# 60 YEARS OF BUSINESS INTELLIGENCE: A BIBLIOMETRIC REVIEW FROM 1958 TO 2017

## THE 17TH INTERNATIONAL CONFERENCE ON INTELLIGENT SOFTWARE METHODOLOGIES, TOOLS, AND TECHNIQUES

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# 1. INTRODUCTION

CONTEXT

Business Intelligence (BI) is being seen as a core activity in business, science, education or any field in which the use of intelligent software are vital to achieve their goals.

The BI concept is also multidimensional, and it can be defined as a technology-driven process for analyzing data and presenting actionable information to support the organizational decisions.

The professionals involved in this area of knowledge are seeking to uncover the conceptual structure of a research area of interest are worth and necessary.

OBJECTIVE

The main aim of this contribution is to develop a bibliometric analysis to evaluate the performance and conceptual evolution of the Business Intelligence from 1958 to 2017.

The analysis is developed using SciMAT.

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# METHODOLOGY

SOFTWARE TOOL

SciMAT was employed to develop a longitudinal conceptual science mapping analysis based on co-words bibliographic networks.

METHODOLOGY STAGES

1. **Detection of the research themes.** Co-word analysis, followed by a clustering of keywords to topics/themes. The similarity between the keywords is assessed using the equivalence index.

2. **Visualizing research themes and thematic network.** Strategic diagram and thematic network (centrality and density). Research themes mapped in a two-dimensional strategic diagram and classified into four groups (Figure 1): i) motor, ii) basic/transversal, iii) highly developed-isolated, and iv) emerging/declining

3. **Performance analysis.** Relative contribution of the research themes to the whole research field: number of published documents, number of citations, and different types of bibliometric indices (h-index).

# METHODOLOGY



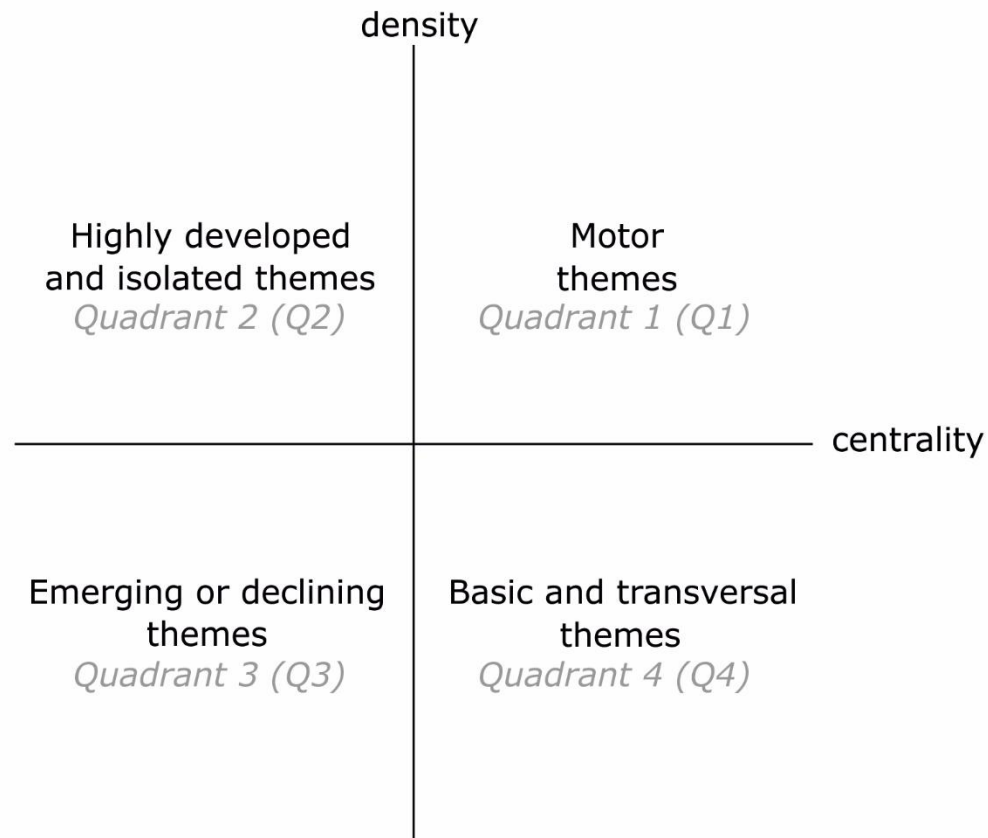Figure 1: The strategic diagram

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# DATASET

CORPUS AND DATABASE
Business Intelligence research documents published in the Web of Science Core Collection.

TIME PERIOD
1958-2017 divided in three period: 1958-2007, 2008-2012 and 2013-2017.

CORPUS SIZE
- 3,351 documents (articles, proceedings and reviews published in English) and 27,779 keywords.
- Citations count up to 1st April 2018.
- 1958-2007: 446 documents and 4,266 keywords.
- 2008-2012: 1,090 documents and 8,787 keywords.
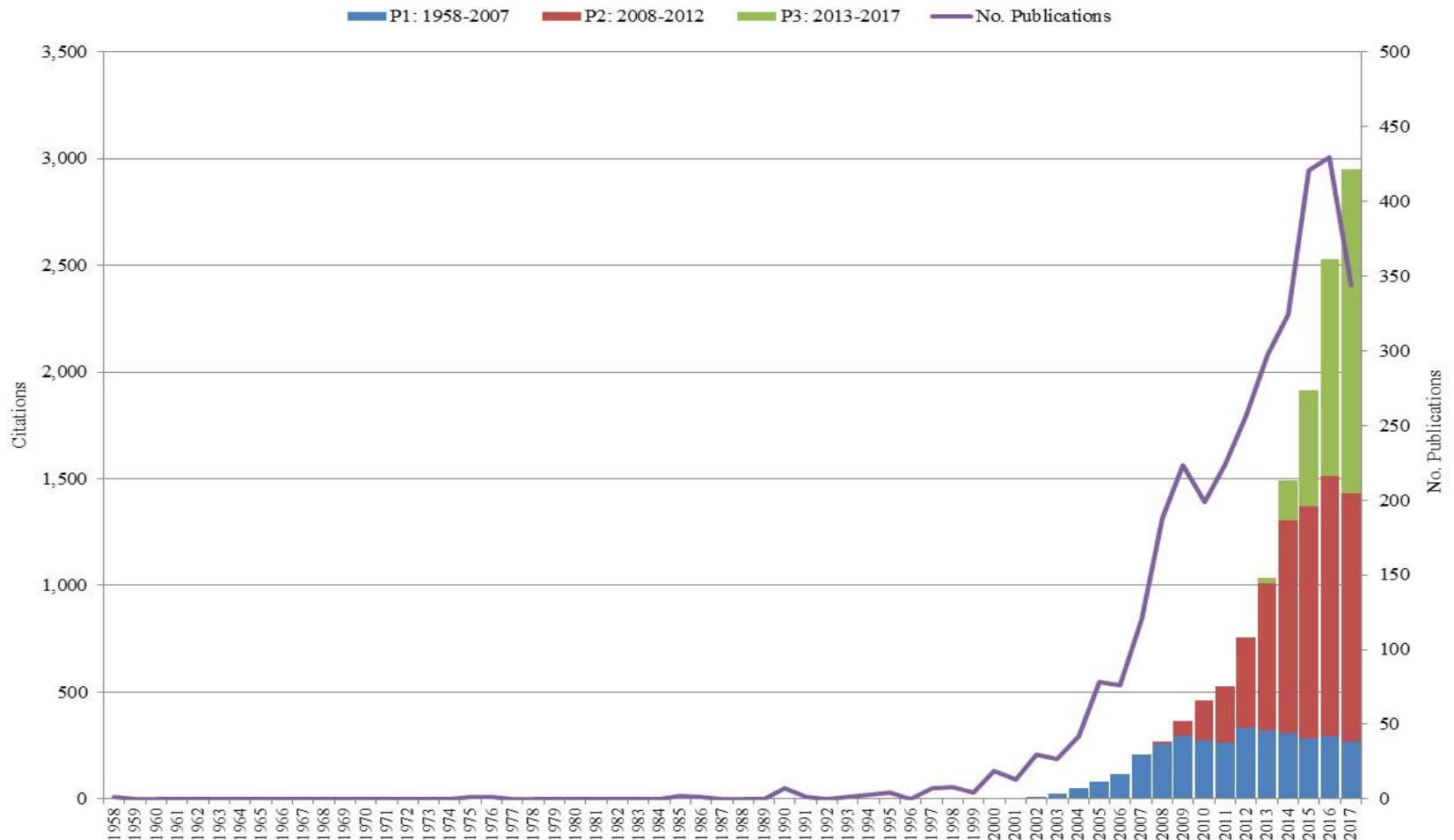- 2013-2017: 1,815 documents and 14,726 keywords.

QUERY
*TS=("Business Intelligence" OR "Business-Intelligence") AND PY=1958-2017*

# DATASET – DOCUMENTS BY YEAR AND PERIOD
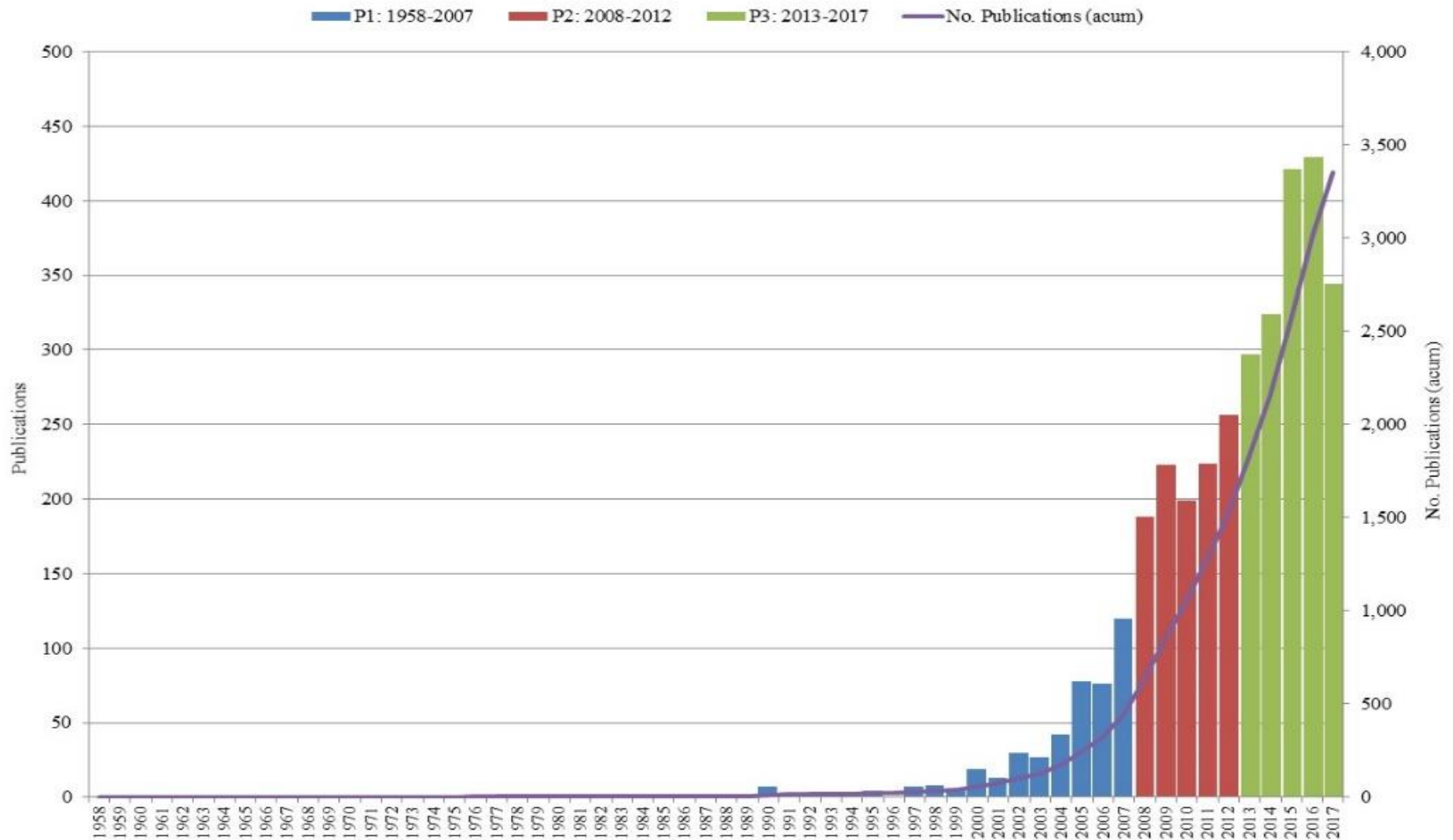
# DATASET – CITATIONS BY YEAR AND PERIOD
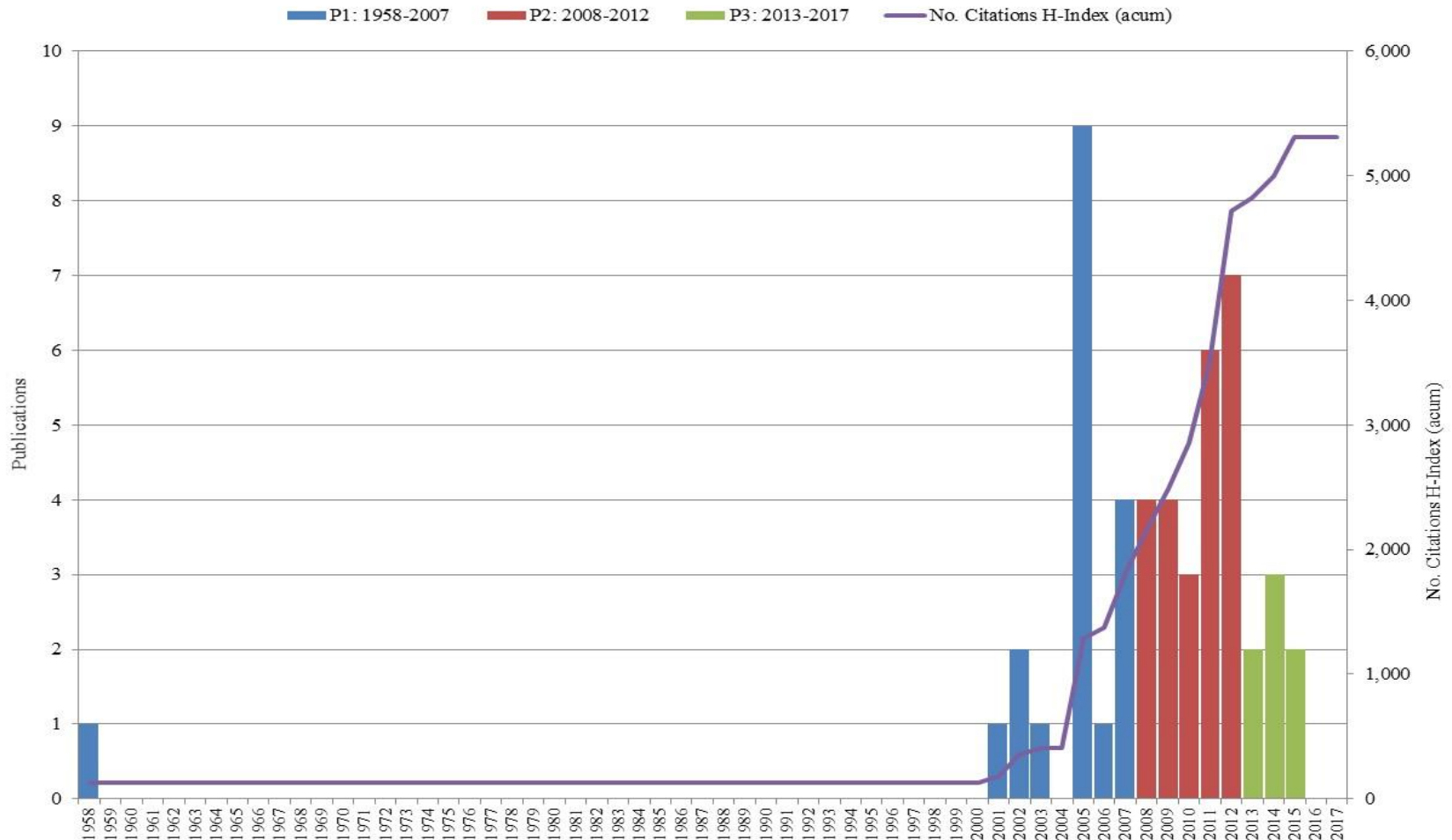
# DATASET – BI H-INDEX PUBLICATIONS
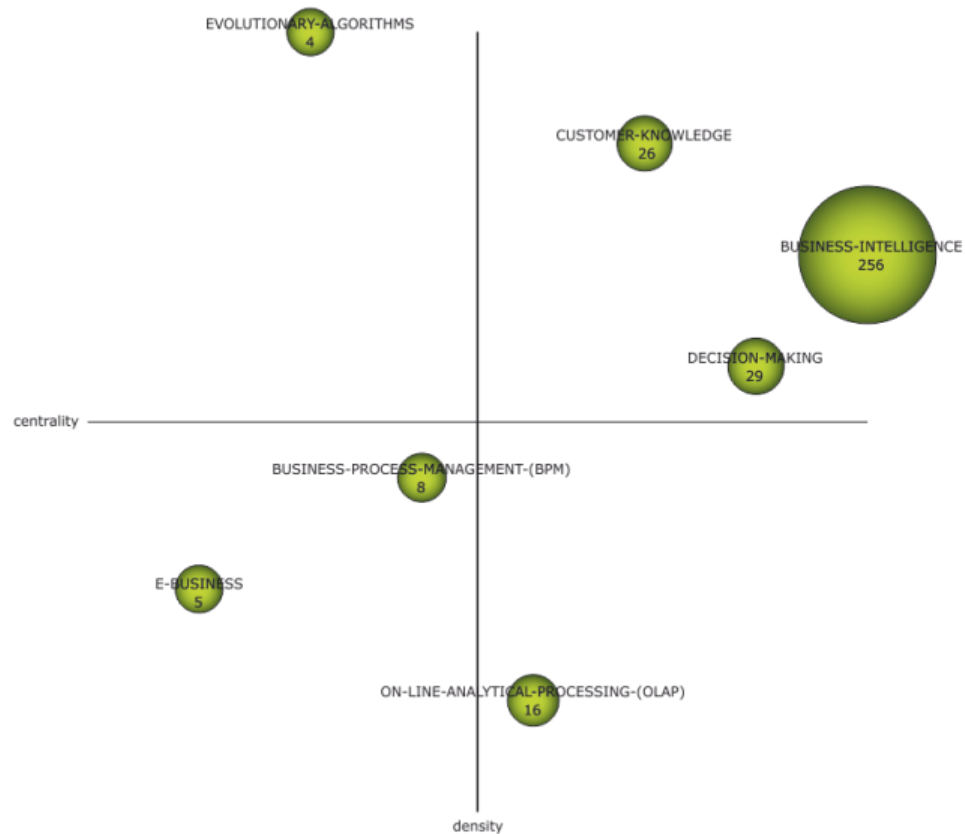
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# CONCEPTUAL ANALYSIS – PERIOD 1958-2007



Figure 4. Strategic diagram for the 1958-2007

# CONCEPTUAL ANALYSIS – PERIOD 1958-2007

| Theme | Documents | Citations | h-index |
|---|---|---|---|
| BUSINESS-INTELLIGENCE | 256 | 1,829 | 22 |
| DECISION-MAKING | 29 | 67 | 5 |
| CUSTOMER-KNOWLEDGE | 26 | 344 | 9 |
| ON-LINE-ANALYTICAL-PROCESSING-(OLAP) | 16 | 207 | 8 |
| EVOLUTIONARY-ALGORITHMS | 4 | 32 | 2 |
| BUSINESS-PROCESS-MANAGEMENT-(BPM) | 8 | 11 | 1 |
| E-BUSINESS | 5 | 4 | 1 |

The first period has lower number of publications than the other periods, we could identify seven themes (Figure 4) related to the Business Intelligence research field. In this regard, we could highlight four key themes (motor theme and basic and transversal themes) of the knowledge field: *BUSINESS-INTELLIGENCE, DECISION-MAKING, CUSTOMER-KNOWLEDGE* and *ON-LINE-ANALYTICAL-PROCESSING-(OLAP).*
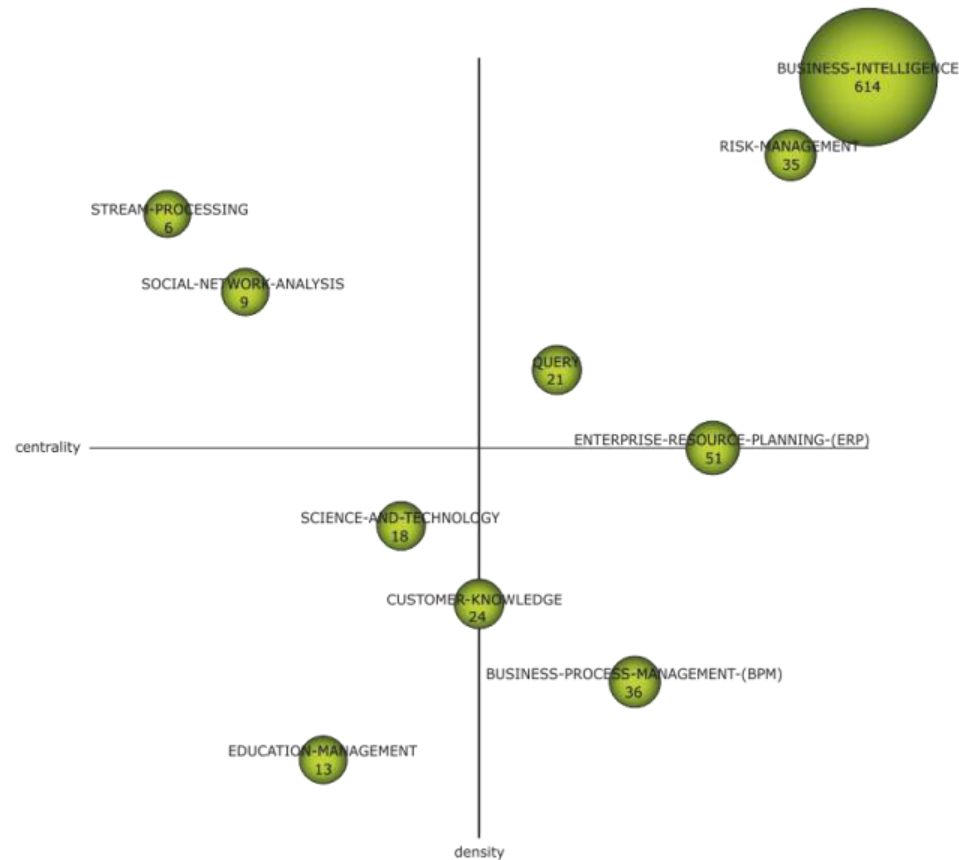
# CONCEPTUAL ANALYSIS – PERIOD 2008-2012



Figure 5. Strategic diagram for the 2008-2012

# CONCEPTUAL ANALYSIS – PERIOD 2008-2012

| Theme | Documents | Citations | h-index |
|---|---|---|---|
| BUSINESS-INTELLIGENCE | 614 | 4,472 | 29 |
| ENTERPRISE-RESOURCE-PLANNING-(ERP) | 51 | 240 | 9 |
| RISK-MANAGEMENT | 35 | 335 | 8 |
| QUERY | 21 | 296 | 6 |
| BUSINESS-PROCESS-MANAGEMENT-(BPM) | 36 | 295 | 7 |
| CUSTOMER-KNOWLEDGE | 24 | 274 | 7 |
| SCIENCE-AND-TECHNOLOGY | 18 | 433 | 7 |
| EDUCATION-MANAGEMENT | 13 | 17 | 3 |
| SOCIAL-NETWORK-ANALYSIS | 9 | 179 | 6 |
| STREAM-PROCESSING | 6 | 31 | 4 |

During the second period we could identify ten themes related to the Business Intelligence research field (Figure 5). Consistent with the last period, six themes are considered keys in the knowledge field: *BUSINESS-INTELLIGENCE, RISK-MANAGEMENT, QUERY, ENTERPRISE-RESOURCE-PLANNING-(ERP), CUSTOMER-KNOWLEDGE* and *BUSINESS-PROCESS-MANAGEMENT-(BPM).*
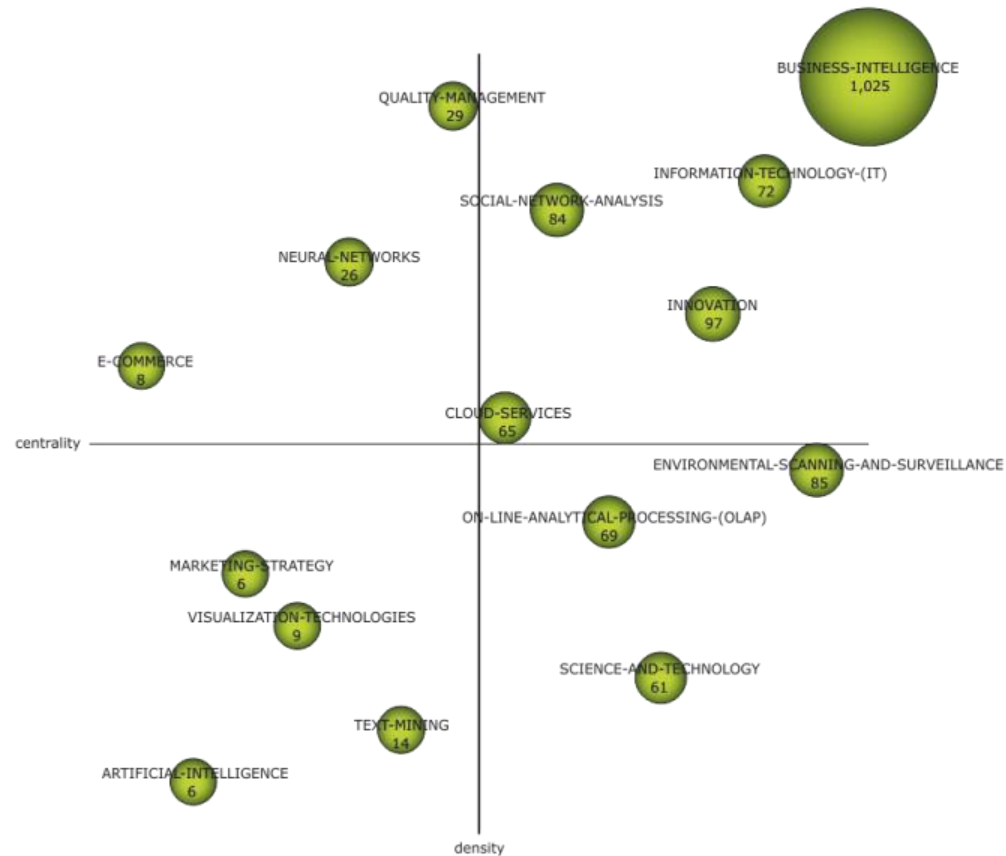
# CONCEPTUAL ANALYSIS – PERIOD 2013-2017



Figure 6. Strategic diagram for the 2013-2017

# CONCEPTUAL ANALYSIS – PERIOD 2013-2017

| Theme | Documents | Citations | h-index |
|---|---|---|---|
| BUSINESS-INTELLIGENCE | 1,025 | 2,542 | 21 |
| INFORMATION-TECHNOLOGY-(IT) | 72 | 258 | 8 |
| ENVIRONMENTAL-SCANNING-AND-SURVEILLANCE | 85 | 232 | 9 |
| SOCIAL-NETWORK-ANALYSIS | 84 | 269 | 10 |
| INNOVATION | 97 | 293 | 8 |
| SCIENCE-AND-TECHNOLOGY | 61 | 211 | 8 |
| ON-LINE-ANALYTICAL-PROCESSING-(OLAP) | 69 | 85 | 4 |
| CLOUD-SERVICES | 65 | 203 | 8 |
| QUALITY-MANAGEMENT | 29 | 53 | 5 |
| NEURAL-NETWORKS | 26 | 74 | 4 |
| VISUALIZATION-TECHNOLOGIES | 9 | 10 | 2 |
| TEXT-MINING | 14 | 28 | 3 |
| E-COMMERCE | 8 | 20 | 3 |
| ARTIFICIAL-INTELLIGENCE | 6 | 1 | 1 |
| MARKETING-STRATEGY | 6 | 21 | 2 |

During the third period we could identify fifteen themes (Figure 6). In this regard, eight of the total themes are considered key: *BUSINESS-INTELLIGENCE, INFORMATION-TECHNOLOGY-(IT), SOCIAL-NETWORK-ANALYSIS, INNOVATION, CLOUD-SERVICES, SCIENCE-AND-TECHNOLOGY, ENVIRONMENTAL-SCANNING-AND-SURVEILLANCE* and *ON-LINE-ANALYTICAL-PROCESSING-(OLAP).*
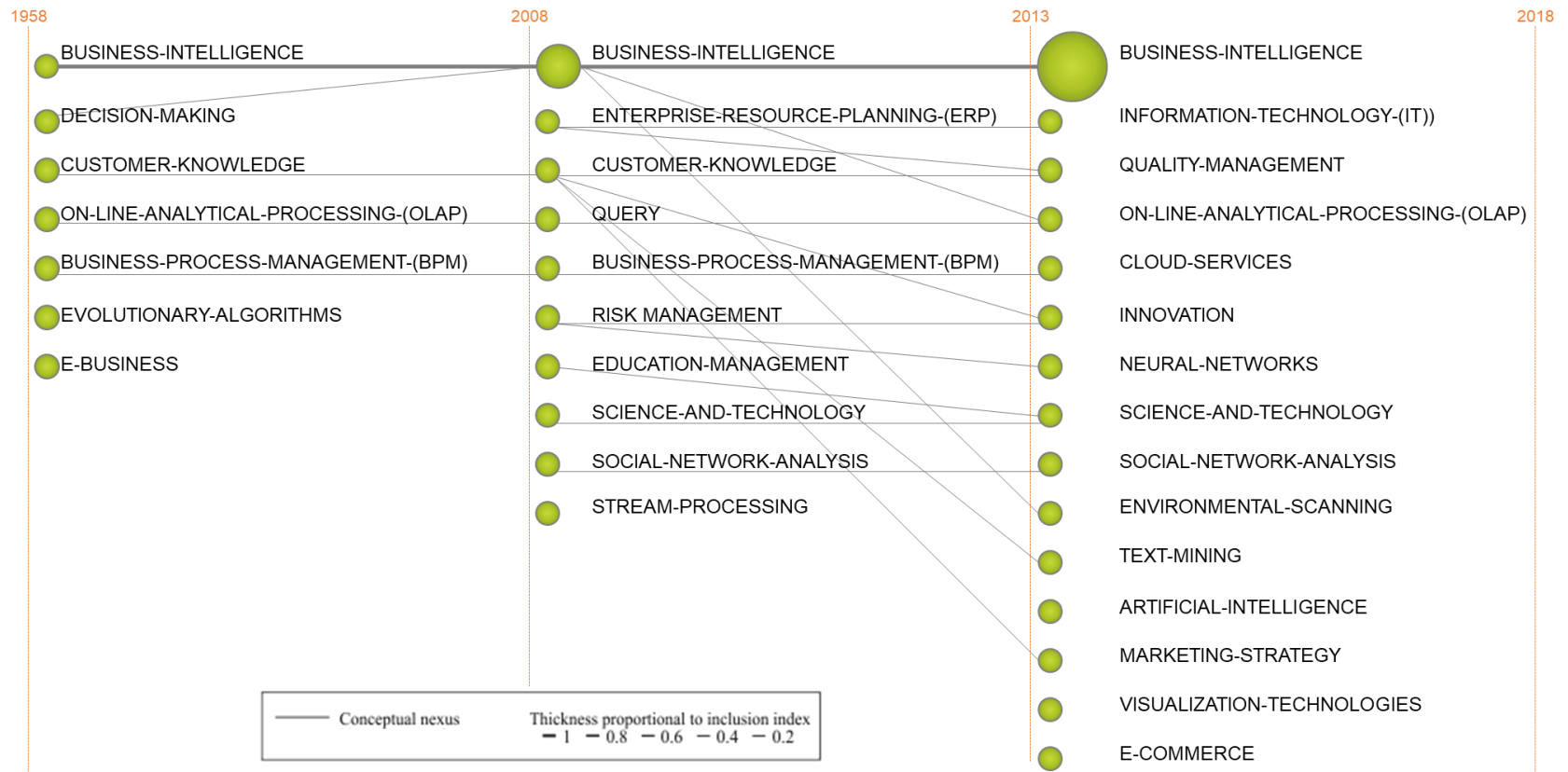
# CONCEPTUAL EVOLUTION MAP



Figure 7. Conceptual Evolution Map 1958-2017

# CONCEPTUAL EVOLUTION MAP

| Period 1: 1958-2007 BI Components | Period 2: 2008-2012 BI Components | Period 3: 2013-2017 BI Components |
|---|---|---|
| TECHNOLOGY, ANALYTICAL TOOLS, ENVIRONMENTAL SCANNING AND SURVEILLANCE, MARKET STRATEGY, WEB 2.0, DECISION SUPPORT SYSTEMS, MANUFACTURING INDUSTRY, DATA MINING, DATA WAREHOUSE, ENTERPRISE 2.0 AND STRATEGIC MANAGEMENT. | TECHNOLOGY, ANALYTICAL TOOLS, ENVIRONMENTAL SCANNING AND SURVEILLANCE, WEB 2.0, DECISION SUPPORT SYSTEMS, ONLINE ANALYTICAL PROCESSING (OLAP), DATA MINING, DATA WAREHOUSE, ENTERPRISE 2.0, INFORMATION SYSTEMS AND DECISION MAKING. | TECHNOLOGY, ANALYTICAL TOOLS, ORGANIZATION, WEB 2.0, DECISION SUPPORT SYSTEMS, BIG-DATA ANALYTICS, DATA MINING, DATA WAREHOUSE, ENTERPRISE 2.0, INFORMATION SYSTEM AND DECISION MAKING. |

In the Business Intelligence evolution map we can identify three kinds of topics: Business Intelligence concepts, Computer Science, and Innovation and Business Competitiveness. Accordingly, *BUSINESS-INTELLIGENCE* is the most representative research theme in the period evaluated followed by *INNOVATION* and *ON-LINE-ANALYTICAL-PROCESSING-(OLAP).*

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# CONCLUSIONS

SUMMMARY

- An amount of 3,351 documents (articles, proceedings and reviews) were retrieved from the Web of Science Core Collection.
- The corpus was divided in three period: 1958-2007, 2008-2012 and 2013-2017.
    - 1958-2007: 446 documents and 4,266 keywords.
    - 2008-2012: 1,090 documents and 8,787 keywords.
    - 2013-2017: 1,815 documents and 14,726 keywords.
- The impact achieved is summarized in the following indicators:
    - Average citations per publication: 4.06
    - Sum of Times Cited (without self-citations): 13,596 (11,032)
    - Citing articles (without self-citations): 10,558 (9,577)
- The H-Classics publications performance is summarized in the following indicators:
    - h-index: 50 publications
    - Average citations per publication: 106.32.
    - Sum of Times Cited (without self-citations): 5,316 (5,286).
    - Citing articles (without self-citations): 4,584 (4,569).

# CONCLUSIONS

MAIN CONCLUSION

- The size of literature related to Business Intelligence research field showed a noticeable increase in the past decade (2008-2017). Given the large volume of publications and citations received in this field, it is expected that the use of these will be seen as part of other knowledge fields.

- The main themes used in the Business Intelligence literature are: *Business-Intelligence, Information-Technology-(IT), Social-Network-Analysis, Innovation, Cloud-Services, Science-and-Technology, Environmental-Scanning-and-Surveillance* and *On-Line-Analytical-Processing-(OLAP).*

FUTURE WORKS

- The Business Intelligence could be complemented by other intelligence terms (i.e Competitive Intelligence, Market Intelligence, Technology Intelligence…).

- Study the evolution of the research themes across the consecutive time periods.

# THANK YOU

## THE 17TH INTERNATIONAL CONFERENCE ON INTELLIGENT SOFTWARE METHODOLOGIES, TOOLS, AND TECHNIQUES

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