# STATE-OF-THE-ART AND ACADEMIC DISCUSSION TREND ANALYSIS USING CONTENT AND CLUSTER ANALYSIS: ACADEMIC SPIN-OFF AND ORGANIZATIONAL STRUCTURE

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## ABSTRACT

This work presents a quantitative way to describe the evolution and tendency of the state-of-the art of academic discussion, using database originated from literature review and content analysis. Specifically, it evaluates academic discussions related to technology development inside the spin-off companies. The documents were evaluated taking in consideration the presence of some characteristic themes, using binary variable. The cluster analysis and other auxiliary methods were used. The resultant clusters were described and evaluated taking in consideration their temporal distribution. The results show that the internal organizational structure is a recent and growing discussion, and the evolutionary approach contributes to the recent discussions and must be considered in future works.

**KEYWORDS: Content analysis, Literature Review, Binary Cluster Analysis, Academic spin-off, Statistics**

# 1. Introduction

Technology development process and new product development process has been studied by different knowledge areas, as comprised by strategy, organization theory, operations and economics (search theory), psychology, and anthropology (Loch & Kavadias, 2008). The new vision presents the evolutionary theory as a candidate for such a theory (Loch & Kavadias, 2008; Atuahene-Gima, 2005; Burgelman, Christensen, & Wheelwright, 2004). The works inspired in this view describes that generation of variety, selection, elaboration and inheritance occur in the level of the industry, the firm and the process (Loch & Kavadias, 2008). The macroview discusses the company as broader than units, uses the competence (and capabilities) focused view, to enable the long-term analysis of company's efficiency and configuration adequacy (Coombs, 1996; Atuahene-Gima, 2005).This view enables a discussion related to internal organizational structure, focused in the development of organizational capabilities.
This work studies a specific environment for technology development: the academic spin-off company. In this specific context, it investigates if this theme presents the same discussion ground and if there is a potential for the evolutionary view contributions to the start-of-the art. This work evaluates academic discussions related to technology development inside the spin-off companies, comparing with the broader technology development management knowledge area. Specifically, it develops a description of the domain evolution pattern and evaluates if it is also evolving to the internal structure focused discussions.

# 2. Research Method

This work conducts a theoretical, descriptive and qualitative research, based on literature review and content analysis method research, using some quantitative tools. The method was developed do describe the evolution of academic discussion, using database originated from literature review and conducting content analysis.
For temporal analysis purpose, firstly, a relational analysis was performed with several documents to indentify the main academic spin-off academic discussion themes. Following, those themes were used to documents evaluation and clustering. Using the obtained clusters, the research line temporal evolution was discussed. So, research papers were used as primary evidence source. Using the themes listing, the codification instructions for content analysis were defined. The document (paper, thesis, dissertation or book) was considered the codification unit. The database was elaborated, evaluating the documents according to the presence or absence of the themes, and the publication date (year). At last, the boxplot, a tools that enables data exploration, were used to describe the temporal evolution of the themes.

# 3. Temporal analysis of the documents

Technological development is dependent on several factors, such as: (i) efficient national innovation system; and (ii) the ability of the companies to efficiently use the knowledge and new technologies available in the universities and founding opportunities supported by the National Public Policy (Digregorio and Shane, 2003; Wright, Birley, and Mosey, 2004a; Wright, Vohora, and Lockett, 2004b).
Aiming at encouraging and supporting academic spin-off creation and development, the research institution can create an Institutional Innovation System, and it can define the spin-off performance (Steffensen, Rogers, Speakman, and Kristen, 1999; Clarysse, Heirman, and

Degroof, 2001; Degroof and Roberts, 2004; Rasmussen and Borch, 2004; Johansson, Jacob, and Hellström, 2005; Powers and Mcdouglall, 2005; Rothaermel and Thursby, 2005; Scholten, 2006). This Innovation System can be comprised by the technology transfer Office, incubators, technology parks, networking, and other initiatives (Edquist, 1997; Smith, 1997; Cripps, Yencken, Coghlan, and Anderson, 1999; Bozeman, 2000; Shane, 2004; MEYER, 2006). The academic spin-off is resultant of the interaction between the researcher-inventor and the Research Institute and its evolution (Johansson, Jacob, and Hellström, 2005). For this reason, studies about networking with other companies, relevant organizations, potential customers and the research institution are observed.

They emerge in an academic culture and present the typical small company problems: small structure, low resources, and difficulties to compete with greater companies. A common focus of discussions related to emerging companies is the entrepreneur (Schumpeter, 1961; Schumpeter, 1982) and its role in the innovation process and identification of opportunities. For this reason, the entrepreneurship area studies discuss the entrepreneurial team and its abilities (Wright, et al., 2004a; Helm and Mauroner, 2007; Cozzi, et al., 2008). As the spin-off grows, it must have the capability to learn new abilities (Rutherford and Fulop, 2006). For this reason, there are some evidences that the entrepreneurial area discussion must not focus on individual ability and must discuss the entrepreneurial team (Hellmann, 2000) and the organizational politics, with an organizational structure that promote the organizational learning and innovation (Garcia-Morales, Llorens-Montes, and Verdu-Jover, 2006).

Another discussion presented is about the academic spin-off development phases (Autio E., 1994; Vohora, Wright, and Lockett, 2004; Golish, Besterfield-Sacre, and Shuman, 2008). This theme is discussed through the following focus: the new product development process (Golish, Besterfield-Sacre, and Shuman, 2008) or some critical factors to promote spin-off growth and competitiveness (Vohora, Wright, and Lockett, 2004).

From this, the main themes discussed are the ones described in Figure 1.

| Theme |
|---|
| Classification of academic spin-off |
| Creation of academic spin-off |
| Entrepreneurship |
| Incubator and technological park, Research Institution |
| Innovation System |
| National Innovation System |
| Networking and spin-off |
| Organizational structure of spin-off |
| Spin-off and entrepreneurial team |
| Spin-off and new product development process |
| Spin-off and Evolutionary Perspective |
| Spin-off development phase |
| Spin-off environment |
| Spin-offs and competitive factor |
| Technology transferring and spin-off. |
| Venture capital and investments |

Figure 1: Themes' list

## 3.1 The database creation

The academic search tool Google Scholar was used to identify publications with key-words "academic spin-off" (648 documents), "university spin-off" (1.420 documents), or "academic start-up" (64 documents), "academic startup" (8 documents), "university start up" (588 documents), "university startup" (215 documents), and "academic "spin-off"" (36.400 documents). The search and the subsequent analysis and database creation was conducted

from August 2007 to July 2008. An initial analysis was conducted to identify the documents that denote some concern with academic spin-off management and performance.
From the original papers, this selection resulted in 85 publications from accessible databases, with theses, dissertations, papers from scientific journals. Publications like case studies and national panorama descriptions were avoided. The sample composition is described in Table 1. The papers from scientific journals are distributed mainly in the following journals: Journal of Technology Transfer (16 papers), Research Policy (14 papers) and Journal of Business Venturing (seven papers).

Table 1: Sample composition

| Publication Type | Count |
|---|---|
| Papers from scientific periodic | 72 |
| Papers available in web (in University, Research Institute or other relevant agent institutional site) | 6 |
| Doctorate dissertation | 2 |
| Book | 1 |
| Proceedings of congress or conference | 4 |

## 3.2 Research lines grouping

The research lines were identified by cluster analysis. The documents were analyzed to evaluate the presence of the themes (identified in Figure 1), using binary variables. The attribute presence was indicated by (1); and the absence, by (0). The documents were analyzed and grouped by its discussed theme similarities, by cluster analysis, using SPSS 13.0. As connection method, the ward method was used, considering that it enables spherical clusters with similar variances and sample sizes achievement without the linkage problem. The similarity measure was the squared Euclidian distance for binary data (SSPC Inc., 1997; Romesburg, 2004; Hair, et al., 2005).
For cluster number definition, the measure of cluster similarity in successive steps was analyzed. The definition point was identified as a significant decrease in the similarity measure progression (stopping rule) (Hair, et al., 2005). From this, ten clusters were obtained. The documents clusters are described through the relative frequency of attributes in Table 2. This relative frequency shows the theme occurrence in the total number of documents in the cluster. In each cluster the 100 % appearance is stressed. The relative frequency of discussions in the total number of documents is also presented. The theme discussed by all components of the cluster was mainly considered for designation of the clusters.
The most discussed themes are: creation of academic spin-off (54%); spin-off environment (47%); and Research Institution Innovation System (42%). Other discussed themes are: technology transfer and spin-off (22%); and spin-off and competitive factor (19%). These themes were used as the major contributor for clusters' names (research line) definition.
The management of spin-off companies theme is still a poorly discussed one (7%). It is highly discussed (100%) by Academic spin-off management with entrepreneurial team focus, moderately (40%) by Organizational Structure of Academic Spin-off, and very poorly (7%) by Environmental and research institute related factors and spin-off creation research line.
It is observed that the theme of new product development is a poorly discussed one (4%). It is presented just by the spread research line (14%) and Organizational Structure of Academic Spin-off research line (20%). This research line also discusses the related theme of decision making process (20%). This theme is only discussed by one more research line, the Academic spin-off management with entrepreneurial team focus (67%).

Table 2: Themes relative frequency in document clusters

| Cluster/ Research line Themes | Classification of academic spin-off | Creation of academic spin-off | Decision-Making | Entrepreneurship | Incubator and technological pa | Industrial Spin-off | Management of Academic Spin-of | National Innovation System | Networking and spin-off | Organizational structure of sp | Research Institution Innovation | Spin-off & Evolutionary Perspective | Spin-off and entrepreneurial t | Spin-off and new product development | Spin-off development phase | Spin-off environment | Spin-offs and competitive fact | Technology transferring and sp | Venture capital and investment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Academic S.O. environment without RI consideration | 0% | 56% | 0% | 11% | 11% | 0% | 0% | 0% | 22% | 0% | 0% | 0% | 11% | 0% | 0% | 100% | 11% | 0% | 0% |
| Academic S.O. as a Tech. transference mechanism | 0% | 0% | 0% | 0% | 33% | 17% | 0% | 17% | 0% | 0% | 0% | 0% | 0% | 0% | 33 % | 33% | 0% | 100% | 17% |
| Competitive factor without RI consideration | 20% | 60% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 60% | 20% | 0% | 40 % | 0% | 80% | 0% | 60% |
| Academic S.O. management with entrepreneurial team focus | 0% | 0% | 67% | 67% | 0% | 33% | 100 % | 0% | 0% | 0% | 0% | 0% | 100 % | 0% | 0% | 0% | 0% | 0% | 0% |
| Environmental and Research Institute related factors and spin-off creation | 0% | 87% | 0% | 7% | 0% | 0% | 7% | 47% | 7% | 0% | 80% | 0% | 7% | 0% | 0% | **100%** | 0% | 20% | 0% |
| Organizational Structure of Academic spin-off | 0% | 0% | 20% | 0% | 0% | 0% | 40% | 0% | 0% | **100%** | 0% | 40% | 40% | 20% | 0% | 40% | 80% | 0% | 0% |
| Academic Spin-off Creation | 0% | **100%** | 0% | 15% | 0% | 0% | 0% | 0% | 8% | 0% | 69% | 0% | 15% | 0% | 0% | 0% | 0% | 8% | 0% |
| Spread | 64% | 7% | 0% | 7% | 0% | 21% | 0% | 0% | 7% | 0% | 0% | 7% | 14% | 14% | 0% | 36% | 7% | 0% | 14% |
| Research Institute environment as competitive factor for academic S.O. | 29% | 57% | 0% | 0% | 14% | 0% | 0% | 0% | 14% | 14% | **100%** | 43% | 0% | 0% | 29 % | **100%** | 86% | 14% | 14% |
| Institutional Innovation System and Academic S.O. creation as Tech. Transf. Mechanism | 13% | 63% | 0% | 0% | 0% | 0% | 0% | 13% | 0% | 0% | **100%** | 0% | 0% | 0% | 0% | 0% | 0% | **100%** | 0% |
| In the total number of documents | 15% | 52% | 4% | 8% | 5% | 6% | 7% | 11% | 7% | 7% | 42% | 11% | 14% | 4% | 7% | 47% | 19% | 22% | 8% |

One knowledge area identified as contributing to the academic spin-off related academic discussions was the Evolutionary Perspective. This theme presented contributions to the following research lines: Competitive factor without Research Institution considerations (60%); Environmental and research institute related factors and spin-off creation research line (43%); and Organizational Structure of Academic Spin-off research line (40%).
The research line denomination and description are presented in Figure 3.

| Research line (quantity) | Description\example |
|---|---|
| **Environm** - Academic S.O. environment without RI consideration (9) | Presents discussion on academic spin-off environments. There is absence of discussion related to National or Institutional Innovation system. 60% discussed about spin-off creation. The least discussed themes were (20%) networking, (10%) Incubator and Technology Park entrepreneurial team, and competitive factor. |
| **Env&RI** - Environmental and Research Institute related factors and spin-off creation (15) | Discusses environmental factors affecting spin-offs, mainly (90%) spin-off creation. The main factors are the Institutional Innovation System (80%), and National Innovation System. It is also discussed the aspects as networking (70%), entrepreneurial team, and spin-off management. |
| **SO_Creat** - Academic Spin-off Creation (13) | All works discuss the spin-off creation. However, this discussion is not technology transfer related. The discussion is frequently (70%) centered in Institutional Innovation System and occasionally (20%) entrepreneurship, entrepreneurial team and networking |
| **SO_TTMec** - Academic S.O. as a Tech. transference mechanism (6) | Discusses using the technology transference focus, emphasizing (30%) incubator and technological park, spin-off development phases, and environmental factors. It is also discussed (20%) venture capital and investments, National innovation System or corporate spin-off. |
| **IS_Creat** - Institutional Innovation System and Academic S.O. creation as Tech. Transf. Mechanism (8) | This cluster discusses (100%) the Institutional Innovation System and its influence on spin-off creation as technology transferring process. The themes National Innovation Systems and spin-off typology are also (10%) discussed. |
| **RI_CompF** - Research Institute environment as competitive factor for academic S.O. (8) | Discuss the Institutional Innovation system and the spin-off environment as competitive factor for academic spin-off. It is also discussed: spin-off creation (60%); Evolutionary Perspective (40%); spin-off development stages (30%); and typology (30%). The themes venture capital; Incubator and Technological Park; networking; spin-off organizational structure and technology transference are less discussed. |
| **Compet_F** - Competitive factor without RI consideration (5) | There are discussed competitive factors focused on venture capital (60%); Evolutionary Perspective (60%), and spin-off creation (60%). None discusses the Research Institution. The themes typology and entrepreneurial team are less discussed. |
| **Enterpr_T** - Academic S.O. management with entrepreneurial team focus (3) | The focus of the theme spin-off management in this cluster is the entrepreneurial team. Frequently are discussed (70%) the themes decision making and entrepreneurship. There are also discussions with comparisons to corporative spin-off (30%). |
| **Org_Str** - Organizational Structure of Academic spin-off (5) | The Organizational structure of academic spin-off is discussed. The focus (80%) is that it acts as the success factor of the spin-off. There are observed significant discussion (40%) about academic spin-off management, entrepreneurial team, and spin-off environment. In 40% of the discussions, the Evolutionary Perspective was used. There are fewer discussions (20%) about Integrated Product Development Process and decision making. |
| **Spread cluster** (12) | This cluster is the most divergent in the discussed themes. The theme typology was discussed in the majority (60%). The spin-off environment was also discussed (40%). Fewer discussions were observed as related to corporate spin-off (20%), entrepreneurial team (10%), networking, competitive factor, Evolutionary Perspective, or spin-off creation. |

Figure 2: Research line (document cluster) description

For better visualization of the research lines' similarity, Table 2 was used to conduct the multidimensional scaling. This method graphically presents the dissimilarity measure as a distance between the research lines. The multidimensional scaling was conducted using Proxscal procedure of SPSS 13.0. The larger dimension number allows a better fit, but visualization can be lost. Hence, a three dimension plot was used. The measures of the obtained fit quality were: 0.05588 for S-Stress measure, and 0.1972 for normalized raw stress. The resultant coordinates were plotted and presented in Figure 4.
The obtained plot (Figure 3) complements Figure 2, showing similarities between obtained research lines. Thus, it is evidenced that the research line Research Institute environment as competitive factor for academic spin-off (RIcompF) and the research line Academic spin-off management with entrepreneurial team focus (Enterpr_T) are the most distant from each other. It means that these two research lines are the most

divergent ones. This is showed in Table 2: in these two research lines, all themes discussed by one research line are not discussed by the other.

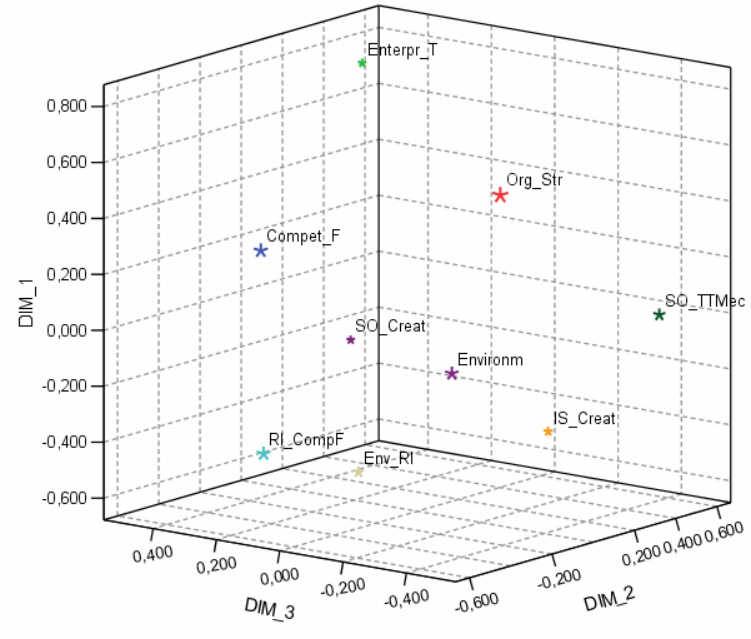



Figure 3: Multidimensional scaling of obtained research lines

The most similar themes were presented by the research lines Environmental and Research Institute related factors and spin-off creation (Env_RI) and Academic spin-off creation (SO_Creat); Env_RI and RICompF; Env_RI and Academic Spin-off environment without Research Institution consideration (Environm); and SO_Creat and Institutional Innovation System and Academic Spin-off Creation as Technology transfer mechanism (IS_Creat). The similarities of those pairs are evidenced by the common discussion of the themes, although with different frequencies.

## 3.3 The temporal evolution of the academic spin-off discussion

The clusters obtained in the previous section are the research lines identified to conduct the objectives of this work. Those research lines were evaluated taking in consideration the distribution of another variable of interest (year of publication). The spread research line was omitted because it has a heterogeneous theme. The Boxplot diagrams in Figure 4 present those distributions. The subsequent analysis was conducted considering the different composition size of the research lines.

Boxplot displays the distribution of variables. The solid line represents the median. The length of the box and whiskers are a measure of spread. Inside the Box borders there are 50% of the data. The length of the whiskers indicates the tail length of the distribution. Points in the outside those limits are possibly outliers. For example, the research line IS_Creat (Institutional Innovation System and Academic Spin-off creation as Technology Transfer Mechanism) shows that the quantity of publications per year is a little more concentrated in the period between 1997 and 2001.

The research line SO_TTMec (Academic Spin-off as a Technology transfer mechanism) is dispersed across a larger publication period than other research lines. Those publications occurred before 2006. It presents great dispersion on initial publication period, but is more concentrated between 2005 and 2006. It is shown that the spin-off

creation as a technology transfer mechanism, even if it started in the early 90's, was more emphatically discussed recently (more than 50 % of publications occurred in 2006).

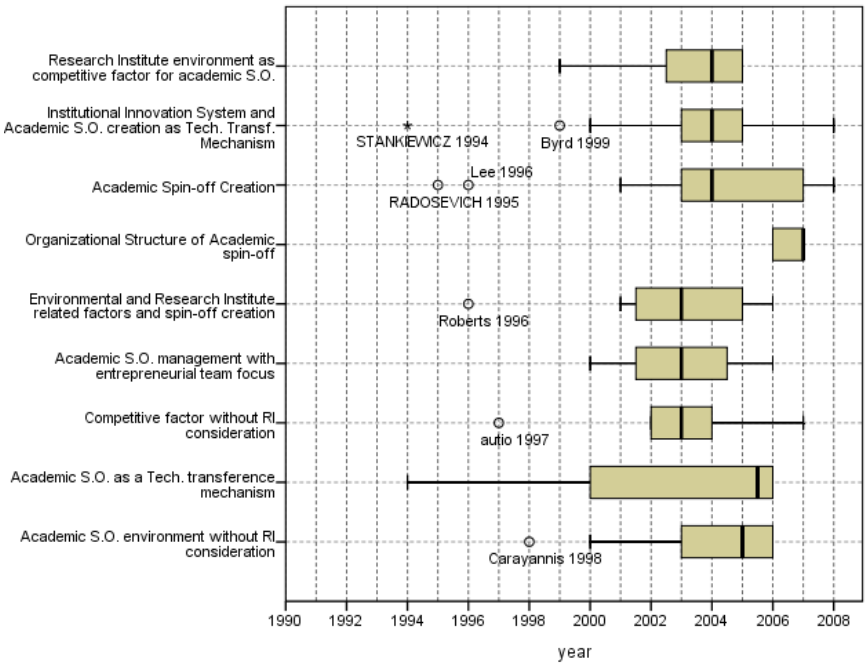



Figure 4: Box plot with publications year distribution for research lines

The research line Environm (Academic spin-off environment without Research Institution consideration) starts mainly in 2000, although there was one outlier in 1998, the work from Carayanis et al.(1998). Therefore, this research line also presents a slight asymmetry to left, indicating more attention to the environment theme more recently.
The research line SO_Creat (Academic Spin-off Creation) presents distribution with asymmetry to right. Most of the research lines start publishing in 2001. However, two outliers are observed in the middle of the 90's, indicating that even if the initial studies on this research line started in the middle 90's, documents were more concentrated in the period between 2003 and 2004, and the works are kept being published until the end of the analyzed time, even if their frequency has diminished through the time.
The focus of this work, the research line Org_Str (Organizational Structure of Academic spin-off), presents an asymmetry to the left and its documents are more concentrated in recent times, between 2006 and 2007. It indicates that the research line is growing. The research lines discussed with reasonable emphasis in recent years are mainly SO_Creat (Academic Spin-off Creation) and Org_Str (Organizational Structure of Academic spin-off), although the former are diminishing and the latter are growing. The research line Org_Str is more recent than RI_CompF. And most of the components (75% or more) of research lines Compet_F, Enterpr_T, EnvandRI, and IS_Creat are prior to Org_Str.

## 3.4 Contribution of the main journals on the theme

Boxplots generated by exploring the database grouping by journals and obtained theme groups illustrates that the theme Spin-off was studied by different views. It is supposed that the journals represent some different knowledge areas discussing the theme Spin-off by different views. Although the graphs presented progression from 1990, it is stressed

that the all main journals analyzed were published only after 1995. As for discussion, were considered journals that presented more than one document in the database and that were included in the Impact Factor evaluation in the Journal Citation Reports (JCR).

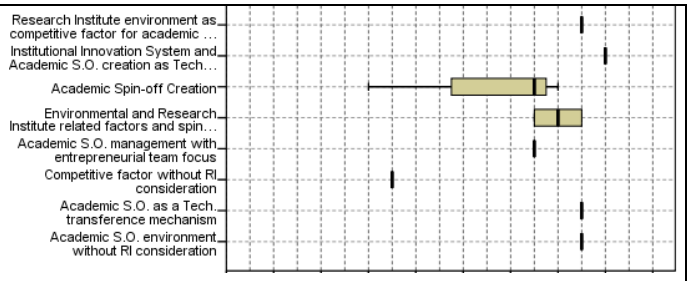
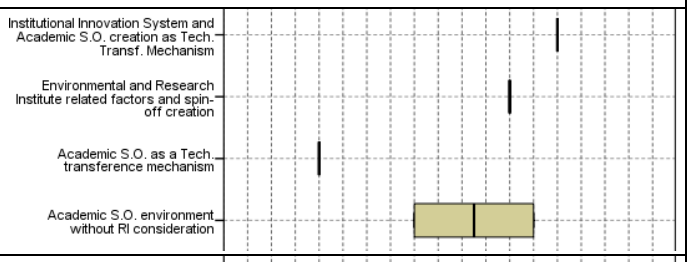
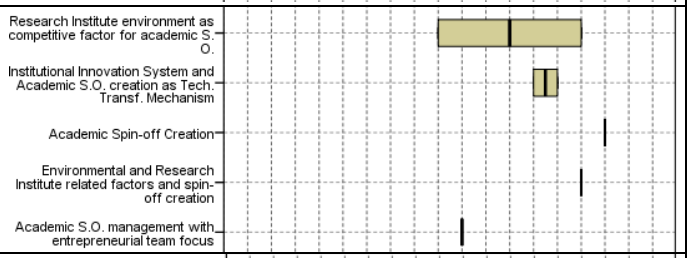
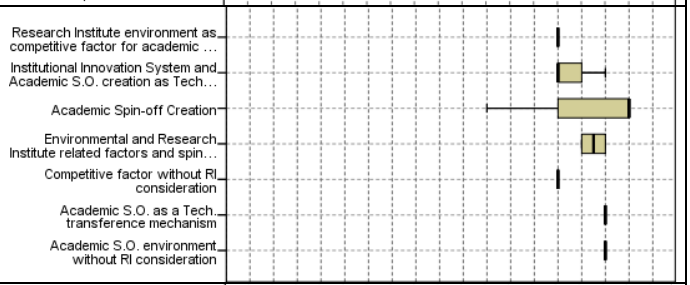
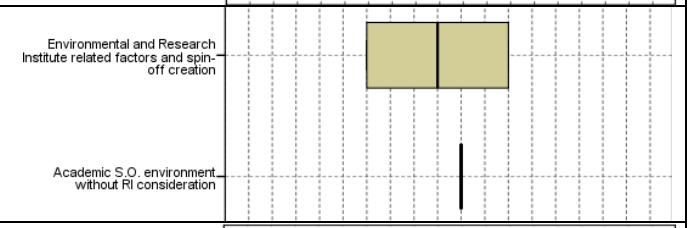
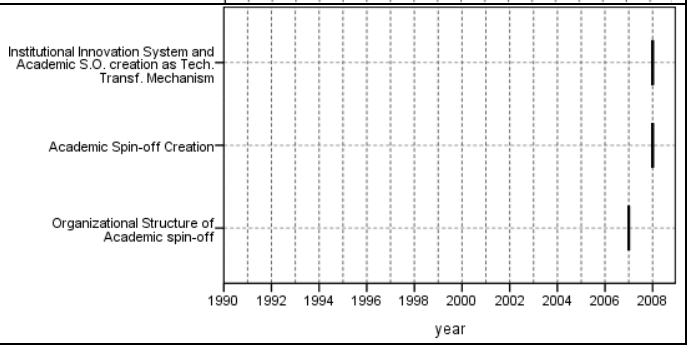
| | | |
|---|---|---|
| Research Policy | Approach: Academic<br>Scope: Entrepreneurship, Evolutionary/ Schumpeterian Economics, Industrial Clusters, Innovation Management/ Policy/ Strategy, Knowledge, System of Innovation, Product and Process Development, R&D Management, Research Policy, Science Policy, Technology Management/ Policy/ Strategy. |  |
| Technovation | Approach: Academic<br>Scope: Management of entrepreneurial ventures, management of innovation in medium–sized and large organizations, organizational structures intended to facilitate innovation, investment strategies related to technology–based enterprises, the innovator, and technology transfer to developing nations |  |
| Journal of Business Venturing | Approach: Practice<br>Scope: Practice of entrepreneurs, innovators, and their support systems; and issues useful to scholars, educators, enablers, and practitioners of the entrepreneurial phenomenon |  |
| Journal of Technology Transfer | Approach: Practice<br>Scope: Management practices and strategies toward technology transfer, as well as on the external environment that affects these practices and strategies including public policy developments, regulatory and legal issues, and global trends |  |
| R&D Management | Approach: Academic<br>Scope: Full range of topics in research, development, design and innovation, and related strategic and human resource issues - from exploratory science to commercial exploitation - articles also examine social, economic and environmental implications. |  |
| Journal of Product Innovation Management | Approach: Academic and Practice<br>Scope: Academic theory and effective management practice for both the internal and external environment of the organization |  |

Figure 5: Journals and temporal distribution of discussion groups

Following, the obtained groups were also described in according to the publishing journal. The Figure 6 detaches two of these groups.

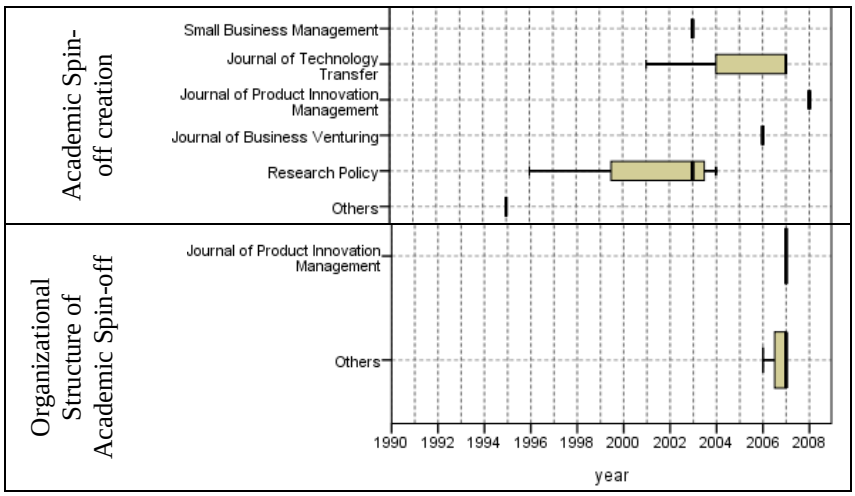



Figure 6: some groups of interests and journals that contributed to this theme group

It is observed that the Academic Spin-off creation theme was initially discussed by policy and National Innovation System view, as demonstrated by the fact that from 1996 to 2004 it was discussed by the journal Research Policy (macro view). Subsequently presents focus in discuss the technology transfer process, new venture generation, as presented by the documents observed from Small Business Management, Journal of Technology Transfer and Journal of Business Venturing. These focuses, as shown by the evaluation of journals main approaches and scope, were more worried about practice inside the Research Institutions and Companies. At last, it was observed a document from the Journal of Product Innovation Management, a journal focused both in the practice and in the academic discussion, but in essence presents more micro view.
The group Organizational Structure of Academic Spin-off was discussed recently, as presented previously. The Figure 6 shows that it was composed by documents from different journals, and between the main elected journals, it was presented in the Journal of Product Innovation Management, one journal that focus on the managerial aspects of the Product Development and Innovation Process inside the company.

# 4. Discussion and conclusion

A feature that must be considered in literature review is amount of analyzed document. The number of documents consulted in this work fairs to represent the totality of the published documents related to the theme. Still the method enabled to conduct an analysis with a sample, composed by a fraction of the population of literature available documents. It is supposed that the consideration of relevant journals of this knowledge area enables the qualitative representativeness of the population. This qualitative representativeness is presumed considering: (i) the presence in the database of significant amount of papers from relevant journals of the theme; and (ii) the use of web-based search tool, that enables search in different databases, that includes papers from relevant journals. From these propositions, it is supposed that the rate of the themes consideration is also representative. Therefore, as a complementing method for a qualitative research, it

have not intended to consider the analyzed documents as representing the state-of-the art in the quantitative, but in the qualitative manner.
This work used cluster analysis and multidimensional scaling, allied to boxplot in content analysis conduction in order to allow the evaluation of research lines evolution and newness of the spin-off internal structure discussion theme. The cluster analysis enabled the definition of research lines discussing the themes differently. The obtained diversity indicates that the spin-off theme is really a fragmented field.
The obtained research lines made the achievement of objectives of this work possible because the Organizational Structure of Academic Spin-off (Org_Str) research line was the only one that presented great relative frequency (100%) of the organizational structure of the spin-off theme discussion. Other research lines did not present this theme discussion, or discussed it with low frequency (14%). That was the case of the research line Research Institute environment as competitive factor for academic spin-off (RI_CompF) (see Table 2). From this, it can be concluded that the obtained clusters represent this work's proposal.
The steps proposed in this work enabled the state-of the art and tendency analysis of the spin-off academic discussion. The conducted review, associated with the analysis, allowed the description of the literature panorama. The panorama was described as composed by list of research lines with some similarities and the temporal distribution of these research lines. Research lines of this broad theme and specific kind of company were identified by cluster analysis. The obtained research lines were analyzed about similarities by multidimensional scaling. The boxplot made the temporal analysis of the research lines possible. The selected method combination for content analysis – with binary cluster, multidimensional scaling analysis, and the publication year dispersion analysis by boxplot – presented itself as efficient for the intended objectives.
This distribution indicates tendencies and opportunities to academic research on academic spin-off development. Therefore, the contribution of this work is to present a quantitative way to analyze the state-of-the art mapping. More than showing the evolution from macro and meso level studies to micro level studies, this work enabled the new approaches identification for micro level studies. Further than networking, entrepreneurship (founders role), factors for performance enabling, recent works started to discuss spin-off management, decision taking and organizational structure evolution.

# 5. References

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