30 years of intelligence models in management and business: A bibliometric review

Business Intelligence and Analytics

Present to:

Dr. Vatcharaporn Esichaikul

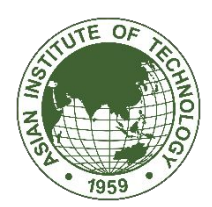**Presented by:**

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CONTENT

PART 01

Introduction

Introduction

- The knowledge-based economy has brought about increased competitive pressure within the business environment.

- **Intelligence** is a framework for action and research for organizations to improve their competitiveness by gathering, analyzing at the right time for use in the decision-making process.

- Intelligence has emerged as a field of study converging various areas.

- Intelligence is presently defined by its terminological plurality, with several notable studies describing the coexistence of terms.

- This study focuses on analyzing and describing the **development** of the **various definitions** of Intelligence in 30 years (1987 - 2017).

- Using bibliometric techniques and tools.
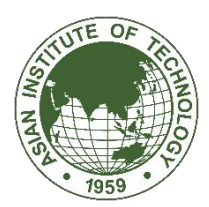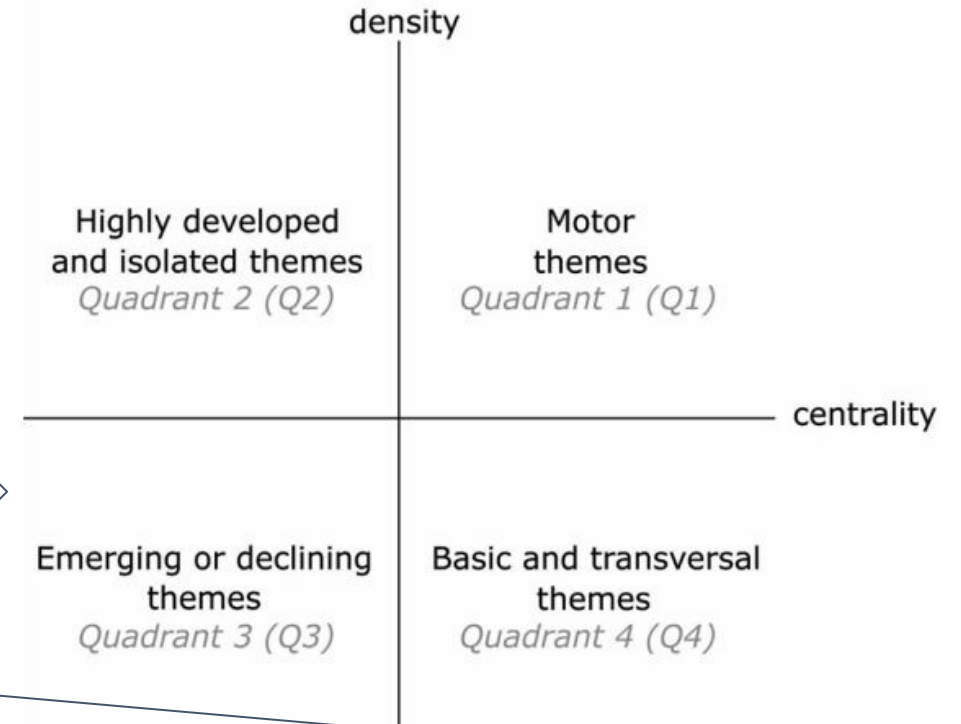
PART 02
Methodology and dataset

Methodology

1. Detection of research themes: clustering algorithm over a normalized co-words network.

2. Visualizing research themes and the thematic network: Determined based on centrality and density rank values using two specific tools: the strategic diagram and thematic network.

density

Highly developed and isolated themes
Quadrant 2 (Q2)

Motor themes
Quadrant 1 (Q1)

centrality

Emerging or declining themes
Quadrant 3 (Q3)

Basic and transversal themes
Quadrant 4 (Q4)

Quadrant Q1: Central and densely connected themes that play a key role in developing and structuring the research field.

Quadrant Q2: Highly specialized, peripheral themes that are strongly related but not of appropriate background or importance for the field.

Quadrant Q3: Relatively weak, with low density and centrality. They can represent either emerging or disappearing themes.

Quadrant Q4: Important but underdeveloped basic and transversal themes with low centrality and density.
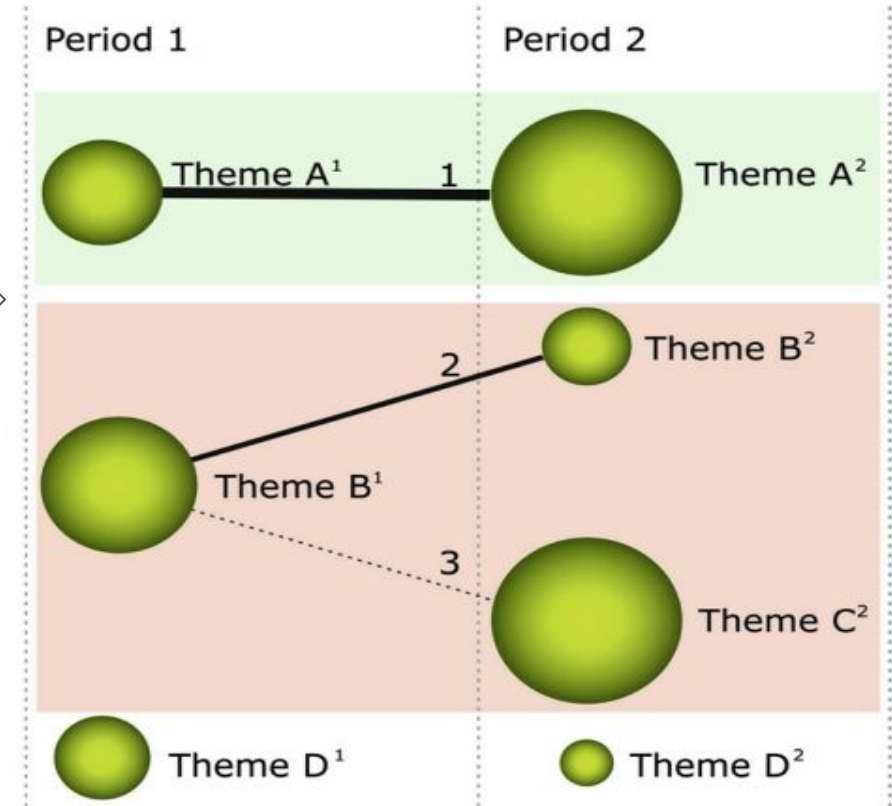
Methodology

3. Discovery of thematic areas: analysis of an evolution map that connects themes of consecutive periods with common keywords.

4. Performance analysis: measuring the relative contribution of research themes and thematic areas.

Methodology

Science mapping analysis

- SciMAT was used for analyzing science mapping.

- The analysis identifies motor themes, highly developed and isolated themes, emerging or declining themes, and basic and transversal themes.

Citation classics analysis

- The concept of H-Classics was used for identifying citation classics.

- H-Classics of a research area "A" are composed of the "H" highly cited papers with more than "H" citations received.

Dataset

- Dataset Collection: The publications related to various intelligence concepts were collected using the Web of Science (WoS) database, based on an advanced query consisting of 29 intelligence-related terms.

- Data Refinement: The collected data was refined to include only English language articles, proceedings, and reviews. The data was also de-duplicated to group similar concepts and meanings.

- Periodization: To avoid data flatness, the study period (1988-2017) was split into four comparable periods: 1988-1997, 1998-2007, 2008-2012, and 2013-2017.
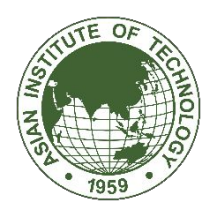
PART 03

Performance bibliometric analysis of the intelligence

Publication and citations

Fig. 1: Increase in Intelligence-related publications in recent years

Total of 6,392 publications from 1988-2017, with 50.08% in first milestone and 49.92% in second milestone

Fig. 2: Positive trend in citations per year during 1988-2017

35,098 total citations recorded, with average of 5.49 per cited article

According to Wang (2013), it takes 3-7 years for a publication to reach its highest number of citations.
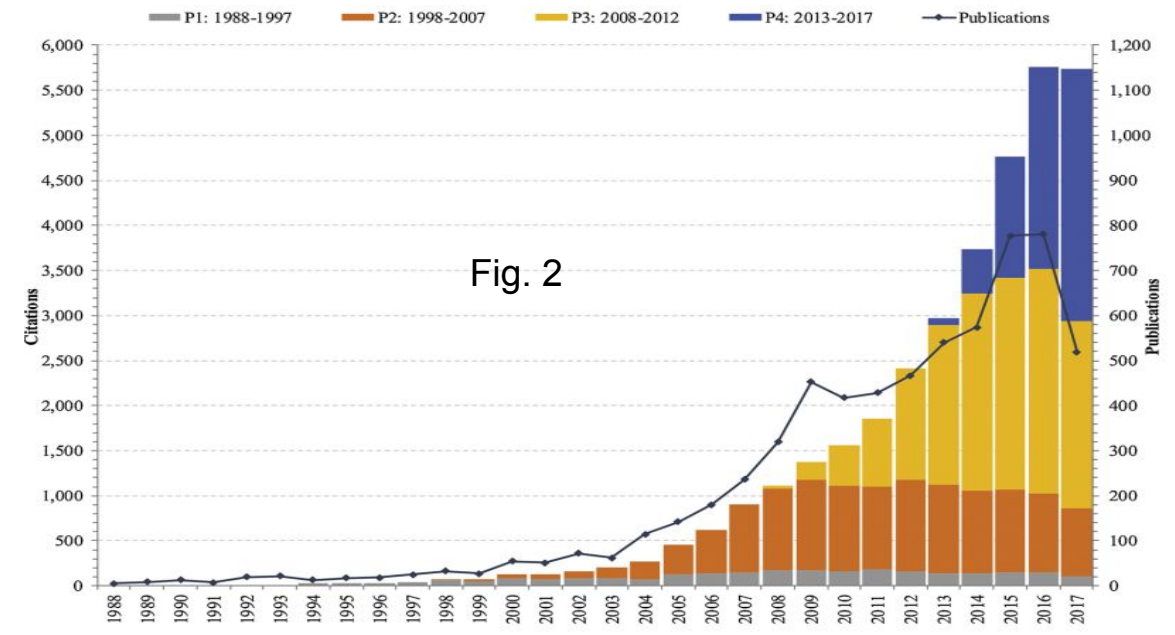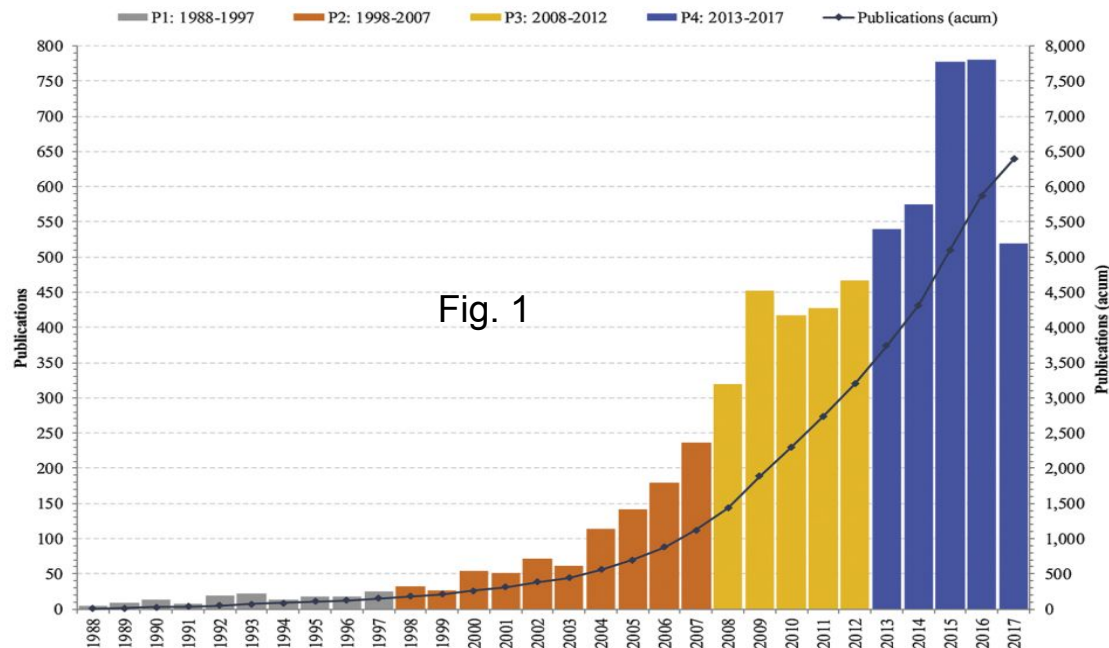
Most productive and cited authors, geographic distribution of publications, and research areas

Identifying the most productive and cited authors, along with the geographic distribution of publications and research areas, is crucial in assessing.

Table 2 shows the most cited authors during 1988–2017.

Table 2. Most cited authors (1988–2017).

Author (Intelligence definitions developed in the publications)	Citations (Publications)	Years of publication
Kohli, A. (Market)	1,029 (3)	1993, 1996, 2016
Chen, H. (Business)	822 (9)	2006, 2007, 2008, 2009 (2), 2010, 2012 (2), 2014
Kostoff, R. N. (Technical)	813 (21)	1997, 1998, 1999, 2000, 2001 (2), 2002, 2004 (2). 2005 (3), 2006, 2007 (5), 2008, 2011 (2)
Kumar, A. (Market)	734 (1)	1993
Jaworski, B. (Market)	734 (1)	1993
Storey, V. C. (Business)	719 (2)	2012, 2015
Chiang, R. H. L. (Business)	719 (1)	2012
Porter, A. L. (Competitive technical)	699 (24)	1997, 2001, 2002, 2004, 2005, 2007 (2), 2009, 2011 (2), 2012 (2), 2013 (2), 2014 (5), 2015, 2016 (3), 2017
Chen, M. (Collective)	1 (413)	2014
Liu, Y. (Collective)	1 (413)	2014
Mao, S. (Collective)	1 (413)	2014

Table 1. Most productive authors (1988–2017).

Publications	Author(s) (Intelligence definitions developed in the publications)
27	Voracek, M. (Regional and National), Yeoh, W. (Business)
26	Santos, M. F. (Business)
25	Trujillo, J. (Business)
24	Porter, A. L. (Competitive Technical)
21	Kostoff, R. N. (Technical)
16	Azevedo, A. (Business), Dayal, U. (Business), Liu, Y. (Collective), Lu, J. (Business), Mate, A. (Business), Mylopoulos, J. (Business), Popovič, A. (Business), Shi, Y. (Business), Zhang, J. (Competitive and Business)
15	Golfarelli, M. (Business), Li, Y. (Competitive and Business), Rizzi, S. (Business), Wang, Y. (Business), Zhang, Y. (Competitive)
14	Alnoukari, M. (Business), Erickson, S. (Competitive), James, D. (Competitive)
13	Capatina, A. (Strategic and Competitive), Chung, W. Y. (Business), Kim, J. (Collective), Nguyen, N. T. (Collective), Pedersen, T. B. (Business), Santos, M. Y. (Business), Zhang, G. Q. (Business)
12	Chen, T. (Collaborative), Elsheikh, A. A. R. (Business), Hussain, F. K. (Business), Jaklic, J. (Business), Rothberg, H. (Competitive), Zhu, D. H. (Competitive Technical)

- Table 1 shows the most productive authors during 1988–2017
- Table 2 shows the most cited authors during 1988–2017
- The table 2 highlights that two of the most productive authors are highly cited: Porter, A. L. and Kostoff, R. N, while the most cited author, Kohli, A., has only published 3 papers and 1,029 citations.

Most productive and cited authors, geographic distribution of publications, and research areas

- In table 3, show top countries by publication count during 1988-2017.

Table 3. Most productive countries (1988–2017).

Country	Publications	Total (%)
United States of America	1,346	21.06
People's Republic of China	831	13.00
United Kingdom	462	7.23
Germany	340	5.32
Australia	299	4.68
Italy	260	4.07
Canada	258	4.04
India	250	3.91
Spain	244	3.82
Romania	240	3.75

Table 4. Most relevant WoS Subject Categories and Research Areas (1988–2017).

WoS Subject Categories	Publications	Research Areas	Publications
Computer Science Information Systems	1,863 (29.15%)	Computer Science	3,513 (54.96%)
Computer Science Theory Methods	1,277 (19.98%)	Business Economics	1,505 (23.55%)
Computer Science Artificial Intelligence	1,204 (18.84%)	Engineering	1,343 (21.01%)
Engineering Electrical Electronic	908 (14.21%)	Information Science Library Science	550 (8.60%)
Business	895 (14.00%)	Operations Research Management Science	414 (6.48%)

- In table 4, show the main subject areas related to Intelligence identified in various field of studies.
- This suggests that there are different approaches and applications of Intelligence within these fields of research.

Most productive and cited authors, geographic distribution of publications, and research areas

Table 5. Journals with the highest number of publications (1988–2017).

Name	Number of Publications	Total Cites Publications	Total Cites Journal	Impact Factor (IF-2016)	5-Year Impact Factor	Immediacy Index	Cited Half-life
Expert Systems with Applications	59	912	31,192	3.928	3.526	0.771	7.5
Decision Support Systems	47	1,202	8,109	3.222	4.290	0.573	6.6
Technological Forecasting and Social Change	46	1,275	6,341	2.625	3.226	0.629	5.9
International Journal of Information Management	30	675	3,087	3.872	4.713	1.043	5.3
Information Systems Management	23	423	830	1.298	2.000	0.130	9.1

Intelligence is becoming increasingly important for improving organizational competitiveness

Citation classics

- H-classics method is used to identify classic papers in any research field
- It is based on the h-index, which is a well-known metric for measuring research impact
- This section uses the H-classics method to discover a classic paper in the field of Intelligence

Fig. 3

Table 6. Authors with the largest number of cited publications.

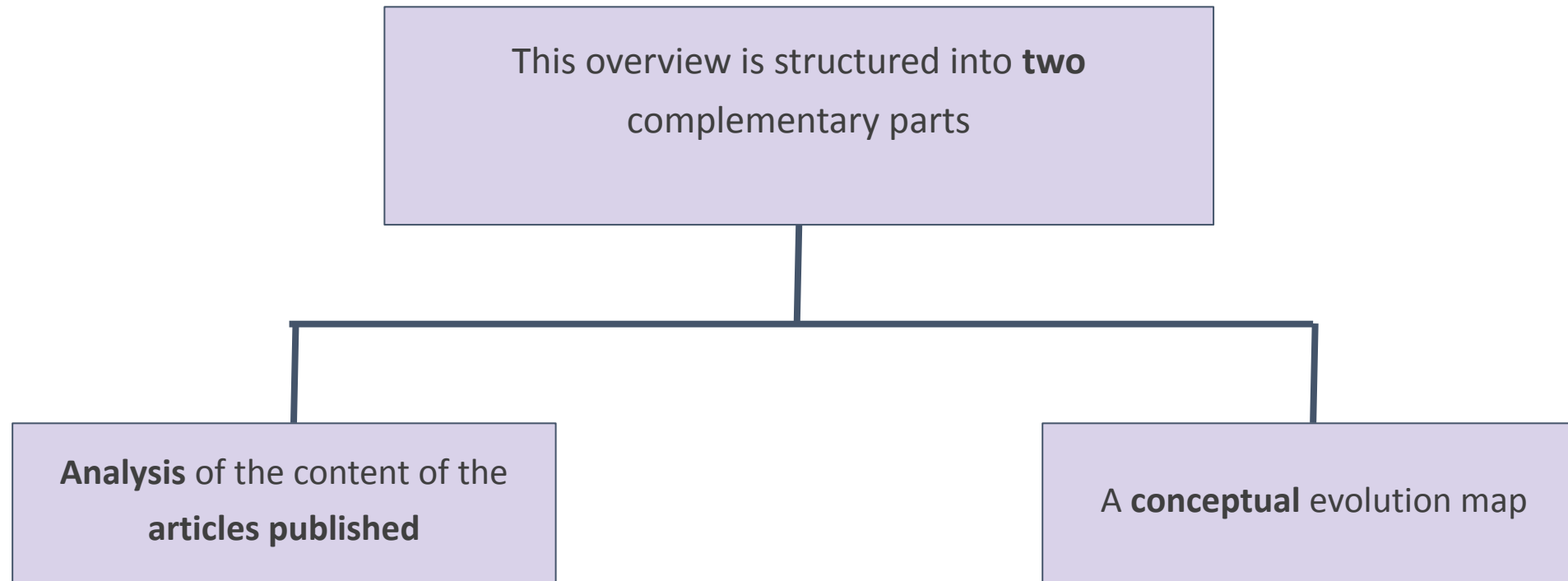| Name	Publications	Citations	Years of publication
Porter, A. L.	4	437	1997, 2001, 2002, 2004
Kohli, A.	2	1,037	1993, 1996
Malon, T. W.	2	514	2010 (2)
Pervan, G.	2	310	2005, 2008
Amott, D.	2	310	2005, 2008
Brabham, D. C.	2	274	2009, 2010
Schultze, U.	2	280	2000 (2)
Smits, R.	2	206	2002, 2004
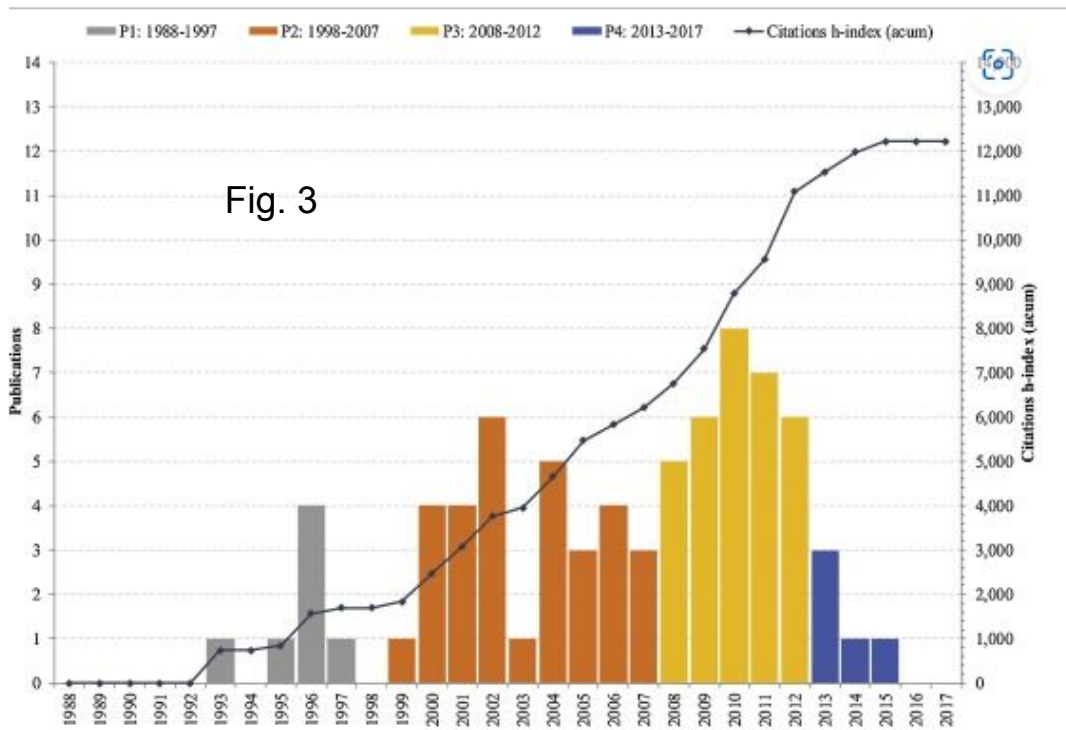
- Fig. 3 shows the total number of citations and the distribution of the most
- Table 6 lists the names of the authors with the largest number of publications used as reference.

Science mapping analysis of intelligence

An overview has explained of the **science mapping** and the **hidden relationships** between **key themes** in the main research fields related to **Intelligence**.
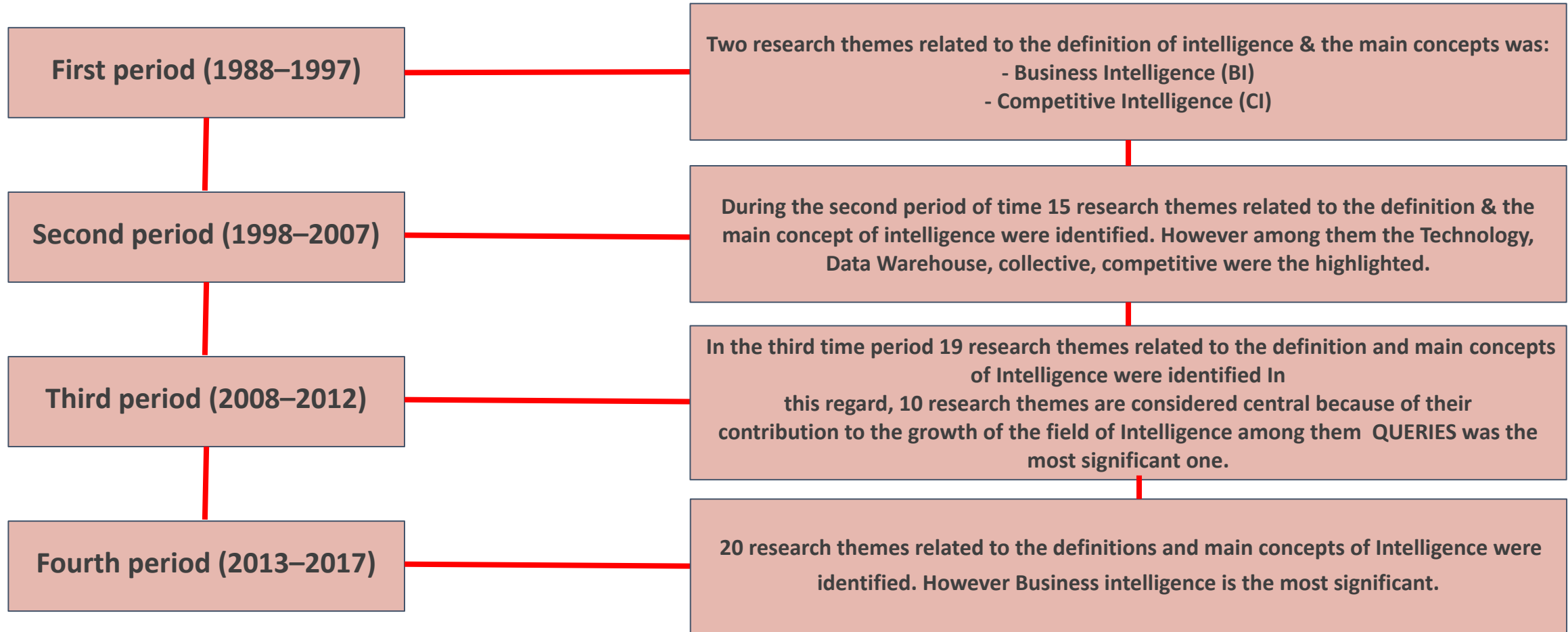
It is categorized into **two** complementary parts:

This overview is structured into **two** complementary parts

Analysis of the content of the **articles published**

A **conceptual** evolution map

Analysis of the content of the articles published

In this part several strategic diagrams has explained in order to analyze the most highlighted themes of the field of intelligence for each period. The period has been classified into four categories

| First period (1988–1997) | Two research themes related to the definition of intelligence & the main concepts was:
- Business Intelligence (BI)
- Competitive Intelligence (CI) |

| Second period (1998–2007) | During the second period of time 15 research themes related to the definition & the main concept of intelligence were identified. However among them the Technology, Data Warehouse, collective, competitive were the highlighted. |

| Third period (2008–2012) | In the third time period 19 research themes related to the definition and main concepts of Intelligence were identified In
this regard, 10 research themes are considered central because of their contribution to the growth of the field of Intelligence among them QUERIES was the most significant one. |

| Fourth period (2013–2017) | 20 research themes related to the definitions and main concepts of Intelligence were identified. However Business intelligence is the most significant. |

Conceptual evolution map

In the **conceptual evolution map**, **six** thematic areas were identified: **Business Intelligence**, **Innovation** and **Organizational Performance Management**, **Collective Intelligence**, **Data and Decision-Making-Process**, **Competitive Intelligence**, and **National Intelligence**. These thematic areas consolidate the main themes and research areas related to Intelligence.

- **Business Intelligence** is the most representative thematic area within the Conceptual Evolution Map.
- **Collective Intelligence** is the second thematic area.
- **Competitive Intelligence** is the third thematic area within the map.
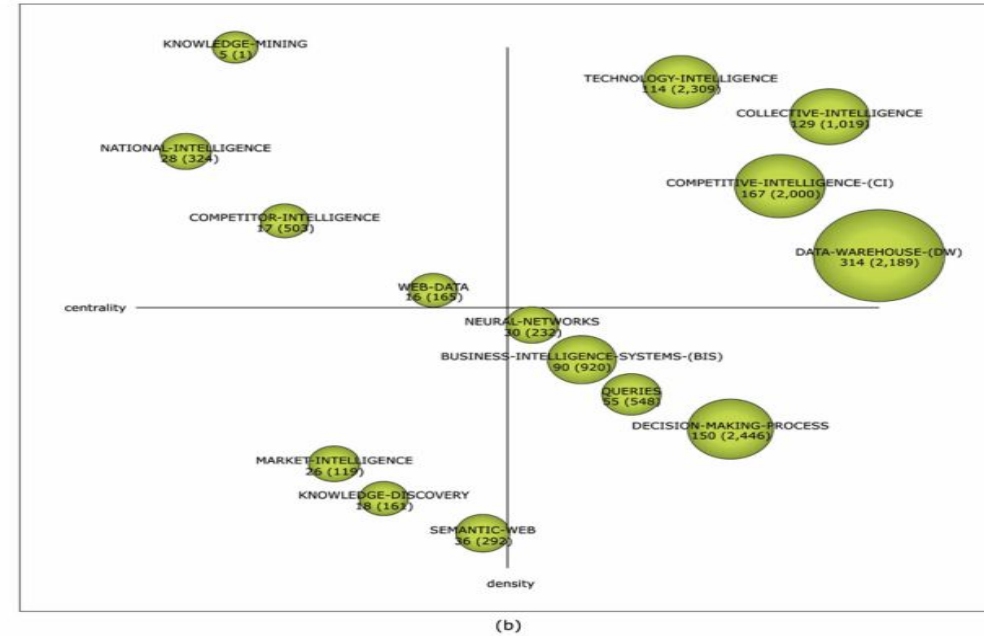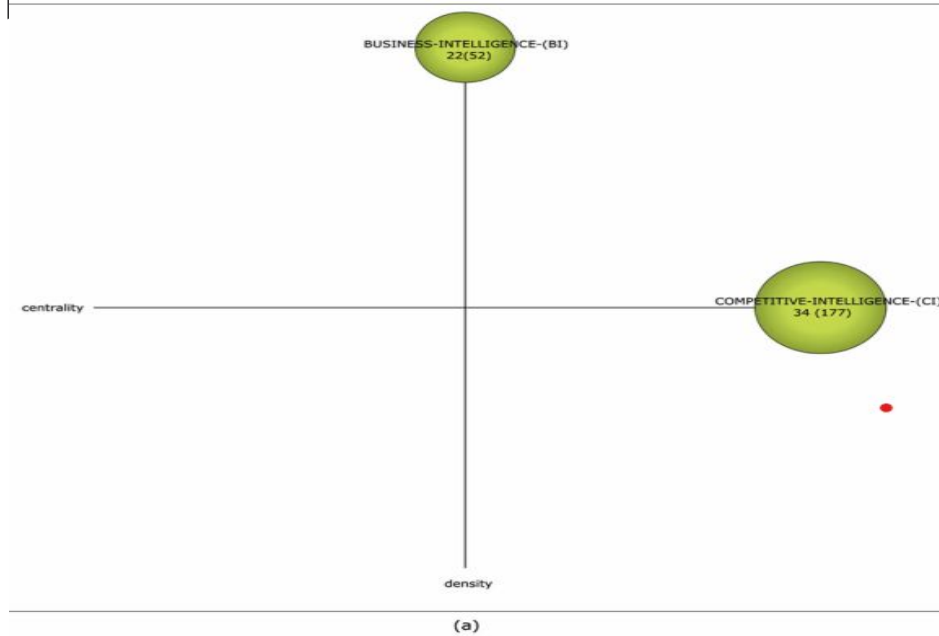
Strategic diagrams
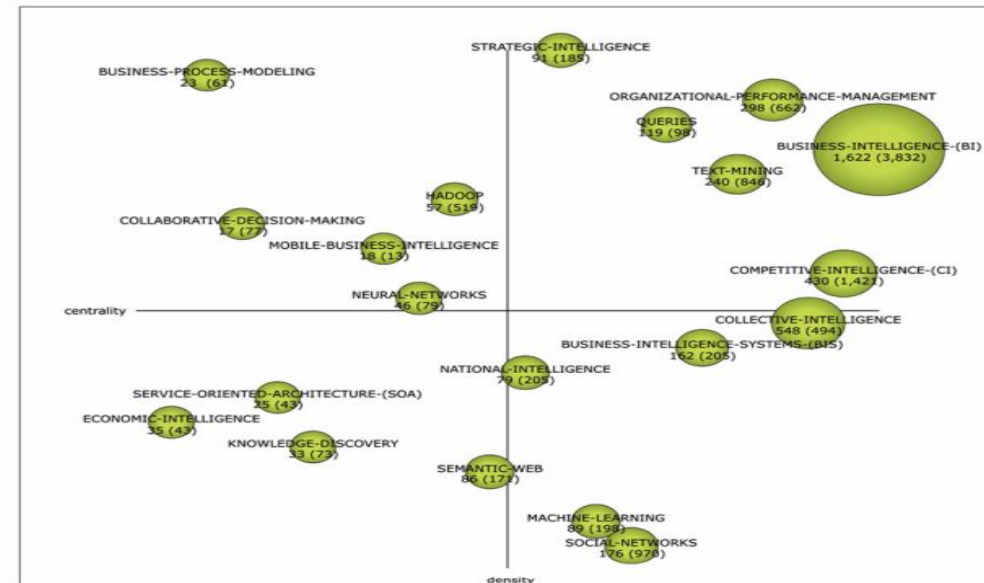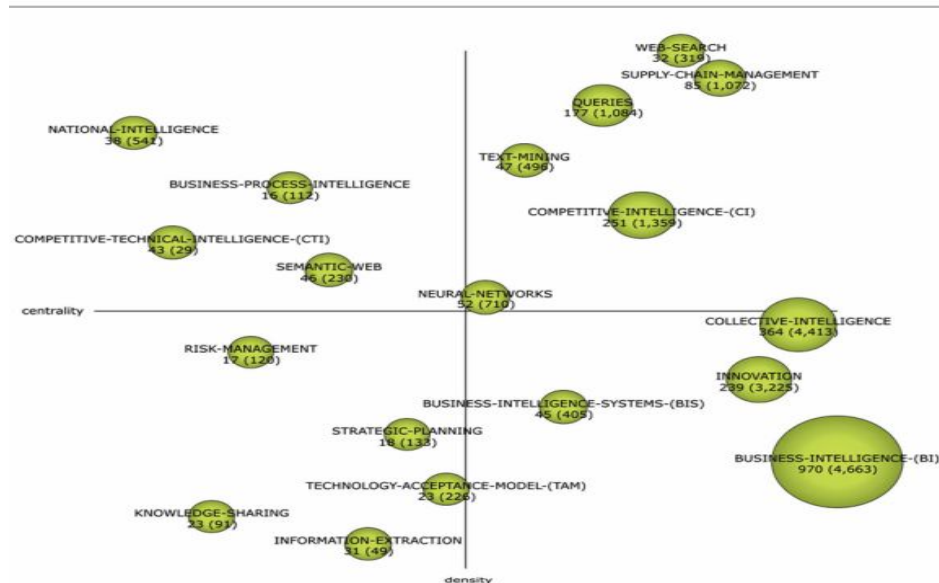
Fig. 5. Strategic diagrams. (a) Period 1988–1997. (b) Period 1998–2007. (c) Period 2008–2012. (d) Period 2013–2017.

Conclusion

In this article it is represents the first **bibliometric** study on the definitions of **Intelligence** and its principal concepts, identifying the **main themes** and **related research** areas. More than **6,392** original research articles have been analyzed and processed using **SciMAT**. In terms of bibliometric performance, the size of literature related to the field of Intelligence research showed a noteworthy increase in the past **30 years (1988–2017)**. Given the large volume of publications and citations received in this field, it is expected that the interest will continue to grow and serve as a support to other knowledge areas such as **Big Data**, **Business Management**, **Decision Support Process**, **Forecasting**, **Knowledge Management**, **Information Management**, **Information Systems**, **Marketing**, **Internet and Social Networks**, and **Strategic Management**. Another significant aspect of the bibliometric analysis is the weightiness that journals have in the dissemination knowledge process. The most active journals in the field of Intelligence have gained prestige in the scientific community, which promotes continuous research, development, and implementation of **Intelligence** and its main the themes.

Question

1. Why Intelligence is important for organizations?

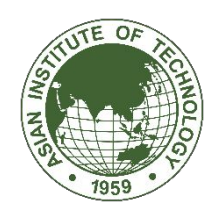2. What is the purpose of the study analyzing existing definitions of intelligence?

Question & Answer

A : 1

Intelligence is important because it gathers and interprets high-value data to inform decision-making and improve competitive position.

A : 2

The purpose is to identify trends in data collection, information management, decision-making, and organizational capabilities by analyzing bibliometric performance indicators, authors, and research areas using SciMAT.

THANK YOU