

# Intellectual Structure and Scientific Evolution of Strategic Decision in the Field of Business and Management (1971 to 2018)

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## ABSTRACT

**Manuscript type:** Review paper

**Research aims:** This study aims to analyse the published works of strategic decision in business and management which have had the greatest impact and evolutionary scientific trend within the intellectual sphere. Drawing from the integrative perspective, this study attempts to: (i) investigate the intellectual structure of earlier works so as to analyse the evolution of strategic decisions; (ii) examine the evolutionary scientific trends, and (iii) identify some implications for future research in this area.

**Design/Methodology/Approach:** This study generates its analysis based on the following bibliometric tools: (i) multidimensional data analysis using the Sankey Diagram, (ii) visual network and heat map analysis using the VOSviewer, and (3) strategic diagrams and evolution maps using the SciMAT. The methodology is based on the bibliometric technique of citation and co-citation analyses which are scientifically applied to a sample of 1,218 articles published in leading management and business journals over a period of 48 years, from 1971 to 2018.

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**Research findings:** The findings of this study plots the intellectual structure of the strategic decision as well as the evolutionary themes of the strategic decisions, for instance, decision-making and intuition (2000-2004), bounded rationality and uncertainty (2005-2009), decision support system and artificial intelligence (2010-2014), and decision-making and intuition (2015-2019). Overall, the results demonstrate the top scientific themes that were prevalent over a period of 48 years. The themes include: decision-making, intuition, rationality, behavioural economics, bounded rationality and investment decision.

**Theoretical contribution/Originality:** These findings provide valuable insights which demarcate the evolution of strategic decision as viewed through the synoptic-incremental continuum of rationality, intuition and political decision process. This study also contributes to the emerging role of behavioural economics on the strategic decision-making process in business and management. The results also highlight the role of the incremental decision process as an intuitive and political decision that can be interactively enhanced by decision-makers while under increased risk and uncertainty.

**Practitioner/Policy implications:** The results of this study suggest that decision-makers need to pay attention towards building and developing the incremental process such as intuitive and political decision along with rationality so as to optimise the decision outcomes.

**Keywords:** Strategic Decision, Decision-Making, Bibliometric Review, Business, Management, Intuition, Rationality

**JEL Classification:** M10, Y3

## 1. Introduction

The past few decades have seen the proliferation of research on strategic decisions (SD) in the field of business and management (Eisenhardt & Zbaracki, 1992; Elbanna, 2006; Ireland & Miller, 2004; Papadakis, Lioukas, & Chambers, 1998; Rajagopalan, Rasheed, & Datta, 1993). The concept of SD has proven to be an interdisciplinary field of research even from the beginning, whether from psychology, organisation or strategic management (Eisenhardt & Zbaracki, 1992; Papadakis et al., 1998). Given its relevance, research on SD seems to have flourished as the field of study evolved (Dean & Sharfman, 1996; Eisenhardt & Zbaracki, 1992; Fahey, 1981; Mintzberg, Raisinghani, & Theoret, 1976).

One of the most important agenda for advancing a particular state of the art in business and management is to synthesise the interdisciplinary research findings (Zupic & Čater, 2015). In general,

researchers have commonly applied two traditional techniques to make sense of the earlier findings – the qualitative approach of a structured literature review (Schmidt, 2008; Zupic & Čater, 2015), and the quantitative method of meta-analysis (Eisenhardt & Zbaracki, 1992; Elbanna, 2006; Rajagopalan et al., 1993; Steptoe-Warren, Howat, & Hume, 2011). Typically, these studies are considered as having adopted the impressionist approach while their findings tended to reflect the subjective views of the authors (Ramos-Rodríguez & Ruíz-Navarro, 2004). Such findings, and their strategic implications were also instinctively determined by the authors, hence they often lack rigour and scientific legitimacy (Tranfield, Denyer, & Smart, 2003). In addition, those types of narrative literature review also carry some degrees of limitation especially those involving longitudinal cases conducted over a long period of time. Consequently, caution should be applied when interpreting the results, except for a few exceptions (Blanco-Mesa, Merigo, & Gil-Lafuente, 2017; Bragge, Korhonen, Wallenius, & Wallenius, 2010; Qaiser, Ahmed, Sykora, Choudary, & Simpson, 2017; Yu, Wang, Zhang, & Zhang, 2018). Thus far, existing studies have not been able to indicate with details, how research on SD had evolved over the years, which this study aims to address.

Reviews of literature had, to some extent applied the bibliometric technique as a quantitative approach to unravel the systematic and rigorous process of refining the quality of the review (Zupic & Čater, 2015). Over time, the bibliometric databases encompassing Scopus or Web of Science, and the various bibliometric tools such as the VOS viewer, and the SciMAT, had attracted much attention. These bibliometric methods have been consistently employed to explore the intellectual structure of strategic management (Ferreira, Fernandes, & Ratten, 2016; Nerur, Rasheed, & Natarajan, 2008; Ramos-Rodríguez & Ruíz-Navarro, 2004; Ronda-Pupo & Guerras-Martin, 2012). Earlier bibliometric literature had mainly focussed on fuzzy decision making (Blanco-Mesa et al., 2017), multiple criteria decision making (Bragge et al., 2010; Yu et al., 2018), and the decision support system (Qaiser et al., 2017). Seminal bibliometric analyses have been used by scholars (Yu et al., 2018; Blanco-Mesa et al., 2017; Ferreira et al., 2016; Steptoe-Warren et al., 2011; Elbanna & Younies, 2008; Rajagopalan et al., 1993) to review literature on SD. However, digressing slightly from this, the current review aims to provide a perspective of the continuity, and a more updated and integrative point of view on the research on SD, as compiled from past studies.

In this regard, the objectives of this study are to: (i) investigate the intellectual structure noted in earlier studies so as to analyse the evolution of the research on SD; (ii) examine the evolutionary scientific trends; and (iii) identify some implications for future research in this area. The contributions derived from this study will help to address the literature gap left by earlier conventional literature on SD research, given the development that had flourished in this area. The questions this study aims to address are: What are the main scientific themes previously noted in SD literature? Who among the authors were the most persuasive? Which was the most dominant paper? and What was the most influential paper? The answers derived for these questions will contribute to a deeper understanding of the SD evolution. Such research profiling analyses have been extensively applied to enrich traditional literature reviews (Bragge et al., 2010; Zupic & Čater, 2015).

This study contributes to the field of business and management in a number of ways. First, it highlights the main clusters of SD. Second, it identifies the most highly cited scientific themes and their interdependencies in the given period within 48 years. These themes include: decision-making and intuition (2000-2004), bounded rationality and uncertainty (2005-2009), decision support system and artificial intelligence (2010-2014), followed by decision-making and intuition (2015-2019). Earlier bibliometric works had focussed on a short time period (Ferreira et al., 2016). Therefore, by analysing previous studies over a long-time frame, the gaps left unattended by previous bibliometric works would be able to shed light on the areas that need to be attended. Further, the findings would also be able to emphasise on how the SD research field may further evolve in the future (Ferreira et al., 2016).

The remainder of this paper is organised as follows. Section 2 examines the conceptual background of SD in the field of business and management. Section 3 discusses the bibliometric methods. Section 4 presents the findings of the analysis. Section 5 draws on the conclusion and Section 6 provides the recommendation for future research.

## **2. Strategic Decision: Conceptual Background**

Prior to performing the bibliometric analyses, we need to identify the underlying concept of strategic decision in this study. In accordance with the works of prolific scholars (Bourgeois & Eisenhardt, 1988; Dean & Sharfman, 1993; Eisenhardt & Zbaracki, 1992; Elbanna, 2006; Kahneman & Tversky, 1979; Mintzberg et al., 1976; Papadakis et al.,

1998; Rajagopalan et al., 1993; Sadler-smith, Hodgkinson, & Sinclair, 2008; Simon, 1987), the ontological and epistemological differences in the selected publications were discussed using a synoptic-incremental continuum. Elbanna (2006) had reviewed seminal works on the SD process which include the rational, intuitive and political process.

The rational process focuses on how decisions can be divided into structured decision problems which can be solved by collecting and analysing specific information (Dean & Sharfman, 1993, 1996), applying certain analytic tools (Dean & Sharfman, 1996), generating alternatives and new aspects (Eisenhardt, 1989), defining goals and priorities as the decision criteria, and thinking about the alternatives and consequences (Dean & Sharfman, 1996). The intuitive process, in comparison, concentrates on the unconscious or subconscious processes and spontaneous manners by applying personal judgments (Khatri & Ng, 2000), gut feelings or hunches (Dane & Pratt, 2007; Hodgkinson, Langan-fox, & Sadler-smith, 2008; Hodgkinson, Sadler-Smith, Burke, Claxton, & Sparrow, 2009; Khatri & Ng, 2000), past experiences (Dane & Pratt, 2007), and heuristics (Bingham & Eisenhardt, 2011; Keats, 1991; Miller & Shapira, 2004). The political process looks at the social aspects when decision makers interact with one another in the social context by exercising their respective power and status so as to enforce decisions, to negotiate, or to bargain with others, to form alliances to effectuate certain interests, and to prioritise personal and group goals over organisational goals (Bourgeois & Eisenhardt, 1988; Dean & Sharfman, 1993, 1996; Elbanna & Child, 2007; Papadakis et al., 1998).

The rational perspective, also termed as the synoptic perspective, relies on the first stage of the rational process, whereas the incremental-political perspective focusses on the other two decision processes mentioned (Elbanna & Child, 2007). Most literature and practices tend to emphasise on the rational rather than the incremental-political perspective. Khatri and Ng (2000) help to explain. They had noted that many scholars and practitioners held the belief that intuitive processes were beyond rationality, hence out of the scope of scientific studies. In fact, "gut-feeling" is actually a sub-conscious derivative of the accumulation of years of management, experience and knowledge while the intuitive process is derived from personal experiences, tacit knowledge and learning (Baldacchino, Ucbasaran, & Cabantous, 2014; Brockmann & Simmonds, 1997; Isenberg, 1986; Khatri & Ng, 2000; Simon, 1987).

Based on this interdisciplinary study, it appears that much of the work in SD showed that there was no single discipline covering

all aspects of the strategic decision process. The decision process had moved from rationality to incrementalism such as intuition and political processes. Of the many authors who were involved with SD in business and management, the most influential were listed as Akinci and Sadler-smith (2012). They had dedicated their works to the “conscious and non-conscious process”. In another study, Kahneman and Tversky (1979) dedicated their work to the “heuristics and biases”, while Mintzberg et al. (1976), Eisenhardt and Zbaracki (1992), and Dean and Sharfman (1996) were the pioneers of the research on strategic decision. Following this, Epstein (1985) proposed the cognitive-experiential self-theory and Simon (1987) established the concept of bounded rationality. Klein (1998) focussed on “naturalistic decision-making”, Sadler-smith and Shefy (2004) stressed on gut feelings and Dean and Sharfman (1993) followed by Elbanna (2006, 2018) emphasised on political decisions.

To deepen the diverse perspectives, there has been recourse to combining diverse fields such as the rational, intuitive and political decision process as an option to generate the integrative approach for the various domains of SD. Following previous seminal literature (Dean & Sharfman, 1996; Elbanna, 2006, 2018; Elbanna, Kapoutsis, & Mellahi, 2017), this study also applies the integrative perspective for addressing the coexistence of the synoptic and incremental perspective on the SD making process. To determine the scope and validity of the bibliometric analysis conducted, this study also applies the inclusion and exclusion criteria. They are systematically defined and then applied. The eligibility criteria was then utilised to identify the appropriate literature. In line with the conceptual background and objective of this study, the inclusion criteria was based on past articles found and indexed by Scopus. The detailed technique depicting this inclusion criteria was explained using key terms, and the Boolean logic. In contrast, the exclusion criteria were derived from the contexts of particular fields of business and management research looking at SD. Further to the criteria, the period of publication dating from 1971 to 2018 was also added so as to exclude other publications that go beyond the selected period.

### **3. Methods**

#### **3.1 Data Collection**

Taking into consideration the objectives of this study, a descriptive analysis of the articles selected were also undertaken. These were compiled from the online database performed by Scopus, dating back

1971 to 2018. The multiple datasets comprised thousands of academic publications, and bibliographic datasets which included authors, citations and affiliations. These were gathered based on key terms, and the Boolean logic - “decision”, “strategic decision”, “decision-making”, “rationality”, “political decision”, “intuition” or “political behaviour”. These may appear either in the title, keywords or abstracts. As a matter of illustration, the current study was undertaken during the middle week of September 2018.

In this review, a total of 8,911 publications were generated. They were filtered by the field, “business and management” which served as the major area of this study. This led to a final total of 1,218 articles published in the period of 1971 to 2018. Data were collected using Scopus journals which were accessed through the University of Indonesia (<http://remote-lib.ui.ac.id>). Our search shows that the field of SD have attracted an increasing interest among researchers and practitioners. Figure 1 depicts the scientific evolution of SD which also highlights the total number of articles published. The figure also demonstrates that from the 1970s until the 1990s, publications were infrequent. An exponential growth was noted between 2005-2009 and 2010-2014 where publications peaked (314 and 348, respectively). The rate however, diminished in the subsequent period between 2015-2018 (only 281).

Table 1 summarises the most influential publication of SD in the field of business and management. In this section, the prolific articles

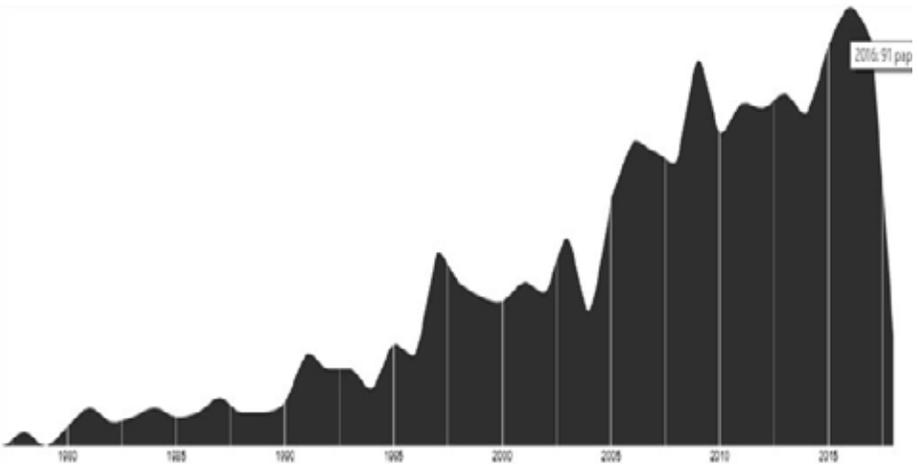


Figure 1: Number of Published Articles Each Year

Table 1: Most Influential SD Publications in Business and Journals Reviewed

Authors, Year	Title	Source title	C
Eisenhardt & Martin, 2000	Dynamic capabilities: What are they?	Strategic Management Journal	4981
Amason, 1996	Distinguishing the effects ... conflict on strategic decision ...	Academy of Management Journal	1124
Lumpkin & Dess, 2001	Linking two dimensions of entrepreneurial ...	Journal of Business Venturing	829
Finkelstein, 1992	Power in top management teams ...	Academy of Management Journal	741
Forbes & Milliken, 1999	Cognition and corporate governance: ... strategic decision-making groups ...	Academy of Management Review	736
Sarkis, 2003	A strategic decision framework ...	Journal of Cleaner Production	687
Eisenhardt & Zbaracki, 1992	Strategic decision making	Strategic Management Journal	628
Swamidass & Newell, 1987	Manufacturing strategy, environmental uncertainty ...	Management Science	615
Dean & Sharfman, 1996	Does decision process matter? ...	Academy of Management Journal	449
Lant, Milliken, & Batra, 1992	The role of managerial learning and interpretation in strategic persistence ...	Strategic Management Journal	449

Note: C = number of citations.

with the largest number of citations are presented and the distribution of the paper sources in the given selected periods are analysed.

Table 2 highlights the distribution periods. In the first period (1970-1989), it seems obvious that Long Range Planning (9.3%) had pioneered the SD field. This is trailed by Strategic Management Journal (9.3%), and the Journal of Management (6.7%), corresponding to 34.7 per cent of the total number of references encountered. In the second period (1990-1999), the Strategic Management Journal (7.4%) dominated, followed by Decision Support Systems (4.6%), Management Decisions (3.7%), and

Long Range Planning (3.7%), corresponding to 50.7 per cent of the total number of references encountered. In the third period (2000-2004), a dramatic change had occurred when Management Science (7%) emerged to be the top followed by Strategic Management Journal (4.2%), and International Journal of Production Economics (2.3%), corresponding to 62.4 per cent of the total number of references encountered. In the fourth period (2005-2009), Management Science (4.8%) remained at the top while the International Journal of Production Economics (3.6%) came second, trailed by the Journal of Business Research (2.5%), and then the Strategic Management Journal (2.2%), corresponding to 61.8 per cent of the total number of references encountered. In the fourth period (2010-2014), there was a substantial change. The International Journal of Production Research (3.2%) moved to the top, trailed by earlier prominent journals, such as Management Decision (2.6%), and the Journal of Cleaner Production (2.3%), corresponding to 69.5 per cent of the total number of references encountered. In the final stage of the years (2015-2018), the Strategic Management Journal (5%) had rebounded to be the top together with the Journal of Cleaner Production (5%), trailed by Technology Forecasting and Social Changes (3.6%), corresponding to 64.1 per cent of the total number of references encountered.

This dynamic change in the increased publications revealed the importance of the SD research, and its evolution over a long-time frame. In accordance with the previous literature on strategic management research (Ferreira et al., 2016; Ramos-Rodríguez & Ruíz-Navarro, 2004), our findings found that the Strategic Management Journal was the most powerful reference for disseminating knowledge in the field of SD research.

Table 3 illustrates the number of publications. It appears that the Strategic Management Journal dominated the race, with a total of 59 references (4,981 cited references), trailed by Management Decision (54 references and 1,124 cited references), Long Range Planning (39 references and 829 cited references), Decision Support Systems (29 references and 1,119 cited references), International Journal of Production Economics (29 references and 1,039 cited references), Journal of Business Research (29 references and 538 cited references), Technological Forecasting and Social Change (27 references and 538 cited references), Journal of Cleaner Production (25 references and 1,701 cited references), Journal of Management (21 references and 1,586 cited references), Decision Sciences (21 references and 1,034 cited references), Journal of Management Studies (17 references and 1,203 cited references),

Table 2: Top 30 Journals and Number of Published Articles in Each Year

Cited Journal	1970-1989 n = 75	1990-1999 n = 217	2000-2004 n = 213	2005-2009 n = 314	2010-2014 n = 348	2015-2018 n = 281
Strategic Management Journal	7	16	9	7	6	14
Management Decision	-	8	15	15	9	7
Long Range Planning	18	8	2	4	4	3
Decision Support Systems	1	10	3	4	6	5
International Journal of Production Economics	-	1	5	12	3	8
Journal of Business Research	-	4	3	8	10	4
Technological Forecasting and Social Change	-	5	2	4	6	10
Journal of Cleaner Production	-	-	1	2	8	14
Journal of Management	5	4	2	3	2	5
Decision Sciences	1	6	6	4	3	1
International Journal of Production Research	-	-	-	3	11	4
Journal of Management Studies	2	3	2	5	3	2
Journal of the Operational Research Society	1	3	4	5	2	0.7%
Management Science	3	2	1	5	-	1
Omega	3	4	2	2	1	-
Journal of Business Ethics	1	1	1	4	3	2
Futures	-	2	2	3	4	1
European Management Journal	1	1	3	3	2	2

Table 2: (continued)

Cited Journal	1970-1989 n = 75	1990-1999 n = 217	2000-2004 n = 213	2005-2009 n = 314	2010-2014 n = 348	2015-2018 n = 281
Industrial Marketing Management	3 4.0%	- -	1 0.5%	4 1.3%	3 0.9%	1 0.4%
International Journal of Technology Management	1 1.3%	6 2.8%	1 0.5%	4 1.3%	- -	- -
Organizational Behaviour and Human Decision Processes	1 1.3%	5 2.3%	1 0.5%	1 0.3%	2 0.6%	- -
British Journal of Management	- -	4 1.8%	2 0.9%	2 0.6%	1 0.3%	1 0.4%
IEEE Transactions on Engineering Management	- -	3 1.4%	1 0.5%	4 1.3%	2 0.6%	- -
Organization Studies	- -	3 1.4%	1 0.5%	1 0.3%	2 0.6%	3 1.1%
Industrial Management and Data Systems	- -	- -	- -	2 0.6%	3 0.9%	5 1.8%
Problems and Perspectives in Management	- -	- -	3 1.4%	4 1.3%	2 0.6%	1 0.4%
Organization Science	- -	4 1.8%	1 0.5%	1 0.3%	3 0.9%	- -
Information and Management Benchmarking	1 1.3%	4 1.8%	3 1.4%	- -	- -	1 0.4%
Production Planning and Control	- -	- -	3 1.4%	2 0.6%	1 0.3%	3 1.1%
Other journals cited	26 34.7%	10 50.7%	133 62.4%	194 61.8%	242 69.5%	180 64.1%

Note: n = number of articles published in every period.

Table 3: Cited Journals, Index and Citations from 1971 to 2018

Cited Journal	n	SJR'17	H Index	C	C/n
Strategic Management Journal	59	8.01	232	10,569	179
Management Decision	54	5.36	209	915	17
Long Range Planning	39	1.71	81	649	17
Decision Support Systems	29	1.66	115	1,119	39
International Journal of Production Economics	29	2.40	141	1,039	36
Journal of Business Research	29	1.26	144	538	19
Technological Forecasting and Social Change	27	1.38	86	538	20
Journal of Cleaner Production	25	1.47	132	1,701	68
Journal of Management	21	6.46	176	1,586	76
Decision Sciences	21	1.38	93	1,034	49
International Journal of Production Research	18	1.43	107	266	15
Journal of Management Studies	17	3.80	145	1,203	71
Journal of the Operational Research Society	15	1.00	87	158	11
Management Science	12	5.36	209	1,210	101
Omega	12	3.52	108	352	29
Journal of Business Ethics	12	0.28	132	219	18
Futures	12	1.23	66	170	14
European Management Journal	12	1.26	84	157	13
Industrial Marketing Management	12	1.66	106	150	13
International Journal of Technology Management	12	0.41	48	55	5
Organizational Behaviour and Human Decision Processes	10	1.99	122	430	43
British Journal of Management	10	1.31	86	255	43
IEEE Transactions on Engineering Management	10	0.73	80	247	25
Organization Studies	10	0.02	120	239	24
Industrial Management and Data Systems	10	0.90	81	61	6
Problems and Perspectives in Management	10	0.14	14	11	1
Organization Science	9	5.50	196	810	90
Information and Management	9	1.63	135	208	23
Benchmarking	9	0.56	49	190	21
Production Planning and Control	9	1.26	61	138	15

*Note:* n = number of articles published, C = number of citations, C/n = number of citations per articles published, SJR = SCImago Journal Rank, H index = an author-level metric in terms of productivity and citation impact.

Journal of the Operational Research Society (15 references and 158 cited references), Management Science (12 references and 1,210 cited references), Omega (12 references and 352 cited references), Journal of Business Ethics (12 references and 219 cited references), Futures (12 references and 170 cited references), European Management Journal (12 references and 157 cited references), Industrial Marketing Management (12 references and 150 cited references), and the International Journal of Technology Management (12 references and 55 cited references). The 20 journals listed in the table provided a total of 467 articles, corresponding to 32.2 per cent of the total number of references encountered.

In accordance with previous literature which had performed bibliometric studies exceeding 40 years (Merigó, Pedrycz, Weber, & de la Sotta, 2018), general indicators such as productivity and influence were measured. From a general point of view, productivity was commonly measured with the number of published articles while influence was assessed by the number of citations (Merigó et al., 2018). According to the productivity and influence analysis shown in Table 3, the Strategic Management Journal (59 references), Management Decision (54 references) and Long Range Planning (39 references) were considered the most productive journals over the given periods.

### 3.2 Preliminary Analysis

To assess the impact factor noted in previous studies (Ronda-Pupo & Guerras-Martin, 2012), we also took into account these additional indicators. A preliminary study of the publications found that by far, the most frequently cited publication per paper (179) was the Strategic Management Journal. Despite having a relatively low number of published articles, the journal of Management Science (101) and Organization Science (90) earned second and third places, respectively.

Based on the keywords illustrated in Table 4, the key scientific words used were: 'strategic decision making' (163 occurrences), 'decision making' (150 occurrences), 'strategy' (44 occurrences), 'strategic management' (36 occurrences), 'strategic planning' (29 occurrences), 'corporate governance' (23 occurrences), 'strategic decisions' (17 occurrences), 'performance' (16 occurrences), and 'competitive advantage' (12 occurrences). The common keywords used throughout the years were 'decision-making' and 'strategic decision making'. This finding also supports our selection for articles related to strategic decision making. Apart from the keywords generally related to decision-making, other

Table 4: Top Scientific Keywords per Year

Keywords	1995- 1999	2000- 2004	2005- 2009	2010- 2014	2015- 2018	Total
Activity-based costing	2	-	-	-	-	2
Australia	1	-	-	-	-	1
Benchmarking	-	4	-	-	-	4
Case study	1	-	-	-	2	3
China	-	-	-	4	-	4
Cognition	1	-	-	2	-	3
Evaluation	-	-	-	3	-	3
Forecasting	-	2	-	-	-	2
Framing	-	2	-	-	-	2
Competitive advantage	1	1	3	3	4	12
Consensus	1	-	-	-	-	1
Corporate governance	-	5	7	7	4	23
Corporate strategy	-	3	-	3	-	6
Culture	1	-	-	-	-	1
Customer satisfaction	-	-	2	-	-	2
Data envelopment analysis	-	-	-	-	3	3
Decision making	15	24	48	48	15	150
Decision support systems	-	4	5	-	-	9
Entrepreneurs	-	-	2	-	-	2
Entrepreneurship	1	-	-	-	-	1
Environmental scanning	-	2	-	-	-	2
Executive information systems	1	-	-	-	-	1
Firm performance	-	-	-	-	2	2
Framing	2	-	-	-	-	2
Governance	-	-	-	-	3	3
Group support systems	2	-	-	-	-	2
Human resource management	1	-	2	-	-	3
India	-	-	-	3	2	5
Information technology	2	3	-	-	-	5
Innovation	-	-	6	-	4	10
Intuition	-	1	-	3	4	8
Knowledge management	1	-	3	5	-	9
Leadership	1	-	-	3	-	4
Learning	3	-	-	4	-	7
Management	1	2	-	-	-	3
Management accounting	-	-	-	-	3	3

Table 4: (continued)

Keywords	1995- 1999	2000- 2004	2005- 2009	2010- 2014	2015- 2018	Total
Managerial cognition	1	-	-	-	2	3
Managerial discretion	2	-	-	-	-	2
Management strategy	-	-	3	-	-	3
Manufacturing strategy	-	-	2	-	-	2
Modelling	1	-	2	-	-	3
Organizational change	1	-	-	-	-	1
Organizational culture	2	-	-	-	-	2
Organizational performance	-	-	5	-	-	5
Product management	2	-	-	-	-	2
Quality functional deployment	-	-	2	-	-	2
Real options	-	-	2	-	-	2
Performance	-	-	6	4	6	16
Personality	-	-	-	3	-	3
Rationality	-	1	-	-	3	4
Scenario planning	-	3	-	-	-	3
Simulation	2	-	-	-	-	2
Small to medium-sized	-	-	-	3	-	3
Social networks	-	-	3	-	-	3
Stakeholders	2	-	-	-	-	2
Strategic change	-	2	-	-	-	2
Strategic decision-making	18	24	33	47	41	163
Strategic decisions	-	2	2	7	6	17
Strategic management	5	7	13	8	3	36
Strategic planning	5	9	10	-	5	29
Strategy	11	7	6	16	4	44
Subsidiaries	-	-	3	2	-	5
Supply chain management	-	2	2	2	2	8
Sustainability	-	-	-	3	3	6
System dynamics	-	-	-	-	2	2
Teams	1	-	-	3	-	4
Teamwork	2	-	-	-	-	2
Top management team	-	-	-	3	3	6
Uncertainty	-	2	-	-	-	2
United States of America	-	-	3	-	-	3
Upper echelons	-	-	-	-	4	4
<b>Total</b>	<b>55</b>	<b>59</b>	<b>100</b>	<b>101</b>	<b>88</b>	<b>403</b>

additional key words were: 'innovation', (10 occurrences), 'decision support systems' (9 occurrences), 'knowledge management' (9 occurrences), 'supply chain management' (8 occurrences), 'learning' (7 occurrences), 'corporate strategy' (6 occurrences), 'sustainability' (6 occurrences), and 'top management team' (6 occurrences). The less commonly used keywords were: 'consensus' (1 occurrence), 'culture' (1 occurrence), 'entrepreneurship' (1 occurrence), and 'executive information' (1 occurrence). It appears that the decision process involved in strategic decision making was given less attention. Further to the above, keywords such as intuition (8 occurrences), rationality (4 occurrences), and cognition (3 occurrences) were also paid less attention in the context of decision-making. A few more keywords which reflected geographical information were also noted: India (5 occurrences), China (4 occurrences), and Australia (1 occurrence).

### **3.3 Bibliometric Methods**

The bibliometric method is an important science mapping technique used in the field of bibliometrics (Cobo, López-Herrera, Herrera-Viedma, & Herrera, 2011, 2012; van Eck & Waltman, 2009). It is commonly used to measure the influence and the similarity of citation analysis, co-citation analysis, author analysis, co-author analysis, and bibliographical coupling (Zupic & Čater, 2015). Our study also utilised complementary bibliometric tools for constructing the intellectual structure and the evolution of strategic decision. They include: (1) multidimensional data analysis using the Sankey Diagram; (2) visual network and heat map analysis using VOSviewer; (3) strategic diagram and evolution map using SciMAT.

In the past few years, Sankey Diagrams have been applied in various ways to perform the multi-dimensional analysis that illustrates the flow of energy. It was first used on steam engines, but in recent years, Sankey Diagrams have also been used on modern energy generating systems including power plants and global energy (Lupton & Allwood, 2017; Soundararajan, Ho, & Su, 2014; Subramanyam, Paramshivan, Kumar, & Mondal, 2015). Our study also applied the Sankey Diagram (<https://medialab.sciencespo.fr/>) to analyse the given datasets, and to visualise the flow of authorship, scientific themes, and journals based on a yearly basis. The Sankey Diagram is becoming particularly relevant for longitudinal analysis, especially when datasets are more detailed

(Lupton & Allwood, 2017). While the analysis highlights the statistics, the visualisation analyses the inter-linkages and the inter-dependencies of the various studies with regards to SD research (Soundararajan et al., 2014). From the datasets gathered, a scientific mapping based on key trends was then conducted for each year from 1971 to 2018. These processes were visualised and interactively explored. To the best of our knowledge, our study appears to be the first attempt to perform a multi-dimensional analysis and the visualisation of SD research in the field of business and management.

Since the VOSviewer is considered a free access programme which was developed for the purpose of constructing a bibliometric map that is based on network data (van Eck & Waltman, 2009), it was also applied in this study. This powerful bibliometric tool collects the data and builds maps for constructing and visualising the citation analysis, co-citation analysis, authorship analysis, co-authorship analysis, co-occurrences of author keywords, and bibliographic coupling (Merigó et al., 2018; van Eck & Waltman, 2009). The citation analysis was then used to assess how the documents cited each other. This was performed by counting the number of times that A cites B, and vice versa (Merigó et al., 2018). The main advantage of this bibliometric tool over other bibliometric programmes is its emphasis on the graphical representations of the maps (Castillo-Vergara, Alvarez-Marin, & Placencio-Hidalgo, 2018).

At the same time, the co-citation analysis estimates the citation of each document from a similar third source; the co-authorship counts the documents which were co-authored by more than one author, and the co-occurrence analysis then identifies the most frequent keywords used. On these maps, terms that coexist are often placed close to each other. Besides identifying the scientific terms used, our results are further classified into four clusters (Figure 2). Additionally, we also used modularity-based clustering and normalising options to smooth the visualisation of these results.

The next method, the SciMAT, is an open source bibliometric tool. It helps studies to visualise the intellectual structure and the evolution of the scientific research. It thus quantifies and visualises the thematic subfields (Heradio, Perez-Morago, Fernandez-Amoros, Cabrerizo, & Herrera-Viedma, 2016; Cobo et al., 2011, 2012). In general, the process of science mapping consists of: (1) the preliminary data processing (data reduction, de-duplication), (2) the network extraction (co-occurrence, coupling, direct linkage), (3) normalisation (association

strength, equivalence index, Jaccard and Salton's method), and (4) scientific mapping (clustering), analysis (network, spatial, temporal) and visualisation (Cobo et al., 2011, 2012).

The processing of the preliminary data helps to detect any duplications or misspelled items. It also performs time slicing. The duplication process then performs the data and network reductions so as to refine the data, cluster the similar words (by plurals), and to look for synonyms or duplicates in words according to the highest number of documents and repetitions. Some keywords with low informational values were, however, excluded. Prior to performing the network extraction, we grouped our datasets into four periods so as to perform a longitudinal analysis: 2000-2004, 2005-2009, 2010-2014, and 2015-2018. The period settings were based on the significant number of articles distributed in each of those years, which were found to be almost comparable. Finally, we analysed the datasets based on the following:

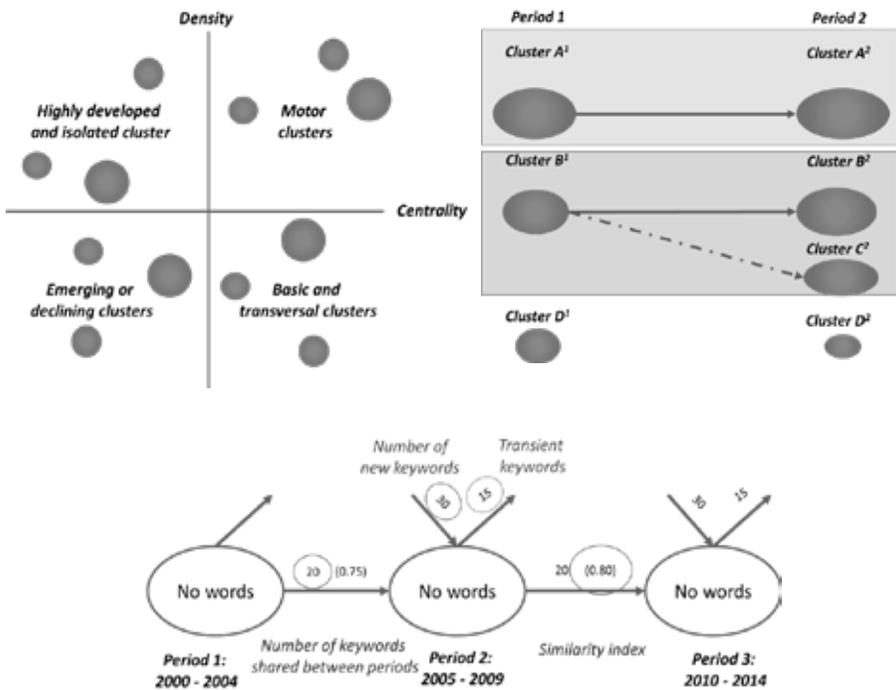


Figure 2: A Strategic Diagram of SciMAT, Evolution Map and Overlapping Graph

the four periods and the author's words, followed by a minimum frequency for data reduction of 1. The performance measures used for the period themes include the number of documents, the citations achieved by those documents, and h-index.

To reduce the network, we further selected the similarity measures for normalisation. Prior to the analysis, we used the equivalence index and visual mapping to identify the research themes. We projected this via the thematic networks and the strategic diagrams. We then used the longitudinal analysis to develop the evolution maps and the overlapping graphs. The configurations used include a network reduction of 1, association strength, normalisation measures, simple centre algorithms, core mapper for the document mappers, h-index and sum citations. The scientific evolution analysis we projected shows the association strength and the overlapping graph mapping thematic clusters for the particular period of time.

In the last stage of our study, we visualised the results by placing them into strategic diagrams, cluster networks, and evolutionary paths of scientific themes. The strategic diagrams highlight the identified clusters and the scientific themes for each of those four periods. This is depicted in a two-dimensional space: density and centrality (Cobo et al., 2011, 2012). The centrality measures the degree of the network interaction which represents the importance of a theme in the development of the research, but the density counts the degree of internal strength of the network. Figure 2 illustrates.

The evolution map is commonly used to identify the scientific clusters. As noted in Figure 2, the multi-sided clusters (D1 and D2) describe the evolution between the periods. The solid lines indicate that the linked clusters share the main items (commonly, the most significant one) and the dotted line describes the elements which are relatively far from the main ones. The thickness of the edges relies on the Inclusion Index which reflects the proportion of the number of published documents in each cluster (Alcaide-Muñoz, Rodríguez-Bolívar, Cobo, & Herrera-Viedma, 2017). The evolution analysis is explained by an overlapping graph as shown in Figure 2 where the horizontal arrow explains the number of items shared by both periods. The emerging trend is depicted by an upper incoming arrow which accounts for the number of new items for period 2 and the upper outgoing arrow represents the transient items that are presented in the previous period, but not in the recent one (Alcaide-Muñoz et al., 2017).

## 4. Results and Discussion

### 4.1 Sankey Diagram

The Sankey Diagram portrays multidimensional elements of the authors (left side), key scientific themes (middle side), and cited journals (right side). The results visualise the inter-linkages and the inter-dependencies of SD in the field of business and management from 1995 to 2018. The primary keywords often used in the first element are: 'decision-making', 'strategic decision-making', and 'strategy'. This is consistent with the keywords we applied at the initial stage of searching for the published articles in the field of SD research. The findings also highlight the major evolving trends given in the second element: learning (1995 and 2012), information technology (2001), strategic planning (2002), corporate strategy (2004), performance (2007), upper echelon (2016), and intuition (2017).

Table 3 describes a number of interdependencies among the given scientific terms. The most prolific authorship found in the third element include: Elbanna, Parayitam, Cray, Dooley and Amason. The top five co-wording terms are relatively dominated by several contexts: decision making, strategic decision making, strategy, strategic decision-making, and strategic management. The most influential publishers are Management Decision, Strategic Management Journal, Long Range Planning, Journal of Business Research and Decision Support System.

The findings derived are consistent with our objective which aims to examine the evolution of decision-making in business and management settings. The Sankey Diagram used illustrate some kind of interdependency among authorships, contexts, and the publishing journals. The most intensive interdependency among these three elements was Elbanna and Parayitam, as noted in the co-wording analysis of decision making published in the Management Decision journal. Our results further show that more authors contributed to the Strategic Management Journal and the Decision Science journal. Our results are in line with our preliminary analysis, thereby demonstrating the domination of the Strategic Management Journal in SD research.

Figure 3 highlights the results derived from examining co-wordings. As mentioned earlier, the network analysis was classified into four clusters between 1971 and 2018. The results visualised in VOSviewer (Figure 4) reveal that the first cluster comprised: 'decision making', 'strategic planning', and 'strategic decisions'. The second cluster comprised strategic decision-making processes which depicted

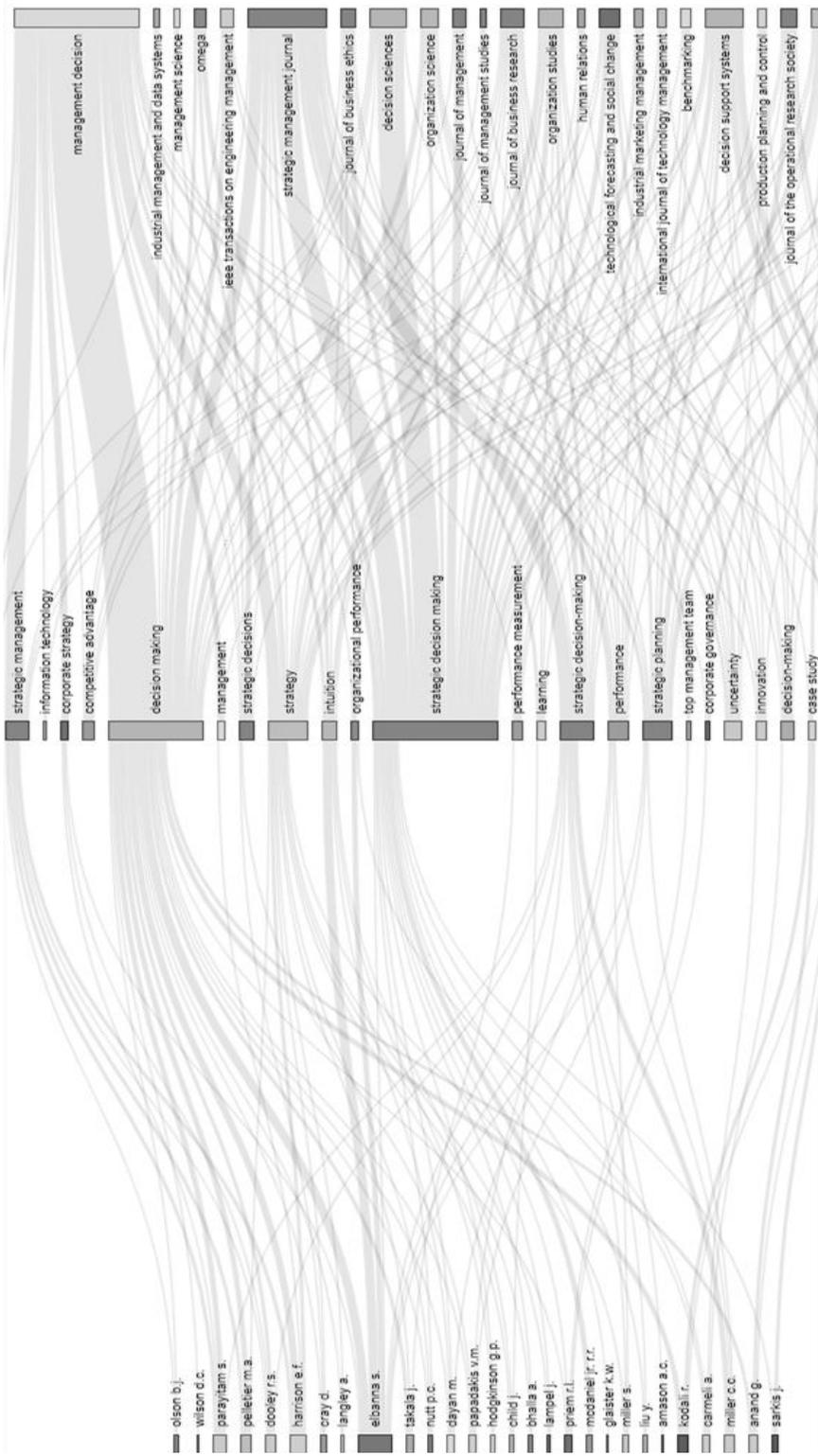


Figure 3: Sankey Diagram of Published Article



Table 5: Authors, Trends and Journals of Published Articles

Main authors	Main keywords	Main journals
Elbanna S. (12 papers)	Decision making (138 papers)	Strategic Management Journal (59 papers)
Parayitam S. (9 papers)	Strategic decision making (124 papers)	Management Decision (51 papers)
Cray D. (7 papers)	Strategy (57 papers)	Long Range Planning (39 papers)
Dooley R.S. (6 papers)	Strategic decision-making (54 papers)	Journal of Business Research (30 papers)
Amason A.C. (5 papers)	Strategic management (44 papers)	Decision Support Systems (28 papers)
Harrison E.F. (5 papers)	Strategic planning (41 papers)	International Journal of Production Economics (26 papers)
Kodali R. (5 papers)	Corporate governance (28 papers)	Journal of Cleaner Production (26 papers)
Liu Y. (5 papers)	Decision-making (27 papers)	Technological Forecasting and Social Change (26 papers)
Mallory G.R. (5 papers)	Strategic decisions (26 papers)	Decision Sciences (22 papers)
Nutt P.C. (5 papers)	Performance (24 papers)	Journal of Management (22 papers)
Pelletier M.A. (5 papers)	Innovation (22 papers)	International Journal of Production Research (18 papers)
Priem R.L. (5 papers)	Decision support systems (20 papers)	Journal of Management Studies (18 papers)
Takala J. (5 papers)	Supply chain management (20 papers)	Journal of the Operational Research Society (13 papers)
Wilson D.C. (5 papers)	Learning (16 papers)	Management Science (13 papers)
Anand G. (4 papers)	Intuition (15 papers)	Industrial Marketing Management (12 papers)
Bhalla A. (4 papers)	Management (15 papers)	European Management Journal (11 papers)
Carmeli A. (4 papers)	Top management team (15 papers)	Futures (11 papers)
Child J. (4 papers)	Case study (14 papers)	International Journal of Technology Management (11 papers)

Table 5: (continued)

Main authors	Main keywords	Main journals
Dayan M. (4 papers)	Corporate strategy (14 papers)	Journal of Business Ethics (11 papers)
Dimitratos P. (4 papers)	Leadership (14 papers)	Omega (11 papers)
Glaister K.W. (4 papers)	Uncertainty (14 papers)	IEEE Transactions on Engineering Management (10 papers)
Hodgkinson G.P. (4 papers)	Competitive advantage (13 papers)	Industrial Management and Data Systems (10 papers)
Lampel J. (4 papers)	Decision support (13 papers)	Organization Science (10 papers)
Langley A. (4 papers)	Knowledge management (13 papers)	Organization Studies (10 papers)
McDaniel Jr. R.R. (4 papers)	Organizational performance (13 papers)	Organizational Behavior and Human Decision Processes (10 papers)
Miller C.C. (4 papers)	Performance measurement (13 papers)	British Journal of Management (9 papers)
Miller S. (4 papers)	Simulation (13 papers)	Information and Management (9 papers)
Olson B.J. (4 papers)	Sustainability (13 papers)	Benchmarking (8 papers)
Papadakis V.M. (4 papers)	Competitive strategy (12 papers)	Human Relations (8 papers)
Sarkis J. (4 papers)	Information technology (12 papers)	Production Planning and Control (8 papers)





4.2.3 The Emergence of Strategic Decisions (2000-2004 and 2005-2009)

Since a substantial number of articles were located during this period of time, we balanced the number of articles by shortening the time period to 5 years, i.e., 2000-2004, and 2005-2009. They represent the third and fourth time period. Figure 7 illustrates results drawn for 2000 to 2004 while Figure 8 illustrates results obtained for 2005 to 2009.

4.2.4 The Latest Development and Evolution of Decision-Making (2010-2018)

This section illustrates the sub-major themes and their interdependencies in the final and latest stage of the time period from 2010 to 2018. Figure 9 illustrates results drawn for 2010 to 2014 while Figure 10 illustrates results obtained for 2015 to 2018. In the figures provided, the first cluster comprised of keywords which include: 'strategic decision', 'decision support system', and 'decision theory' while the second cluster portrayed keywords such as: 'decision making' and 'information'. The rest of the clusters portrayed other minor trends of decision making such as 'decision-making tools' and 'managers' decision'.

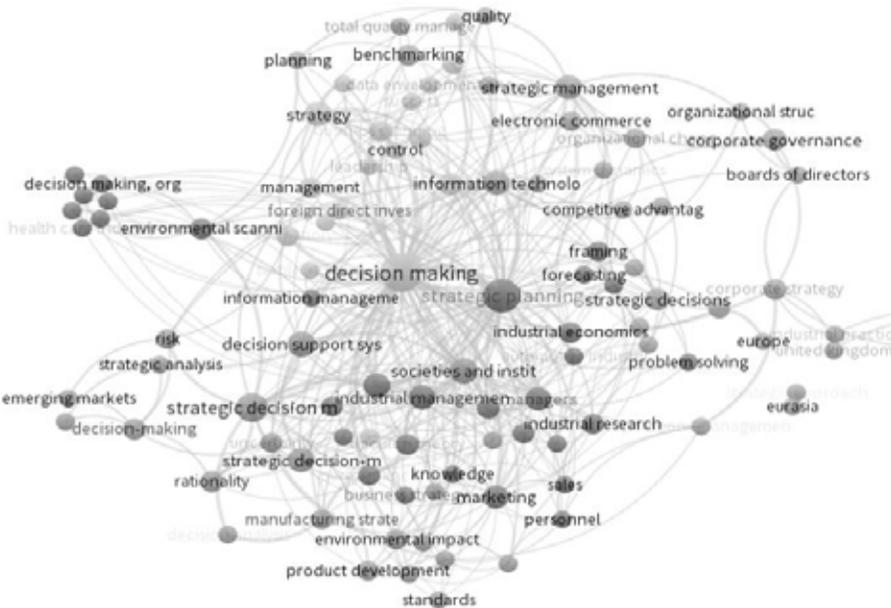


Figure 7: Mapping of Journals Bibliographic Coupling during 2000 and 2004





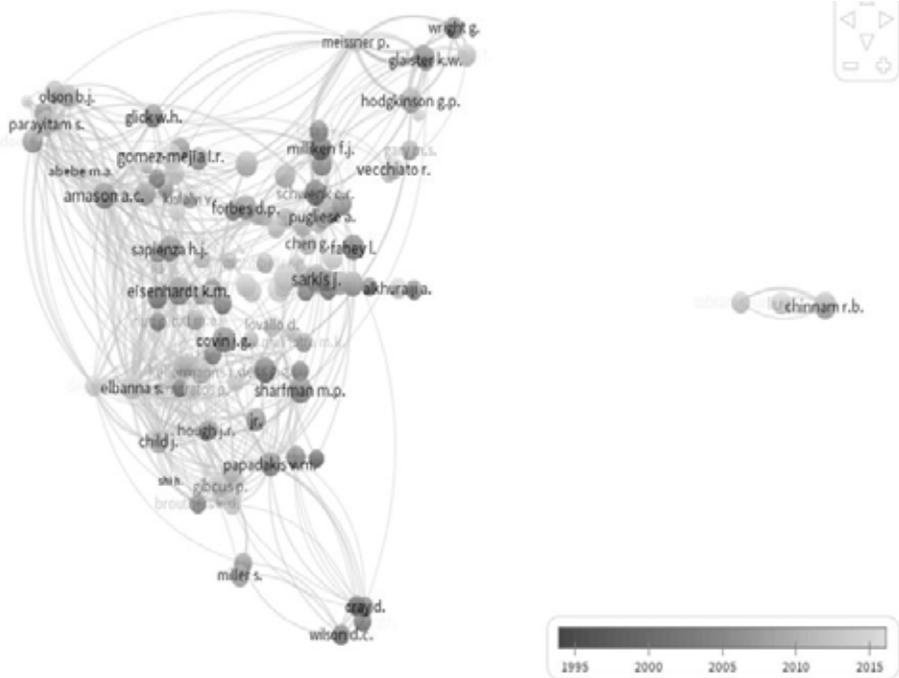


Figure 11: Longitudinal Mapping of Journals Bibliographic Coupling during 1971 and 2018

with the strongest networking found to be between Eisenhardt, Elbanna, Parayitam, Child and Papadakis.

Further to the bibliometric analysis, we also performed the bibliometric coupling by selecting the countries which were related to the scientific articles. The findings reveal that the SD literature is exclusively concentrated on developed countries such as the United States and the United Kingdom. With regards to academic institutions, it is found that both countries have the largest number of universities, hence their huge influence in the field of strategic decision-making.

Without doubt, these two developed nations are the absolute leader in this research field with the best indicator for influence and productivity in all the dimension we had analysed so far. It appears that the strongest networking for joint scientific productions is also between these two developed countries. Results further indicate that the transitioning and emerging countries have acquired second place as noted in the clusters while other countries such as Australia, Canada,



Figure 12: Mapping of Journals Bibliographic Coupling by Country during 1971 and 2018

China, Spain, Greece and the United Arab Emirates are also fairly influential, but with lesser productivity. The results explain that the geographical gaps need to be addressed in future research.

**4.3 Scientific Mapping and Evolution**

According to the evolution analysis illustrated by the SciMAT, the scientific mapping of the evolutionary trends were classified into four strategic diagrams, following the time period of 2000 to 2018. In this regard, we used a proportional number of published articles which were associated with each research theme instead of the datasets from 1971 to 1999. Co-occurrences analysis was then applied so as to map the decision-making literature with the subfields identified. This was

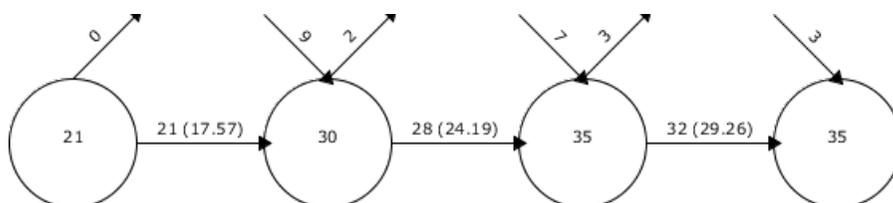


Figure 13: Overlapping Graph and Longitudinal Results of Evolution during Periods

accomplished by measuring the association strength of the publication keywords (Cobo et al., 2011, 2012; Heradio et al., 2016). Results were then automatically plotted by document count of articles based on density and centrality. This is illustrated in Figure 13.

Figure 13 highlights the overlapping graph which represents the number of items shared within the periods of: (i) 2000-2004, (ii) 2005-2009, (iii) 2010-2014, and (iv) 2015-2018. It is observed that the number of items shared by periods had increased from 21 items in the first period to 35 items in the last period. This outcome reveals that the number of new and transient keywords was relatively high while the number of shared keywords between successive sub-periods had increased, thereby leading to the higher similarity indices (17.57, 24.19 and 29.26). These signs suggest that the research field had not reached a stage of maturity yet.

The upper incoming line in Figure 13 demonstrates the number of new items in a period while the upper outgoing arrow displays the items that were presented in the prior period. The results show that the number of new items is relatively higher during the second period (9 items) and third period (7 items). The number declined to three (3) items during the last period. This shows that the items presented in the prior period had increased from two items in the second period to three items in the last period.

With reference to the strategic diagram shown in Figure 14, the analysis shows that the research seemed to have fragmented in the major scientific themes. This is consistent with our study which focusses on the themes of: decision-making, rationality, behavioural economics, bounded rationality and intuition (high centrality-high density). The results also show some research areas using other scientific themes such as: political-decisions, leadership, entrepreneurship (low centrality-high density), strategic planning, game theory and real options (high



decisions. It appears that the new approach paved by the dual process theory, three-way-decision, and game theory have transformed the way decisions were made during those time periods.

In the same figure, the second cluster highlights the highly developed but isolated topics (quadrant 2) of: innovation, prospect theory, cognition, analytic hierarchy process, strategic decisions, new product development, information, tacit knowledge, projects, psychological bias, mental models and market. These research topics are associated with how strategic decision making served as a central element for issues related to innovation, prospect theory, cognition and analytic hierarchy process. The third cluster in the same figure projects topics that are marginal and inadequately developed such as emerging or disappearing topics. They include: political decision, entrepreneurship, leadership, cognitive bias, sense-making and chief of executives.

The last quadrant projects the imperative topics which are weakly structured. They encompass: decision-making, intuition, rationality, behavioural economics, bounded rationality, decision support system, uncertainty, artificial intelligence, fuzzy sets, big data, multi-criteria decision making, knowledge and human resource management. Our findings reveal that strategic decision-making has a wide perspective – from classical scientific themes of synoptic and incremental perspectives (rationality, intuition, bounded rationality and decision support system) to neo-classical scientific themes (behavioural economics, artificial intelligence and big data).

According to the performance measures we applied, several major themes were detected. These include: decision-making, intuition, rationality, bounded rationality, decision support system, dual process theory, and political decision. These research themes are able to gather a significant impact rate, achieving more than 50 citations, and getting higher h-indexes when compared to the remaining themes. Our results also establish several very important themes for the decision-making research. They include: decision-making, and intuition (2000-2004), bounded rationality, and uncertainty (2005-2009), decision support system, and artificial intelligence (2010-2014), and decision-making and intuition (2015-2019).

According to the centrality and density of our results, it is observed that the most important themes for the decision-making research were: decision-making, intuition, rationality, bounded rationality, and the decision support system. It should be noted too that both themes had accomplished great impact measures (citation and h-index). Overall, our

results also summarise the top co-wordings based on centrality from 1971-2018. They encompassed: decision-making, intuition, rationality, behavioural economics, bounded rationality and investment decision. Our results also locate the topmost themes based on centrality range. They include: decision-making, intuition, rationality, behavioural economics and decision support system. The five topmost themes that are based on density range were: knowledge-based systems, information, tacit knowledge, new product development and strategic decisions.

In this study, the impact of the co-wording terms was analysed using the average citation among the co-wording maps within each cluster by using the relational database extracted from the decision-making articles. The results are able to exhibit the strategic diagram of the evolution and also a set of thematic networks. Our results also reveal that the major themes are related to the decision-making field such as: analytical hierarchy process, cognitive biases, bounded rationality, real options, multi-criteria decision, cognition, knowledge-based systems, behavioural economics, strategic planning, artificial intelligence, decision support system and intuition.

Towards the end of our analysis, it is found that the most developed theme, and the one that is most important for the construction of the scientific field, is decision-making, given that it represents a strong centrality and a high density. Research on the topic of strategic decision is related to aspects involving dynamic capability where strategic decision-making is a relevant factor. This has been studied by Eisenhardt, Miller and Papadakis. In comparison, research on the topic of behavioural decision is related to aspects involving intuition. This has been conducted by Elbanna, Child and Hodgkinson. The findings from these studies are in line with our focus on decision-making, rationality, behavioural economics and intuition. Consequently, the trend in research themes development was identifiable, thereby making it more conducive for future research to explore further.

#### *4.3.1 The Scientific Mapping of Strategic Decision (2000-2004)*

In order to visualise the most prominent scientific themes of strategic decision-making in the field of business and management in the two sub-consecutive periods of 2000 to 2004 and 2005 to 2009, we used SciMAT to develop the strategic diagram. Figure 15 is provided.

It was observed that from 2000 to 2004 there has been a rapid rise in the study of decision-making. According to the centrality and density

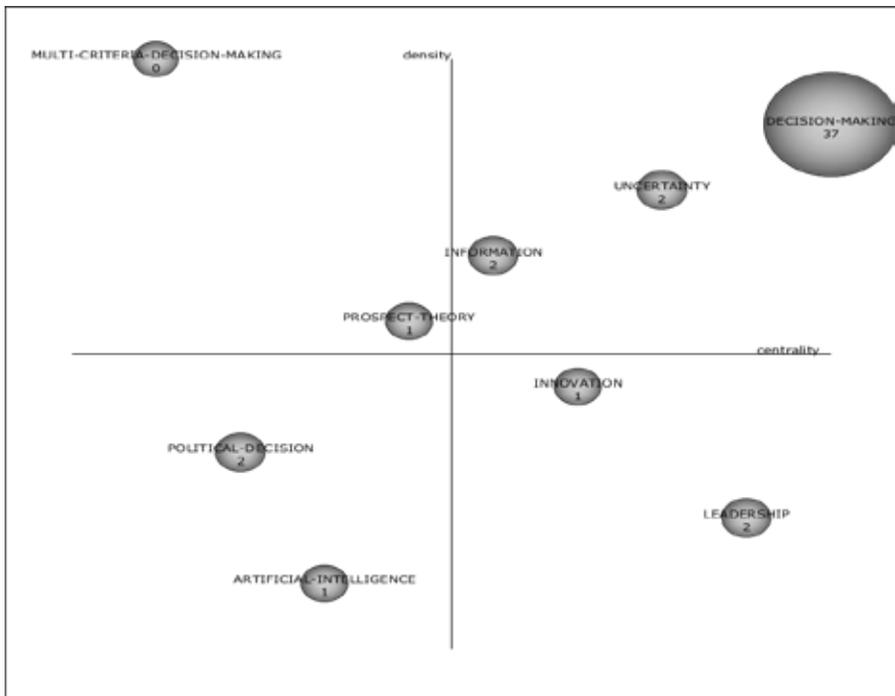


Figure 15: Strategic Map Diagram Using SciMAT 2000-2004 (secondary document counts)

of the results, the most significant of these themes were: decision-making, uncertainty, and information. The impact created by themes include citation and h-index which were relatively well developed, and important for a given scientific field in a given period of time. This is referred to as the motor themes, in quadrant 1. The underdeveloped themes are shown in quadrant 2. They are relatively important, weakly structured but possibly of considerable significance (Cobo et al., 2011, 2012; Heradio et al., 2016). These themes comprise leadership and innovation. The declining themes in quadrant 3 are inadequately developed and marginal, encompassing artificial intelligence and political decision. They are either emerging or disappearing topics. Finally, the basic themes presented in quadrant 4 are prospect theory and multi-criteria decision-making. They are well-developed internal links but they have marginal external ties.

According to the cluster network (Figure 16), the decision-making has a central role that is mainly associated with major scientific themes

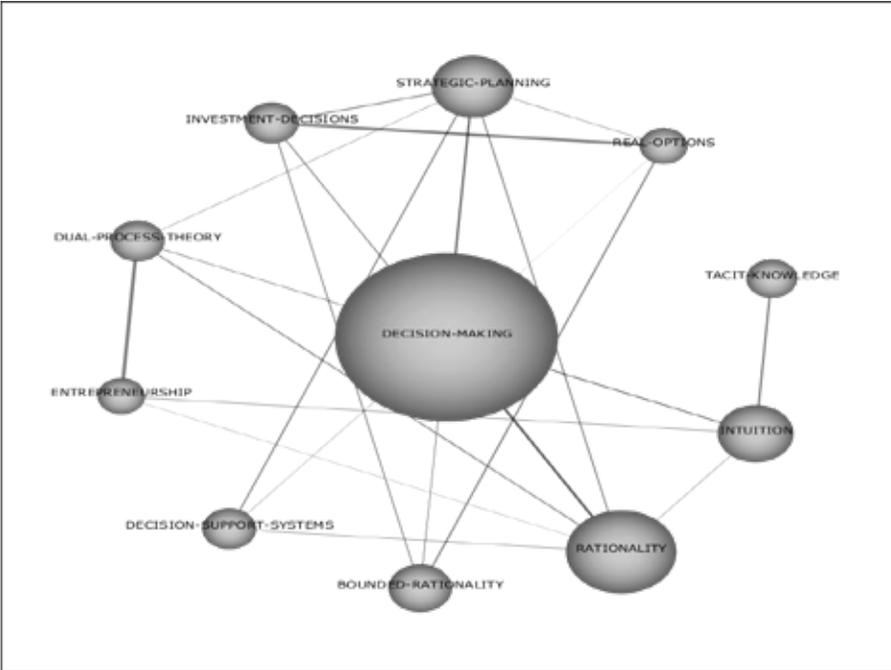


Figure 16: Cluster Network Using SciMAT 2000-2004 (decision making)

such as rationality, strategic planning, intuition, bounded rationality decision support systems. While the rest of the cluster presented the minor scientific themes such as: dual process theory, investment decision, real options, entrepreneurship and tacit knowledge, it seems obvious that decision-making plays a vital role among the scientific themes. It seems to have a powerful influence on other scientific themes as shown in the cluster network for the period of 2000 to 2004.

4.3.2 *The Scientific Mapping of Strategic Decision (2005-2009)*

Based on the strategic diagram provided by SciMAT as shown in Figure 17, it can be noticed that during the period between 2005 to 2009, the most important themes of decision-making research were: decision-making, bounded rationality, information and tacit knowledge. These motor themes as given in quadrant 1 of Figure 17 are relatively well developed and imperative for a given scientific field in a given period of time. The underdeveloped theme shown in quadrant 2 is strategic

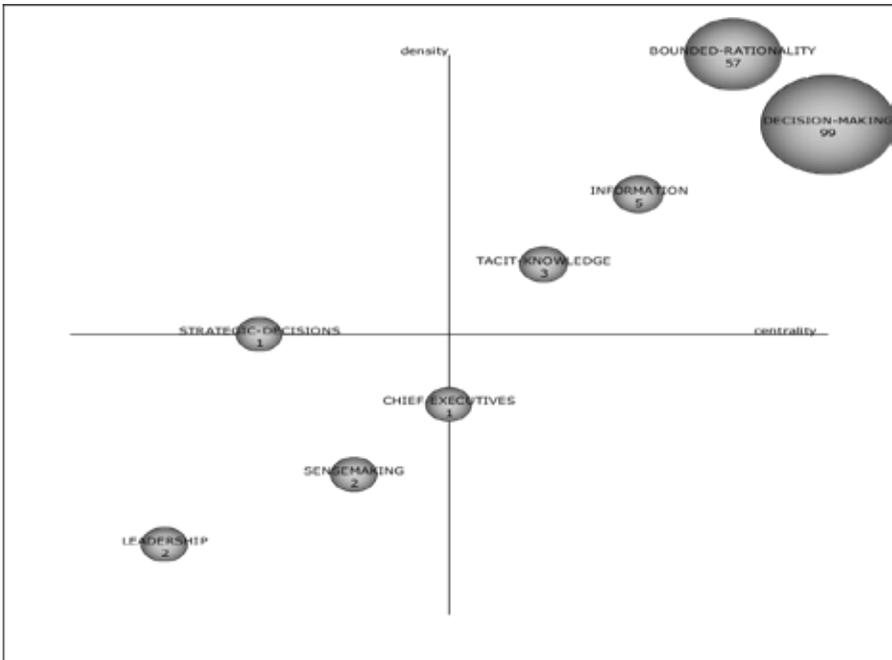


Figure 17: Strategic Map Diagram Using SciMAT 2005-2009 (secondary document counts)

decisions which is relatively important but weakly structured. This suggests that the topic of strategic decision is underdeveloped but of considerable significance for the entire research field. The declining themes presented in quadrant 3 are: leadership, and chief executives. They were inadequately developed and marginal, representing either emerging or disappearing topics. The strategic diagram has no basic and transversal themes which are commonly found in quadrant 4.

According to the cluster network shown in Figure 18, the bounded rationality has a central role which is mainly associated with prominent scientific themes such as: uncertainty, real options, game theory, innovation and strategic planning. The rest of the cluster consists of minor scientific themes such as: political decision, dual process theory, investment decision, analytic hierarchy process, cognitive bias, behavioural economics, artificial intelligence, fuzzy sets, prospect theory, innovation and entrepreneurship. The findings reveal that bounded rationality plays a vital role in the scientific themes. It has a powerful

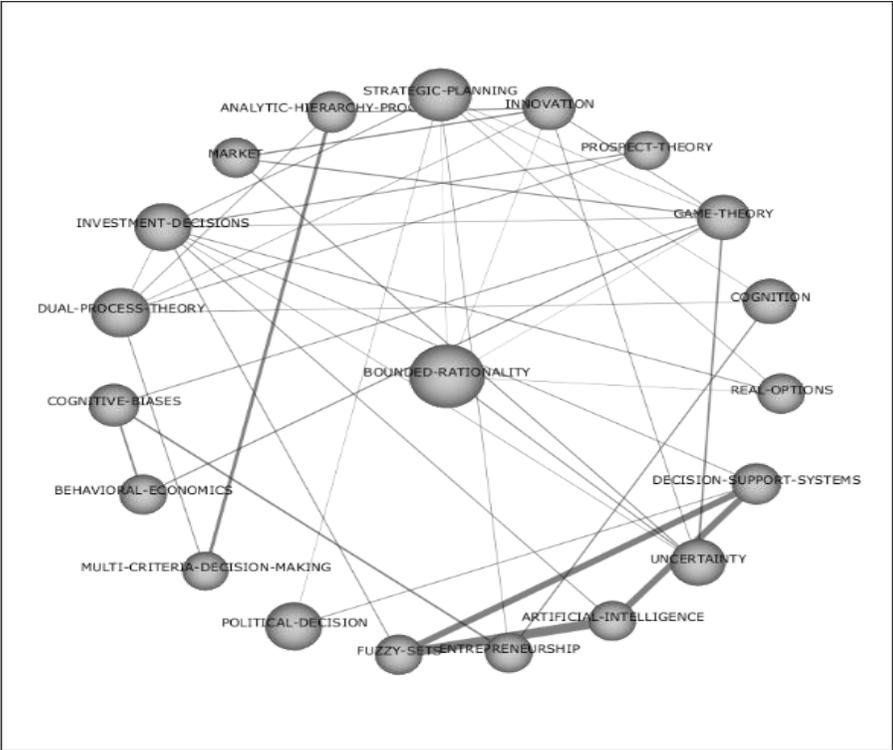


Figure 18: Cluster Network Using SciMAT 2005-2009 (bounded rationality)

influence towards other scientific themes given in the cluster network during the period of 2005 to 2009.

4.3.3 *The Scientific Mapping of Strategic Decision (2010-2014)*

To illustrate the analysis for the period 2010 to 2014, Figure 19 is provided. It highlights the most significant themes of the decision-making research field which comprised: decision-making, game theory, entrepreneurship, strategic planning and portfolio management. These scientific motor themes as shown in quadrant 1 of Figure 19 are relatively well developed and imperative for a given scientific field in a given period of time. The underdeveloped themes shown in quadrant 2 comprised: strategic decision, mental models, projects, real option, and tacit knowledge. They are relatively important but weakly structured.

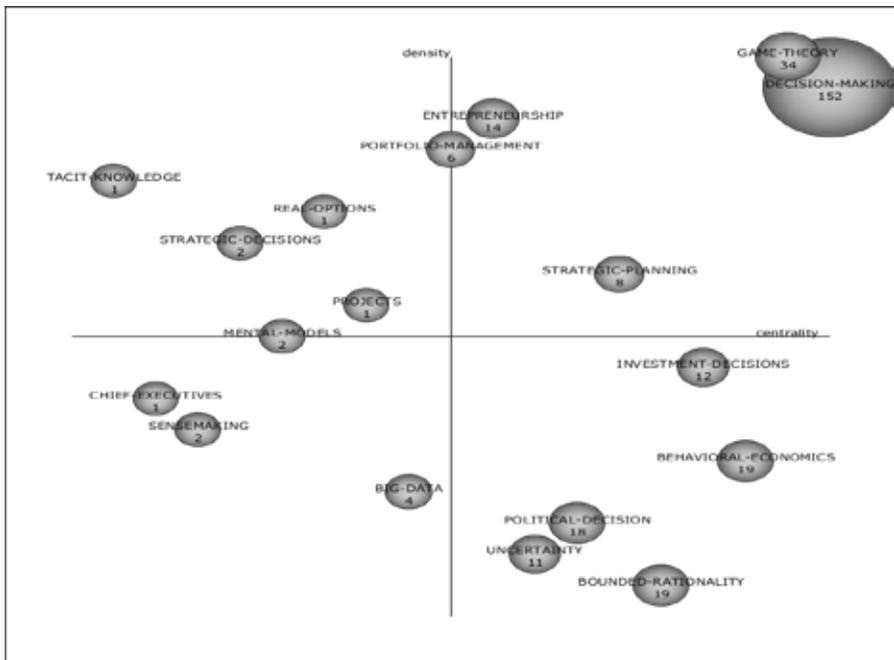


Figure 19: Strategic Map Diagram Using SciMAT 2010-2014 (secondary document counts)

The declining themes such as big data, sense-making and chief executive can be found in quadrant 3. Both are inadequately developed and marginal topics, representing the emerging topics in the age of industrial fourth revolution. Finally, the basic and transversal themes such as: behavioural economics, bounded rationality, political decision, investment decision, and uncertainty are illustrated in quadrant 4. They are well-developed internal links but they have marginal external ties.

To highlight the fuzzy sets, Figure 20 is provided. According to the cluster network, the fuzzy sets have the largest network. It is also mainly associated with prominent scientific themes such as: artificial intelligence, multi-criteria decision-making, and decision support system. The rest of the cluster network consists of minor scientific themes such as: prospect theory, cognition, and game theory. The findings reveal that the decision support system plays a vital role in the scientific themes. It has a powerful influence on other scientific themes such as those given in cluster network during the period of 2010 to 2014.

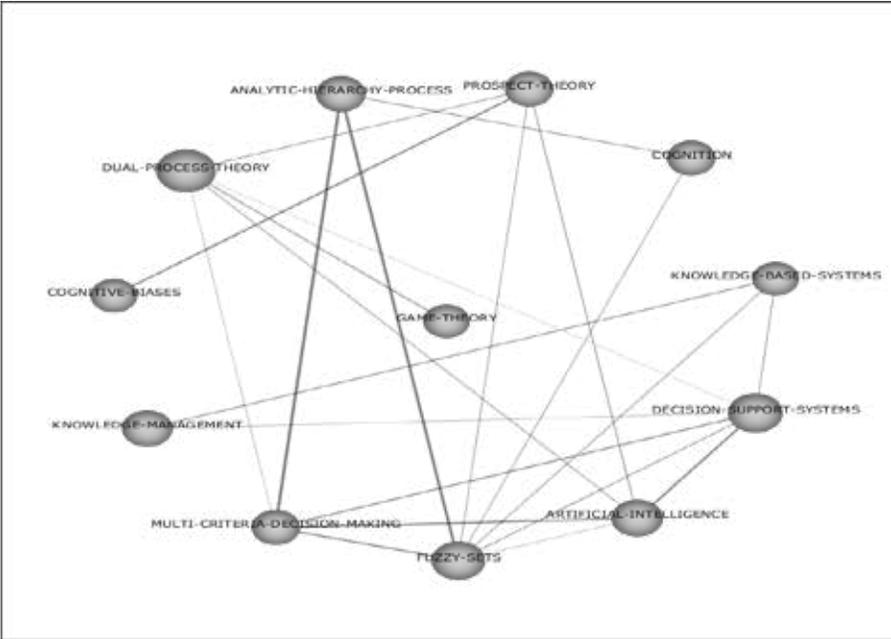


Figure 20: Cluster Network Using SciMAT 2010-2014 (decision support system)

4.3.4 The Scientific Mapping of Strategic Decision (2015-2018)

Figure 21 is provided to explain this section. During the period between 2015 and 2018, the most important themes of the decision-making research field are intuition, bounded rationality, cognition and innovation. These scientific motor themes shown in quadrant 1 are relatively well developed and imperative for a given scientific field in a given period of time. The transversal or underdeveloped themes are shown in quadrant 2 are relatively important but weakly structured: three-way decision, analytic hierarchy process and new product development. These considerable themes are classified to be transversal topics or underdeveloped topics of considerable significance for the entire research field.

The declining themes such as leadership, psychological bias and market can be found in quadrant 3 which are both inadequately developed and marginal topics, representing emerging topics in the age of industrial fourth revolution. Lastly, the basic and transversal themes such as political decision, uncertainty and entrepreneurship can

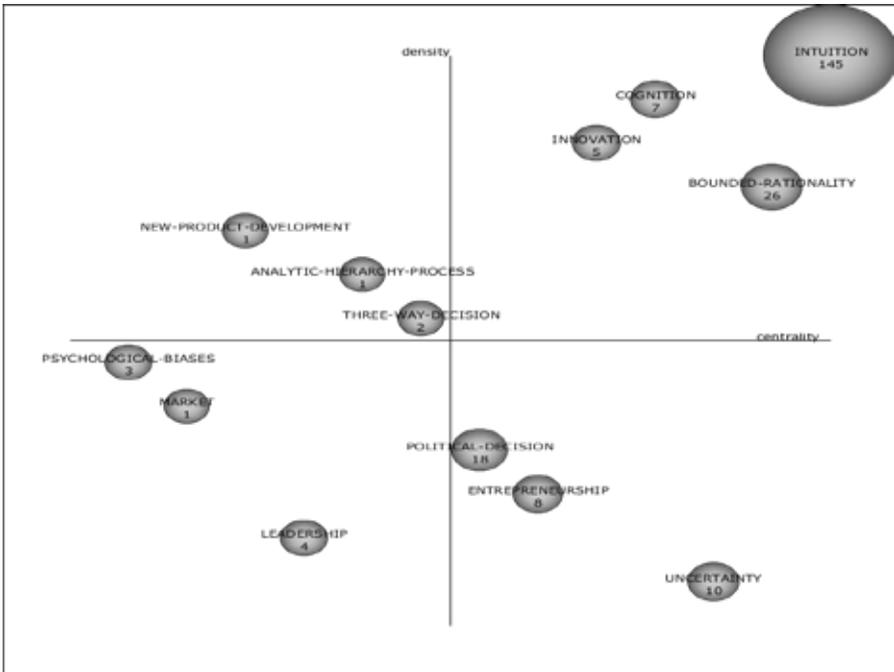


Figure 21: Strategic Map Diagram Using SciMAT 2015-2018 (secondary document counts)

be found in quadrant 4. These particular themes are well-developed internal links but they have marginal external ties. According to the cluster network of Figure 22, the largest network on research involving decision-making is mainly associated with prominent scientific themes such as: behavioural economics, intuition, rationality and dual process theory. The rest of the clusters consist of minor scientific themes such as: fuzzy sets, big data, investment decision, multi-criteria decision-making, strategic planning and game theory. The findings revealed that decision-making plays a vital role in the scientific themes. It also has a powerful influence on other scientific themes such as those given in the cluster network during the period of 2015 and 2018.

The findings further reveal the thematic focus for each of the time periods. For instance, decision-making and intuition for 2000 to 2004, bounded rationality and uncertainty for 2005-2009, decision support system and artificial intelligence for 2010 to 2014, and decision-making and intuition for 2015 to 2019. Overall, it can be summarised that

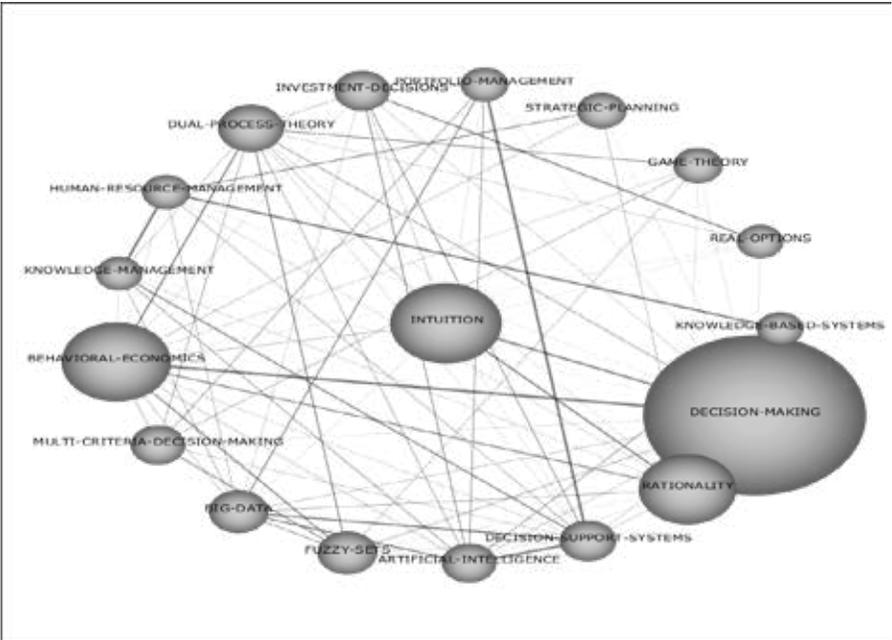


Figure 22: Cluster Network Using SciMAT 2015-2018 (decision-making)

the top co-wordings, based on centrality from 1971 to 2018 include: decision-making, intuition, rationality, behavioural economics, bounded rationality and investment decision. Further, the prominent themes based on centrality range include: decision-making, intuition, rationality, behavioural economics and decision support system. The top five themes based on density range include: knowledge-based systems, information, tacit knowledge, new product development and strategic decisions.

Once the keywords’ evolution was analysed, we then evaluated the scientific evolutionary themes of strategic decision-making field through the thematic areas (see Figure 23). Many of the results achieved in this epigraph confirmed the initial evolution we had highlighted. Initially, research was related to how the decision was made in a given process - intuition, rationality and political decision (decision-making, intuition, rationality, political decision). This outcome was derived based on specific tools such as: the decision support system, fuzzy sets, and artificial intelligence (decision support system, fuzzy sets, artificial intelligence) based on a condition of uncertainty and the cognitive constraint of bounded rationality (uncertainty, bounded rationality).

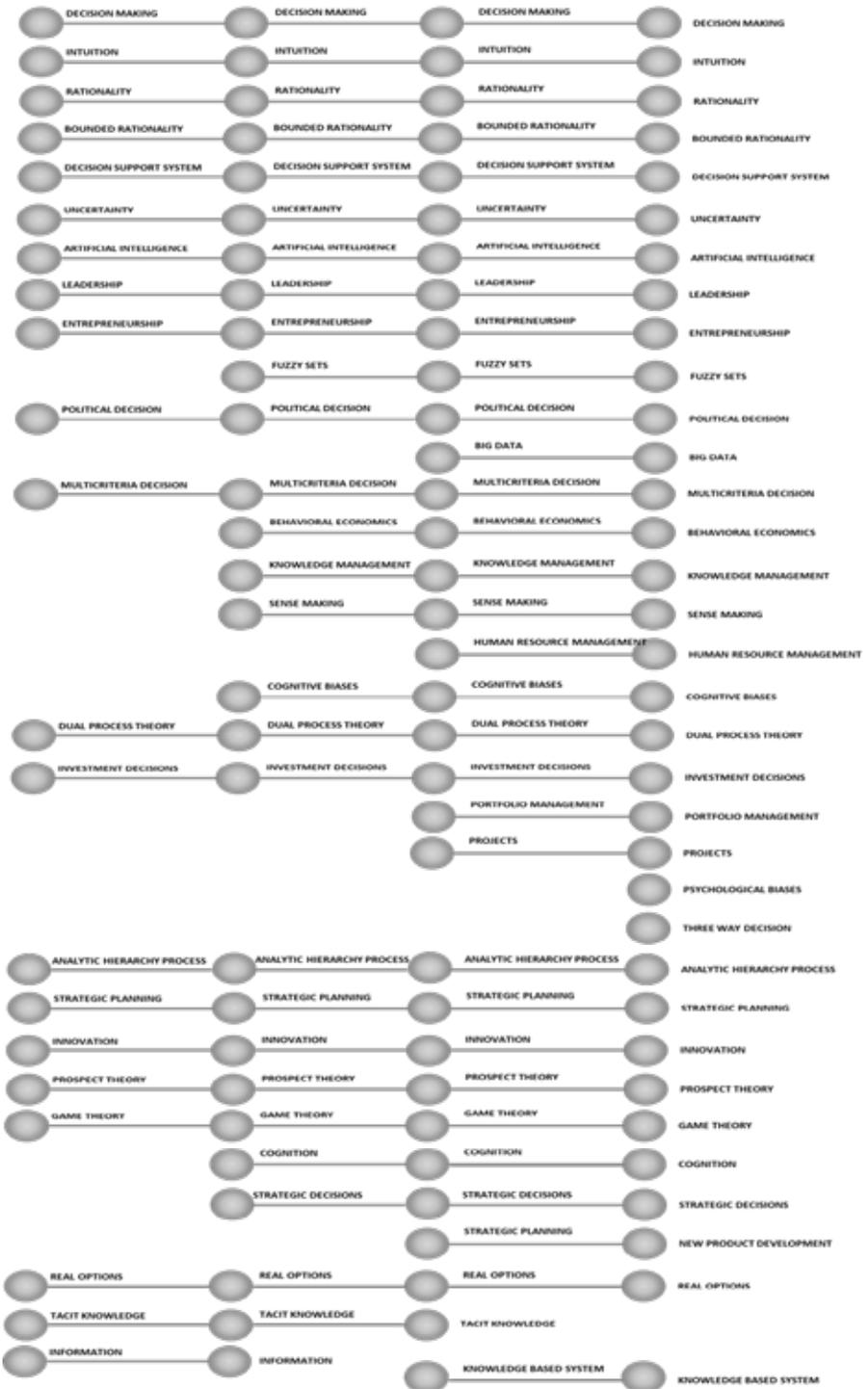


Figure 23: Longitudinal Analysis Based on Core Document H Index Using SciMAT 2017-2018

According to the evolution map shown in Figure 23, the emerging themes comprised: behavioural economics, knowledge management, sensemaking, strategic decisions, cognition and portfolio management. In contrast, the disappearing themes were related to: information, market, tacit knowledge and chief executives. According to the h-index, some of the most attractive studies carried various scientific themes such as: decision-making, intuition, rationality, bounded rationality, decision support system, artificial intelligence, leadership, entrepreneurship, fuzzy sets and political decision. It appears that the thickness of the edges is proportional to the Inclusion Index, and the volume of the spheres is proportional to the number of published documents associated with each cluster (Alcaide-Muñoz et al., 2017). The findings also denoted the emerging scientific themes to be: fuzzy sets, big data, behavioural economics, knowledge management, sensemaking, human resource management, cognitive biases, portfolio management, projects, psychological biases, three-way decision, cognition, strategic decisions, new product development and knowledge based systems.

## 5. Conclusions and Implications

### 5.1 Contributions

Our study has provided a systematic and updated review of past studies which focussed on SD. In this regard, we also pursued a longitudinal study which embraced four time periods from 1971 to 2018, covering a span of 48 years. Our results depict a long list of taxonomy, highlighting the evolution of research on SD in the field of business and management. Our findings reveal the huge shift in the study of SD, especially over the past ten years. The results depict a gradual increase in the number of studies published in international scientific journals since 2000 and the peak of the publication was between 2010 to 2018.

From our review and detailed analysis, several outcomes are generated. First, the Sankey Diagram illustrated the intellectual structure of the authors, co-wordings and scientific publishing journals. The line's thickness and its interdependency reflected the strong connection among the given scientific terms. We also analysed the multi-dimensional aspect of the bibliometric datasets such as: authorships (Elbanna, Parayitam, Cray, Dooley and Amason), co-wording terms (decision making, strategic decision making, strategy, strategic decision-making, and strategic management), publishing journals (Management Decision,

Strategic Management Journal, Long Range Planning, Journal of Business Research and Decision Support System).

The Sankey Diagram illustrated the gap between the prolific scholars, and the existing key wording profiles of a given sector or subsector of SD research. This difference of the lines' thickness reflecting the inter-linkages and the inter-dependencies of the keywords, thus served as a basis for further evaluation of the field of research (Subramanyam et al., 2015). Meanwhile, the most cited papers were found to introduce both the emerging theories and perspectives, and this seems to change the direction of the research (Ferreira et al., 2016). In order to deepen our understanding, we suggest the development of new theories from the rational perspective to the incremental perspective in the development of SD research in the field of business and management research.

Additionally, the scientific networks and cluster trends shown in the VOSviewer have also displayed the evolution of SD research in business and management from 1971 to 2018. The decision-making processes had evolved in diverse ways, moving from analytical hierarchy processes to fuzzy logic, decision support system, rationality, intuition, political decision (part of behavioural research), data analytics, and artificial intelligence. The clusters shows that decision-making as a research theme, have been investigated within the wide context of business and management, for instance, 'strategic planning', 'supply chain management', 'manufacturing', 'product development', 'investment', 'marketing', and 'industrial management'.

Finally, the strategic diagrams and performance measures shown in the SciMAT reveal some of the most significant themes of strategic decision-making in the field of business and management from 1971 to 2018. They include: 'decision-making', 'intuition', 'rationality', 'bounded rationality', 'decision support system', 'dual process theory' and 'political decision'. According to the results shown in each sub-time period, some of the most important themes that had emerged in the decision-making research field were: 'decision-making' and 'intuition' (2000-2004), 'bounded rationality' and 'uncertainty' (2005-2009), 'decision support system' and 'artificial intelligence' (2010-2014), followed by 'decision-making' and 'intuition' (2015-2019). From the centrality and density of the results generated, some of the most important themes that had surfaced in the decision-making research field were: 'decision-making', 'intuition', 'rationality', 'bounded rationality' and 'decision support system'.

Grounded on the results derived from the bibliometric mapping analysis, it is also observed that some of the scientific themes of SD that carried the highest number of publications and citational measures were: 'intuition', 'rationality', 'bounded rationality' and 'decision support system'. We also found a high number of new and transient keywords within the time period we selected, for instance, 'behavioural economics', 'knowledge management', 'sense making', 'strategic decisions', 'cognition' and 'portfolio management'. They signify that the research on strategic decision-making has not reached a period of maturity yet.

## *5.2 Recommendation for Future Research*

The recommendation approach adopted by previous studies had used certain emerging and discontinued themes, as depicted in the SciMAT (Alcaide-Muñoz et al., 2017; Cobo et al., 2011, 2012). In this study, our findings have stressed on the importance of addressing some forthcoming works that could provide implications and directions for future research. Over the years of studies conducted, academics and scholars have observed that very few studies have focussed on behavioural economics and knowledge management. Based on this lack, it is imperative to know the relationship of these themes on decision-making. For instance, how are behavioural features highlighted for making strategic decisions? What kind of problems and risks can influence the making of strategic decisions in the field of portfolio management?

Next, it appears that future research needs to explore the discontinued themes of information, market and tacit knowledge because they are still relevant in today's world. This can be accomplished by empirical research that evaluates how those relationships impact on decision-making. In addition, it is also necessary to understand if there were any difficulties involved when decision-makers applied their tacit knowledge in making strategic decisions. This may also raise issues on the kind of information used by decision makers to effectively make their strategic decisions. From this, various problems obstructing the effective use of information for SD research can be revealed.

Further to the above implications, it seems imperative for future regional or global analysis to be performed by taking into account the context of emerging countries, instead of merely focussing on particular fields such as business and management research. By com-

binning the research on SD with other fields, a more holistic analysis in understanding interdisciplinary perspectives of SD research can be accomplished. From this standpoint, it may also enrich queries and keywords which can further reveal the diverse scientific themes of decision-making (Cobo, Jürgens, Herrero-Solana, Martínez, & Herrera-Viedma, 2018).

Finally, the evolution of the research themes could be studied by using other scientific tools such as the Web of Science (WoS) as one approach to expand on the articles published. It is one of the most imperative bibliographic datasets applied over the last ten years (Cobo et al., 2018).

### ***5.3 Limitation of the Study***

In spite of the evidence generated in this study to support our conclusion and implications, this study is also constrained in some ways. First and foremost, the complex nature of the SD process used within an interdisciplinary research serves as the limitation, particularly in the selection of datasets (Nooraie, 2008).

Second, by focusing only on the Scopus retrieval system, this study is also restricted by publications of different sources. In reality, many articles related to SD had also been published beyond the Scopus retrieval system.

Third, our selection of articles zoomed in on business and management issues only. Other datasets from diverse perspectives, and empirical works with different contexts and settings were thus overlooked. Therefore, even though our findings had reported on the taxonomy and evolution of SD over a long-time frame, our evidence was restrictive in some ways. Multiple datasets extracted from diverse and complex fields of study would be more generalisable.

Fourth, our datasets were gathered using key terms and the Boolean logic of keywords in either the title or abstracts only. This kind of limitation is common in bibliometric studies (Chen, Chiang, & Storey, 2012), hence there is a need to concentrate on this gap for interpretability and generalisability of the findings. Nonetheless, despite the limitations, our findings had visualised the intellectual structure and evolution of strategic decision in the field of business and management. Future research may consider assessing the generalisability of these findings by implementing the approach on different situations and settings.

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