using the multidimensional scaling procedure, a dimension reduction technique that aims at fitting the original data into a low-dimensional space such that the distortion of the similarities and dissimilarities among the original data caused by reduction in dimensionality is minimized [7]. Two-dimensional solutions were explored in the multidimensional scaling with the procedure of ALSCAL. Furthermore, an exploratory factor analysis was conducted to assess the underlying dimensions among the journals. The principal components analysis was used to extract factors. Kaiser's criterion and the scree test were compared to determine the extracted number of factors. After the extraction, factors were rotated using the procedure of Varimax rotation. Factor analysis can be used to complement multidimensional scaling and clustering displays and show an entity's contribution to more than one specialty. Unlike cluster analysis, which only assigns an entity to one cluster, the entity can load on more than one factor in a factor analysis. Therefore, the interrelationships between specialties can be easily revealed from a different perspective [8].

2.3. Strategic Diagram Analysis

Strategic diagram developed by the co-word analysis has a merit, which can identify the evolving trends and relational patterns between the topics represented by clusters [9]. In a strategic diagram, X-axis stands for centrality and Y-axis stand for density.

Density is used to measure the strength of relations that make terms in a cluster. We define the density as following.

$$D(k) = \frac{\sum_{i=0}^N \sum_{j=0, j \neq i}^N r_{ij}}{N - 1}$$

Where $D(k)$ is the density of cluster k , N is the number of keywords in cluster k , and r_{ij} is the relation value between word i and word j which are both within the cluster k .

Centrality is used to measure the extent to which a cluster is connected with other clusters. We define the centrality as following.

$$C(k) = \frac{\sum_{i=0}^N \sum_{j=0}^{M-N} r_{ij}}{(M - N) * N}$$

Where $C(k)$ is the centrality of the cluster k , M is the number of all keywords which are selected for clustering, N is the number of keywords in cluster k , and r_{ij} is the relation value between word i within the cluster k and word j without the cluster k . The Strategic Diagram and its meaning are shown in Figure 1.

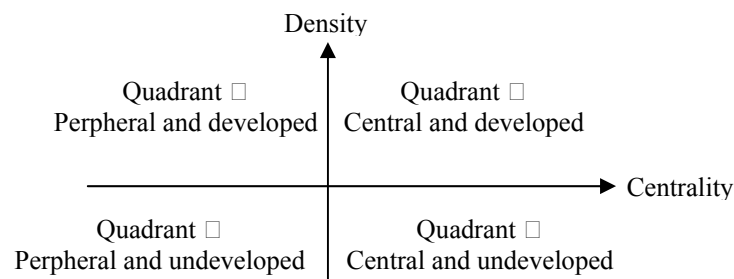


Figure 1. Strategic Diagram and Its Meaning

2.4. Social Network Analysis

Social network analysis (SNA) is the mapping and measuring of relationships among components in a system. A network in SNA consists of a set of nodes and links. The nodes represent the components and the links stand for relationships between the nodes. In this paper, we structure the keywords network of research on treatment adherence, in which the nodes are the keywords while the links represent the co-occurrence of these keywords. To understand the structure of the keyword network in literature on treatment adherence, we evaluate the location of keywords in the network by measuring the centrality of each node and the network centralization. The communication between two nodes in a network can be facilitated, blocked, distorted or falsified by a node falling between them, and therefore the node between the other two nodes has a potential to control their communication. When a particular node in a group is strategically located on the shortest communication path connecting pairs of others, that node is in a central position. The centrality is defined in terms of the degree to which a node falls on the shortest path between others, and named as betweenness centrality [10].

3. Data Collection and Preparation

3.1. Data Collection

To retrieve sufficient ‘improvisation’ related papers, the Web of Science literature database is initially used for paper retrieval. In order to have sufficient coverage of the papers, the following query has been tried: improvisation or improvisational or improvise or improvising in the topic. A total of 212 papers was retrieved from the database covering the period of 1997-2012 and were selected as the co-word analysis sample. In Figure 2. the distribution of documents (Article, Proceeding Paper and Review) from management, business and economic field per year is shown.

From each of these papers, author keywords and keywords plus were selected. Due to the fact that different words can be used for describing the same concept, it is necessary to standardize words. For example, (1) plural forms are standardized to their singular form; (2) firm performance, task performance, new venture performance, organizational performance, business performance, job performance, financial performance are standardized to performance; (3) organizational memory, working memory, transactive memory are standardized to memory; (4) transformational leadership, strategic leadership are standardized

to leadership; (5) knowledge intensive entrepreneurship, international entrepreneurship, technology entrepreneurship are standardized to entrepreneurship; and (6) international strategy, marketing strategy, technology led strategy, development strategy, business strategy are standardized to strategy. At last, 745 keywords were collected and frequency distribution of keywords is shown in Figure 3. As shown in Table 1. 50 keywords with frequency more than 5 were chosen as the research sample for co-word analysis.

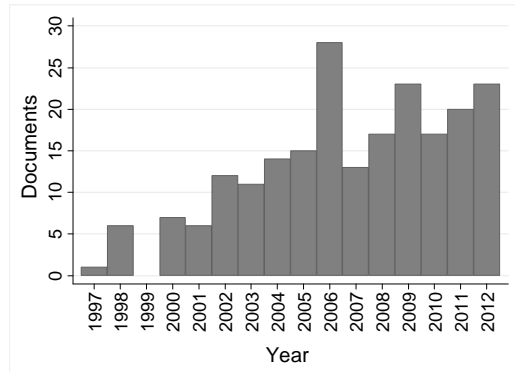


Figure 2. Documents Published from 1997 to 2012

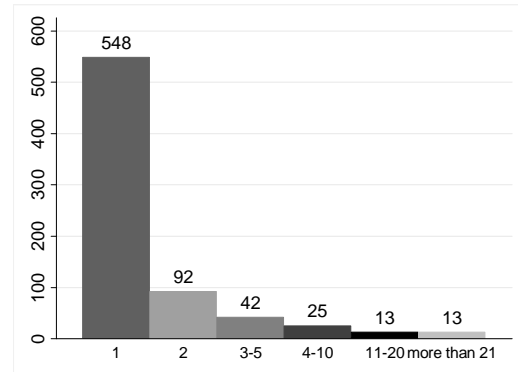


Figure 3. Frequency Distribution of Keywords

Table 1. Top 50 High Frequency Keywords

No.	Keyword	Frequency	No.	Keyword	Frequency
1	Improvisation	94	26	Creativity	12
2	Performance	48	27	Dynamic capability	10
3	Product development	41	28	System	10
4	Innovation	40	29	Flexibility	10
5	Organizational improvisation	36	30	Sensemaking	9
6	Knowledge	36	31	Identity	8
7	Strategy	34	32	Capability	8
8	Jazz	32	33	Organizational learning	8
9	Organization	32	34	Decision making	8
10	Management	31	35	Communication	8
11	Environment	26	36	Network	8
12	Firm	23	37	Antecedents	8
13	Perspective	22	38	Field	8
14	Learning	18	39	Leadership	7
15	Memory	18	40	Success	7
16	Model	17	41	Organizational change	7
17	Metaphor	17	42	Experience	7
18	Entrepreneurship	15	43	Absorptive capacity	7
19	Evolution	15	44	Team	7
20	Competitive advantage	14	45	Market orientation	7
21	Technology	14	46	Transformation	6
22	Industry	13	47	Uncertainty	6
23	Bricolage	13	48	Information technology	6
24	Work	13	49	Complexity	6
25	Time	13	50	Impact	6

3.2. Matrix Generation

Specifically bibliometrics software Bibexcel was used to calculate the number of times two keywords appear together in the same publication. Thus, we have formed a co-occurrence matrix of 50×50 keywords. In the cell of keyword X and keyword Y we put the co-occurrence frequency of X and Y. The diagonal values of the matrix were treated as missing data. The matrix was transformed into a correlation matrix by using Pearson's correlation coefficient indicating the similarity and dissimilarity of each keyword pair, which is shown in Table 2.

Table 2. The Raw Co-citation Matrix and Correlation Matrix (section)

	1	2	3	4	5	6	7	8	9	10
Absorptive capacity	0 (1.00)	0.503	0.389	0.293	0.186	0.468	0.192	0.374	0.463	0.713
Antecedents	1	0 (1.00)	0.364	0.358	0.613	0.64	0.551	0.654	0.505	0.650
Bricolage	1	0	0 (1.00)	0.573	0.321	0.371	0.511	0.421	0.648	0.397
Capability	0	0	0	0 (1.00)	0.387	0.346	0.509	0.527	0.512	0.268
Communication	0	1	0	0	0 (1.00)	0.44	0.511	0.645	0.346	0.378
Competitive advantage	2	2	1	1	0	0 (1.00)	0.584	0.415	0.518	0.618
Complexity	0	0	0	0	0	0	0 (1.00)	0.566	0.499	0.337
Creativity	0	2	0	0	1	0	1	0 (1.00)	0.502	0.426
Decision making	0	1	1	1	1	1	0	0	0 (1.00)	0.425
Dynamic capability	3	1	1	0	0	2	0	0	0	0 (1.00)

Note. The data above diagonal line mean the correlation coefficient and the data below diagonal line mean the frequency

4. Results and Analysis

4.1. Results of Multivariate Statistical Analysis

A hierarchical cluster analysis with Ward's method and multidimensional scaling (MDS) with ALSCAL method were carried out, and the results were shown in Figure 4 and 5, respectively. The stress value (0.19890, lower than an acceptable value 0.2) and R² (0.75809 for two-dimensions) showed an outstanding fit for the data. The results of factor analysis were shown in Table 3 and 4.

Cluster analysis and multidimensional scaling reach a uniform conclusion. As a result, five large theme groups emerged from right to left on the horizontal axis. Theme 1 focus on the research about strategy and innovation [11-12], which involves product development, knowledge, performance, environment, management, model, market orientation, competitive advantage, uncertainty, industry, success and flexibility. Theme 2 focus on the research about learning [13], leadership and change, which emphasizes the importance of field, system, complexity, experience, organization and technology. Theme 3 focus on the research about metaphor [14-15], memory and creativity, and includes jazz, time, work, sensemaking, identity, team and communication. Theme 4 focus on the research about entrepreneurship [16] and evolution, and especially involves networking, bricolage, firm, decision making and transformation. Theme 5 focus on the research about capability, such as absorptive capability, dynamic capability, and organizational improvisation under the context of information technology.

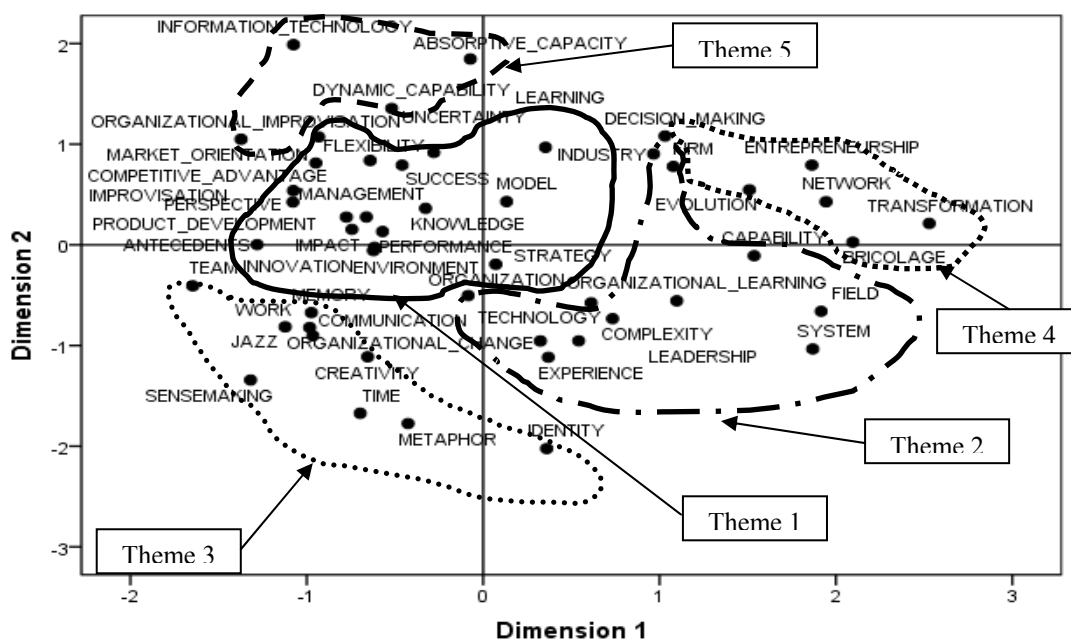


Figure 4. Multidimensional Scaling Map

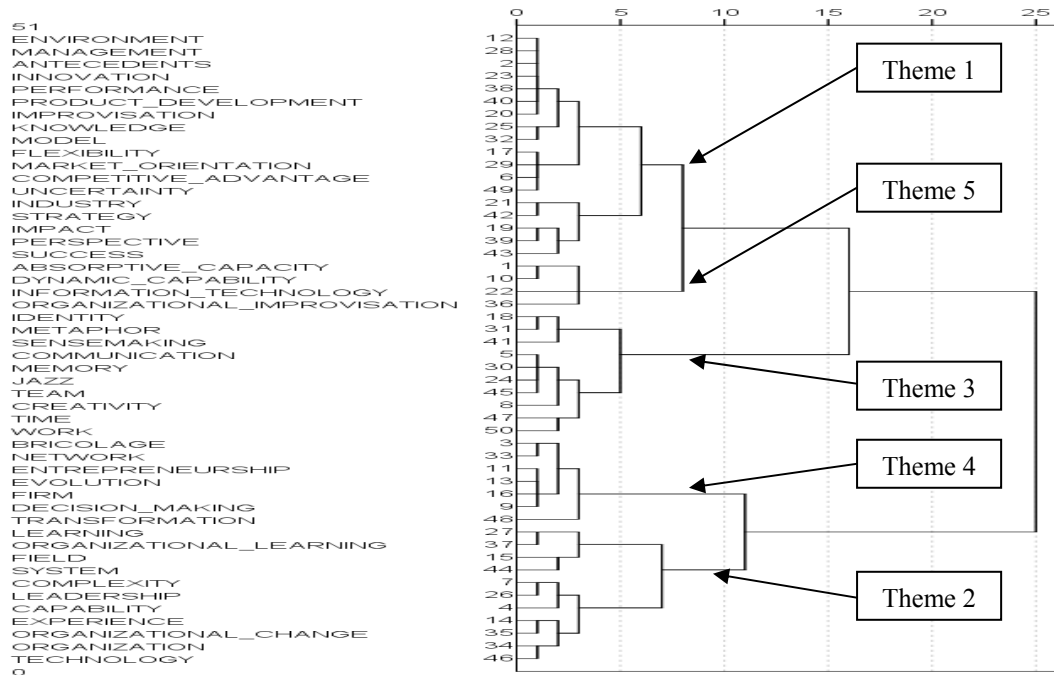


Figure 5. Hierarchical Cluster Analysis

Table 3. Rotated Component Matrix of Factor Analysis

Factor	1	2	3	4	5	Factor	1	2	3	4	5
Management	0.922	0.163	0.232	-0.050	0.108	Decision making	0.437	0.747	-0.245	0.013	-0.047
Flexibility	0.921	-0.061	-0.093	-0.120	0.107	Network	0.056	0.709	-0.298	0.464	0.100
Competitive advantage	0.899	0.089	0.006	0.074	-0.205	Transformation	-0.422	0.668	-0.196	0.091	0.053
Market Orientation	0.895	-0.134	-0.160	0.002	-0.244	Capability	0.217	0.627	-0.036	0.290	0.387
Antecedents	0.885	-0.164	0.334	-0.047	-0.022	Strategy	0.443	0.594	0.452	-0.262	0.149
Environment	0.882	0.139	0.317	0.053	0.149	Technology	0.394	0.571	0.36	0.204	0.3
Uncertainty	0.875	0.265	-0.051	-0.103	-0.026	Jazz	0.405	-0.104	0.847	-0.047	0.028
Product development	0.866	0.068	0.341	0.036	-0.155	Time	-0.068	0.142	0.82	-0.432	0.162
Improvisation	0.852	-0.06	0.159	-0.087	-0.003	Metaphor	0.016	-0.159	0.816	0.240	0.332
Innovation	0.838	0.179	0.408	0.06	0.029	Sensemaking	0.058	-0.365	0.786	0.112	-0.094
Performance	0.813	0.206	0.434	0.104	-0.174	Team	0.537	-0.279	0.666	-0.321	-0.001
Knowledge	0.729	0.252	0.303	0.249	-0.243	Experience	0.186	0.459	0.644	0.137	0.146
Organization	0.725	0.149	0.205	0.379	0.272	Meomory	0.619	-0.055	0.629	-0.017	0.204
Dynamic capability	0.723	0.103	-0.089	0.022	-0.539	Creativity	0.46	-0.073	0.627	0.155	0.357
Model	0.699	0.377	0.196	0.364	-0.234	Work	0.298	0.025	0.578	0.031	-0.219
Success	0.680	0.210	0.066	-0.254	0.236	Organizational learning	0.265	0.077	0.140	0.838	-0.127
Impact	0.676	0.157	0.388	-0.034	-0.076	Field	-0.040	0.292	-0.066	0.781	0.138
Communication	0.618	-0.159	0.544	0.147	0.268	System	-0.222	0.209	0.084	0.731	0.146
Perspective	0.596	0.244	0.336	-0.591	0.024	Identity	-0.135	-0.205	0.532	0.714	0.172
Complexity	0.552	0.228	0.038	0.470	0.499	Learning	0.537	-0.042	-0.065	0.709	-0.18
Evolution	0.108	0.967	0.006	0.100	-0.064	Organizational improvisation	0.285	0.048	0.380	-0.496	-0.489
Entrepreneurship	-0.017	0.927	-0.2	0.021	-0.043	Absorptive capability	0.339	0.160	-0.087	0.075	-0.857
Firm	0.260	0.894	0.099	-0.069	-0.141	Leadership	0.458	0.268	0.233	0.280	0.660
Bricolage	-0.130	0.88	-0.113	0.325	0.121	Information technology	0.246	-0.439	-0.219	0.088	-0.614
Industry	0.215	0.749	0.136	-0.359	0.083	Organizational change	0.487	0.271	0.212	0.188	0.489

Table 4. Total Variance Explained of Factor Analysis

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	18.865	37.729	37.729	18.865	37.729	37.729	15.725	31.450	31.450
2	8.432	16.863	54.592	8.432	16.863	54.592	8.239	16.478	47.928
3	5.910	11.819	66.412	5.910	11.819	66.412	7.422	14.844	62.773
4	4.828	9.656	76.067	4.828	9.656	76.067	5.364	10.729	73.501
5	2.634	5.267	81.335	2.634	5.267	81.335	3.917	7.833	81.335

Based on the correlation matrix, we conducted a factor analysis with a Varimax rotation to extract the key conceptual themes in the improvisation field. Table 4 shows that six factors are extracted with 81.335% of the explained variance. The results of factor analysis different from the outcomes of two approaches above, but the factor 1, 2, 3, 4 and 5 basically reflect the same research structure.

4.2. Results of Strategic Diagram Analysis

Based on the computational formula of density and centrality, we can obtain the strategic diagrams based on times cited of different periods, which are shown in Figure 6-9.

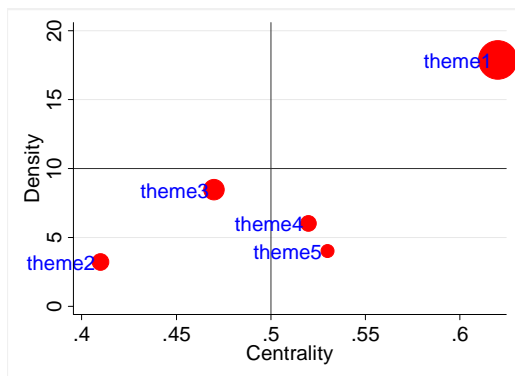


Figure 6. Strategic Diagrams of 1997-2012

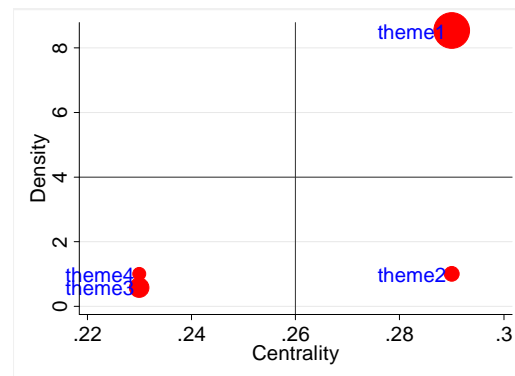


Figure 7. Strategic Diagrams of 1997-2002

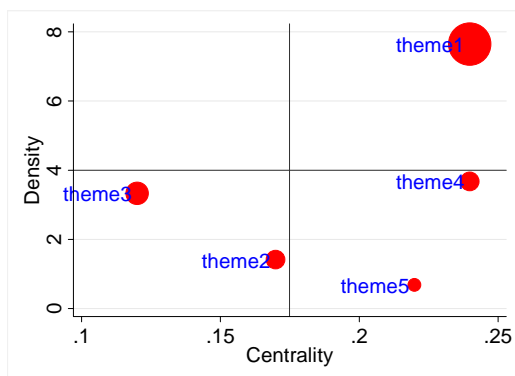


Figure 8. Strategic Diagrams of 2002-2007

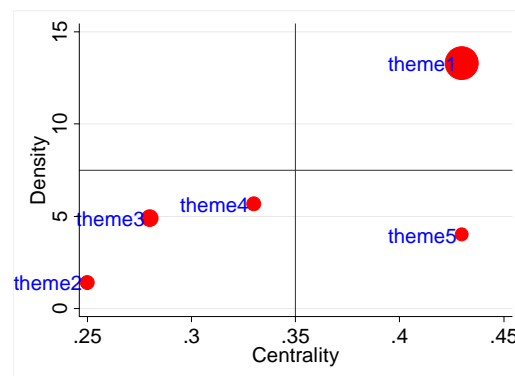


Figure 9. Strategic Diagrams of 2008-2012

Figure 6 shows the results of the whole period (1997-2012). Because of its strategic position (upper-right quadrant), theme1 was identified as the motor-theme of the period. Similarly, because of its high/medium centrality and low density (lower-right quadrant) theme 4 and 5 were regarded as general basic themes with strong external interconnection but low conceptual development. However, the strategic position of theme 2 and 3 (lower-left quadrant), which had a low density and low centrality, indicated that they were either emerging or disappearing themes. Figure 7 shows the results of the first period (1997-2002), in this stage,

theme 1 was still the motor-theme. Theme 3 and 4 were regarded as general basic themes, and theme 2 was emerging theme. At the same time, theme 5 was not appearing. Figure 8 shows the results of the second period (2003-2007), this stage was similar with the result of the whole period, which indicated that the position of theme 2 and 4 was changed, and theme 5 was appearing from the first stage to the second stage. Figure 9 shows the results of the second period (2008-2012), the position of theme 4 changed from lower-right quadrant to lower-left quadrant.

The results above show that the position of theme 1, 3 and 5 was stability and the posting of theme 2 and 4 was changed greatly, which indicates that the hot topic of different period was slightly different.

4.3. Results of Social Network Analysis

In order to grasp the overall co-word analysis, we analyzed keywords based on the whole period (1997-2012). Then we divided the whole period into three parts, so that we can identify the dynamic changes during these three periods. In the figures of the co-word network, the size of dots means the scale of degree centrality, and the size of lines means the tie strength of the keywords, and different color means the theme. The co-word networks of four periods were shown in Figure 10-13.

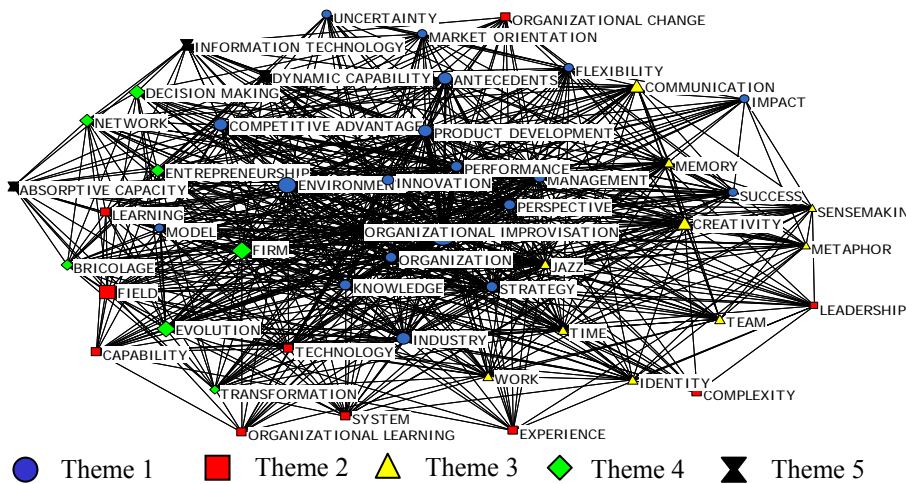


Figure 10. Co-word Network of 1997–2012

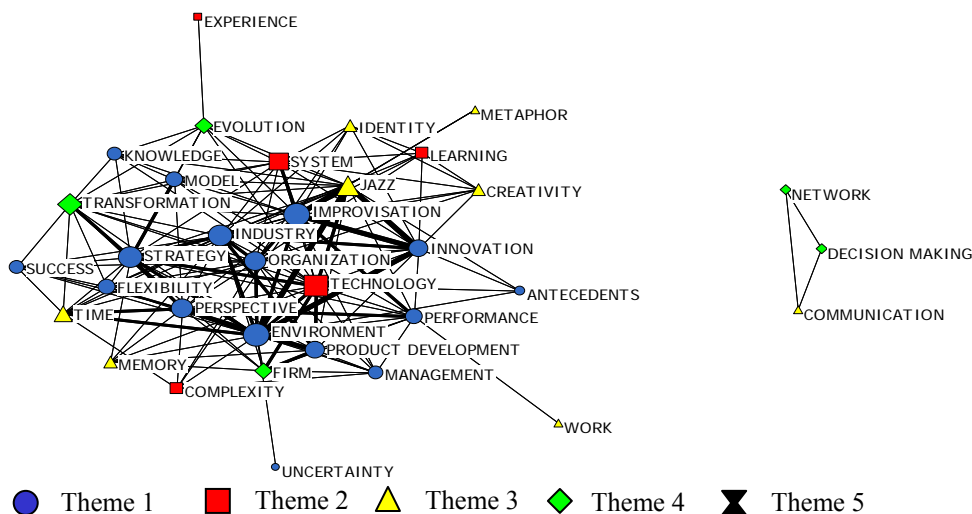


Figure 11. Co-word Network of 1997–2002

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