

A Systematic Bibliometric Analysis on the Nature of and Trends in Decision-Making in Sport *Sporda Karar Verme Sürecinin Doğası ve Eğilimleri Üzerine Sistematik Bir Bibliyometrik Analiz*

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Abstract: This study employed a bibliometric approach to examine the research landscape surrounding decision-making in sport. Utilizing the R programming language with the Biblioshiny interface, we analyzed data extracted from the Web of Science (WoS) database to identify prevailing trends and key contributors to this field. Our analysis encompassed 1683 articles published between 1988 and 2024, authored by 5,107 individuals across 112 journals, with an average annual publication rate of 8.42 articles. Key findings highlight the UK as the leading nation in collaborative research within this domain. Davids K. emerged as the most prolific author (n=47), while Victoria University led in institutional productivity (n=53). Keyword analysis revealed a predominant focus on "sport," "performance," and "decision-making," followed by "return," "reliability," and "physical activity." Furthermore, recent trends indicate a growing emphasis on topics such as rehabilitation, reconstruction, and football within the context of sports decision-making. This comprehensive analysis provides valuable insights into the evolution and current state of research on decision-making in sport, informing future scholarly endeavors in this area.

Keywords: Sport, decision-making, bibliometric analysis, R, biblioshiny, WoS.

Özet: Bu çalışmada, sporda karar verme sürecini çevreleyen araştırma ortamını incelemek için bibliyometrik bir yaklaşım kullanılmıştır. Biblioshiny arayüzü ile R programlama dilini kullanarak, Web of Science (WoS) veritabanından elde edilen verileri analiz ettik ve bu alanda hakim eğilimleri ve önemli katkıda bulunanları belirledik. Analizimiz, 1988 ile 2024 yılları arasında yayınlanan, 112 dergide 5.107 kişi tarafından yazılan ve yıllık ortalama yayın oranı 8,42 makale olan 1683 makaleyi kapsamaktadır. Temel bulgular, Birleşik Krallık'ın bu alandaki işbirlikçi araştırmalarda lider ülke olduğunu vurgulamaktadır. Davids K. en üretken yazar olarak ortaya çıkarken (n=47), Victoria Üniversitesi kurumsal üretkenlikte (n=53) başı çekmiştir. Anahtar kelime analizi, ağırlıklı olarak "spor", "performans" ve "karar verme" konularına odaklanıldığını, bunları "geri dönüş", "güvenilirlik" ve "fiziksel aktivite" konularının izlediğini ortaya koymuştur. Ayrıca, son dönemdeki eğilimler, sporda karar verme bağlamında rehabilitasyon, yeniden yapılanma ve futbol gibi konulara giderek daha fazla vurgu yapıldığını göstermektedir. Bu kapsamlı analiz, sporda karar verme konusundaki araştırmaların evrimi ve mevcut durumu hakkında değerli bilgiler sunmakta ve bu alandaki gelecekteki bilimsel çabaları bilgilendirmektedir.

Anahtar Kelimeler: Spor, karar verme, bibliyometrik analiz, R, biblioshiny, WoS.

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INTRODUCTION

Decision-making underlies virtually all human actions, manifesting as a multifaceted process through which individuals select from among multiple alternatives. This systematic process is grounded in rationality and future-oriented thinking (Koçoğlu, 2010), while being shaped by personal values and experiences (Papamichail & Robertson, 2003) through the generation and evaluation of alternatives (Hamzah, 2012). The decision-making process benefits from a cognitive framework characterized by independence and risk assessment capabilities, as these attributes can enhance outcome quality. Herbert Simon (1987), who made seminal contributions to decision-making theory, conceptualized the process as "the individual's conscious choice of an alternative to achieve a certain goal," highlighting the integration of goals, volition, and preferences. Given that decision-making is inherently personal, scholars have examined it through various theoretical lenses.

In Rational Decision-Making Theory, individuals evaluate available information objectively and proceed with a systematic, step-by-step approach to decision-making (Falahati, 2021), while subjecting available options to logical reasoning (Jankelová & Puhovichová, 2020). The Limited Rational Decision-Making Model, which challenges the traditional concept of complete rationality in decision-making processes, acknowledges that individuals are constrained by various factors such as cognitive limitations, time constraints, and decision problem complexity (Walton, 2019). Under this model, even when individuals endeavor to make rational choices, these constraints may prevent them from realizing their preferences (Oraby & Bauch, 2015). The Garbage Can Decision-Making Model, which possesses a more complex structure than the aforementioned models (Cohen, March & Olsen 1972) explains that decisions are made in a non-linear and unpredictable manner (Kuwashima, 2014), uncertainty dominates the process (Fardal & Sørnes, 2008), and solutions do not derive from individual volition (Mandell, 1988). However, the practical

applications of these theories may vary across disciplines. Based on these differences, the present study examines the concept of decision-making in sport by investigating the field of sport sciences, which is regarded as a discipline where decision-making is of paramount importance.

Decision-making in sport encompasses a multifaceted process involving various stakeholders, including athletes, coaches, health professionals, and organizational leaders. However, among these stakeholders, athletes are attributed greater significance as active decision-makers, being considered the primary protagonists (Arden et al., 2016). Consequently, Çetin and Kara (2024) defined decision-making in sport as a mental process where the most appropriate choice is made by consciously considering all dynamics within sport and potential outcomes (Roca & Williams, 2017). While Scott and Bruce (1995) characterized decision-making as a learned and habitual response pattern, Alver (2003) described it as the implementation of choices based on characteristic traits. As decision-making is intrinsically linked to athletes' cognitive and behavioral processes (Deniz, 2004), it falls within the domain of sport psychology. Moreover, decision-making behavior in sport can be understood as a manifestation of an athlete's characteristic traits. Therefore, in the field of sport psychology, focus should be placed on managing weaknesses in effective decision-making processes to enhance the instantaneous decision-making abilities of practitioners and athletes—who constitute the components of sport—both before and during competition (Smith & Keegan, 2023).

The study of decision-making processes in sport has garnered increasing attention in the literature, with researchers striving to identify the dynamics that influence these processes. For instance, Waelle et al. (2021) investigated the cognitive aspects of decision-making in sport, emphasizing the role of visual cognition and

experience, particularly in young athletes. Similarly, Kara (2020) examined karate athletes and found a relationship between decision-making tendencies and individual cognitive structures. These studies highlight the impact of both internal and external factors on decision-making in sport. While general decision-making encompasses rational, reactive, and hasty elements, the context of sport appears to involve a narrower focus, with internal and external stimuli exerting a more pronounced influence. This assertion is supported by Çetin and Kara (2024), who identified two dimensions affecting athletes' decision-making behaviors: internal and external decision-making. Their research introduced the Effective Decision-Making Scale in Sport to the field of sport psychology. In essence, while autonomy and cognitive factors are common to decision-making across all disciplines, internal and external dynamics are particularly salient in the athletic context. Decision-making in sport involves a complex network of stakeholders, necessitating a nuanced approach that considers the well-being and interests of all parties. Therefore, a clear and consistent terminology is crucial to facilitate understanding and effective implementation of decision-making processes within this domain.

Grounded in the preceding discussion, this study aimed to provide researchers with guidance on relevant authors and journals when exploring decision-making in sport. To achieve this, a bibliometric analysis was conducted to analyze the evolving trends and current state of research in this domain. Bibliometric analysis involves the application of statistical methods to analyze and interpret a defined set of information within a selected timeframe (Uzun, 2022). This method allows for the identification of trends, patterns, and the impact of publications within a specific field (Yao, 2024). Furthermore, it enables the examination of knowledge carriers such as articles, journals, authors, institutions, and countries (Nichols et al., 2023), facilitating an objective evaluation of academic productivity (Barbosa et al., 2022). Decision making is a fundamental cognitive process that involves evaluating alternatives and selecting the most appropriate course of action (Kahneman & Tversky, 2013). In the context of sports, athletes' decision-making is influenced by psychological factors such as cognitive flexibility, mental fatigue, and situational pressure (Raab, 2012; Laborde et al., 2016). These factors can shape

the quality and speed of decisions, particularly under high-stakes conditions.

This study holds significance as one of the first to explore and present prevalent topics in decision-making in sport, visualizing the interconnections between key concepts. By providing a comprehensive overview of the existing literature, this research aims to assist researchers in navigating this growing field of inquiry.

METHODS

Adhering to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, a PRISMA flow diagram was generated to illustrate the systematic literature review process, which provided a transparent visual representation of the study selection process, outlining the inclusion and exclusion criteria applied (Hernández et al., 2021). Such diagrams are valuable tools in educational research for clarifying the rationale behind the selection of studies for review. The bibliometric analysis encompassed articles sourced from the Web of Science database, spanning from January 1988 to February 27, 2024. This comprehensive time frame ensures the inclusion of seminal works and contemporary research on decision-making in sport. The dataset was exported in BibTeX format to ensure compatibility with the Bibliometrix R-package

Selection Strategy and Criteria

This study employed a criterion-based purposive sampling strategy to select articles for analysis. This method, detailed in the PRISMA flowchart (Figure 1), involves establishing predetermined criteria for inclusion. Specifically, the study focused on works indexed in the WoS database with a primary focus on "Decision-Making in Sport." To maintain the study's scope and rigor, articles indexed under different subject areas were excluded. Furthermore, certain publication types were deemed outside the scope of this analysis and thus excluded. These included Booknotes, Editorial Material, Proceedings Papers, Letters, Reviews, Items About An Individual, Biographical Items, Corrections, Correction Additions, and Discussions. Data collection concluded in February 2024, resulting in a final sample of 1683 works for analysis.

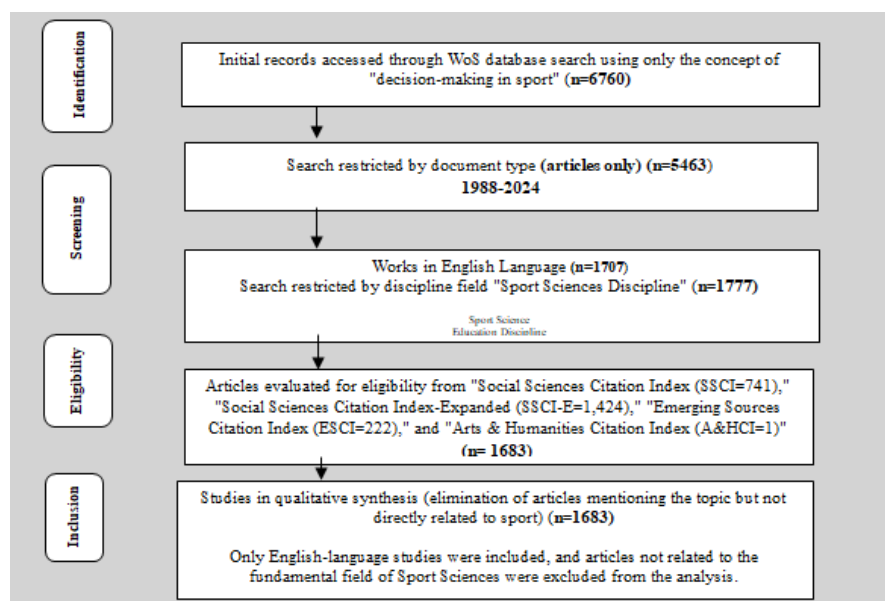


Figure 1: Prisma flow chart

The bibliometric analysis included 1683 documents retrieved from the WoS Core Collection database using the search term "decision-making in sport." Employing the principles of descriptive bibliometrics, this analysis aimed to uncover trends and patterns within this body of literature. As Thompson and Walker (2015) noted, descriptive bibliometrics utilizes mathematical and statistical methods to analyze scientific publications. In alignment with this approach, the present study examined descriptive statistics to reveal distributions and trends across various dimensions, including authorship, country of origin, publication year, and subject area. This quantitative examination, as described by Mendes et al. (2017), provided valuable insights into the publication patterns, trends, and key characteristics of the field of decision-making in sport.

Data Analysis Technique: In addition to descriptive analyses, this study employed social network analysis (SNA) to further explore the relationships within the "decision-making in sport" literature. SNA, a valuable tool in bibliometric research, offers a means of visualizing and interpreting complex relationships within scientific publications. Zanon et al. (2022) suggest that SNA can provide insights into the structure of scientific collaboration, revealing patterns and connections that may not be apparent through traditional analyses. This method allows for a deeper understanding of collaboration networks at various levels, including authors, institutions, countries, and even keywords, as highlighted by Chen et al. (2021). By examining these interconnected networks, researchers can gain a comprehensive understanding of the field's landscape and evaluate the performance of its key components (Ni et al., 2022). In this study, SNA was used to identify prominent

authors and illuminate the dynamic relationships shaping the field of decision-making in sport.

Numerous software tools are available for bibliometric analysis. However, for this study, the bibliometrix software through R was selected, as it has proven compatibility with data inclusion criteria and is highly suitable for the Biblioshiny program. The Bibliometrix R package, developed in R language (Liu et al., 2023), is specifically designed for quantitative bibliometric and scientometric research (Lee et al., 2022) and offers various functions for comprehensive science mapping analyses (Fu et al., 2022). Moreover, Bibliometrix is an open-access tool recognized for its competency in performing scientific mapping analysis of literature (Aydoğdu, 2023) and provides a range of resources for quantitative studies (Fernandez-Rodriguez & Alvarez, 2021).

The WoS database was chosen for data flow within the research scope. WoS provides information flow for bibliometric studies by offering access to significant international data sources such as the "Science Citation Index (SCI)," "Social Science Citation Index (SSCI)," and "Art & Humanities Citation Index (A&HCI)." For bibliometric studies, it provides information about works' publication dates, types, languages, and author names. Additionally, information such as countries of origin, citation counts, and keywords in the works is provided.

The research findings were examined under two main headings, with detailed analysis of the general structure and intellectual topics of decision-making in sport. The diagram and subheadings related to this examination are visualized in Figure 2.

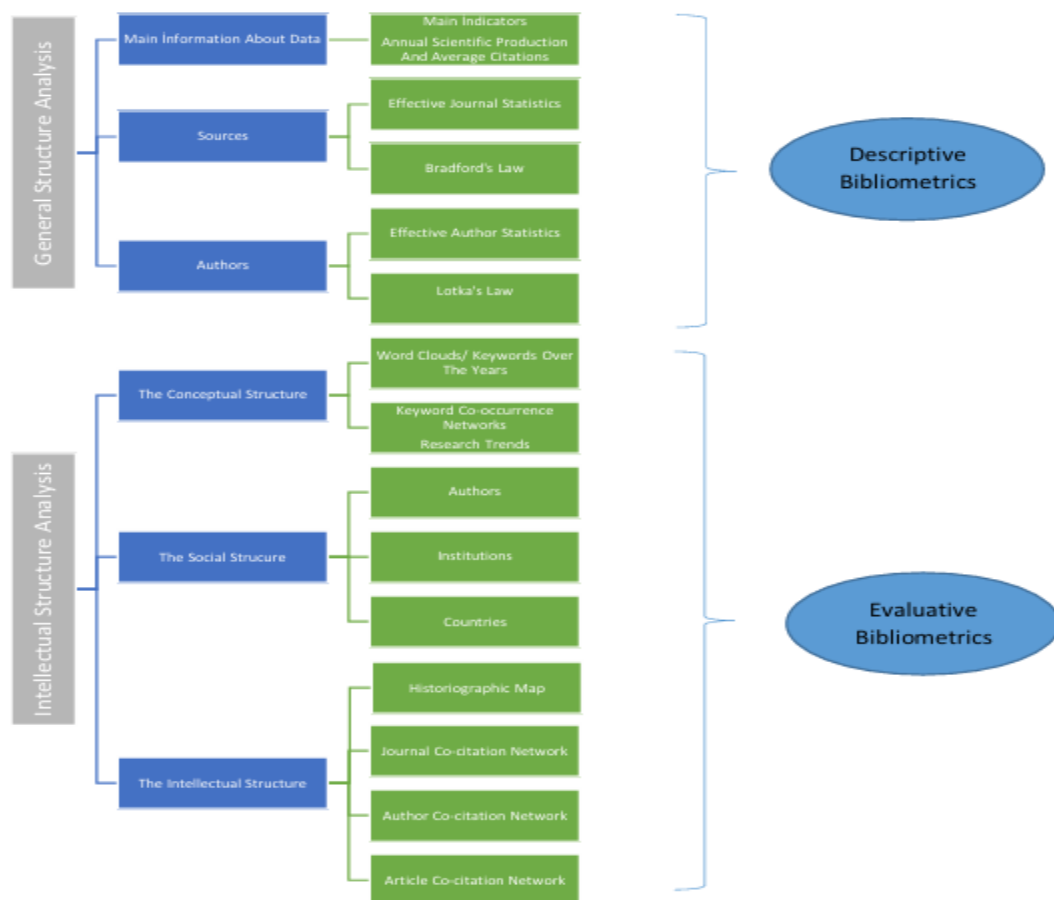


Figure 2. Data analysis flow chart (Uzun, 2022)

General Structure Analysis: The study incorporated a general structure analysis to examine fundamental bibliometric indicators related to decision-making in sport. This analysis encompassed key information such as the number of articles, sources, keywords, collaboration index, and associated mean values. Various calculations were performed to identify the most influential indicators within this corpus of literature. Bradford's Law was employed to assess the distribution of relevant publications. This principle, crucial for managing information retrieval systems and scientific knowledge, posits an unequal distribution of information within bibliographic databases (Yu et al., 2019). Bradford's Law provides a framework for understanding the concentration of information within core journals and aids in making informed decisions about journal acquisition and retention based on relevance and usage patterns. Considered a cornerstone of bibliometrics alongside Zipf's Law and Lotka's Law, Bradford's Law contributes significantly to understanding the intricacies of scientific publication and citation practices.

In analyzing authorship patterns, this study utilized Lotka's Law to calculate scientific productivity. Introduced by Lotka in 1926, this fundamental principle of scientometrics describes the distribution of productivity among authors (Zhou & Sun, 2017). Lotka's Law states that the number of authors producing a specific number of articles is inversely proportional to the square of that number. In essence, it suggests that a small proportion of authors contribute significantly to the literature, while the majority publish only a few works. This law offers researchers a quantitative estimate of potential contributions to a specific field (Yilmaz, 2006).

Intellectual Structure Analysis: This study further investigates the intellectual structure of the "decision-making in sport" literature through three distinct lenses: conceptual, social, and intellectual.

Conceptual Structure (Co-Word Analysis): Co-word analysis, a cornerstone of bibliometric research, examines the co-occurrence of keywords within a body of literature to reveal the underlying knowledge structure of a scientific field (Tonbuloglu & Akbel, 2023). This method goes beyond simple word counts; it maps the semantic relationships between terms, highlighting how different concepts are interconnected and organized within a field (John & Rajashekar, 2011). By identifying recurring word combinations and clusters, co-word analysis provides valuable insights into the conceptual landscape of a research domain (Bosshard et al., 2022). In this study, co-word analysis was employed to uncover the key concepts and themes shaping the field of decision-making in sport.

Social Network Analysis: Social network analysis (SNA) serves as a powerful tool for revealing hidden patterns, relationships, and structures in social networks, providing valuable information that can inform decision-making processes across various disciplines and applications. This methodology, as described by Rienties et al. (2009), involves the examination of social structures by analyzing relationships and interactions between social actors within a network. SNA focuses on understanding connections and patterns existing in social networks, whether at an individual

level such as personal networks or on a broader scale encompassing entire social structures. In this study, SNA was utilized to map the collaborative networks among authors, institutions, and countries engaged in research on decision-making in sport

Intellectual Structure (Co-Citation Analysis): Co-citation analysis provides a means of tracing the intellectual lineage of a field by examining patterns of co-citation among publications. This method, as noted by Özkaya (2019), identifies influential works and tracks the evolution of research themes over time. By analyzing which publications are frequently cited together, researchers can identify key turning points, emerging trends, and the overall dynamics of a field's intellectual structure. As Zhou (2022) explains, co-citation analysis relies on citation frequency as a proxy for academic impact, with higher citation counts generally indicating greater influence. Furthermore, co-citation analysis is particularly effective in revealing relationships between documents, such as identifying shared intellectual influences and common references (Habib & Afzal, 2017). This study employed co-citation analysis to identify foundational works and trace the evolution of research on decision-making in sport.

Citation analysis stands as a cornerstone of bibliometric research, providing invaluable insights into the intellectual landscape of academic disciplines. This method is instrumental in mapping the intricate relationships between publications, authors, and research topics (Hammarfelt, 2012). Within the broader domain of citation analysis, co-citation analysis focuses specifically on identifying publications that are frequently cited together. This technique operates on the premise that co-cited articles share thematic similarities, allowing researchers to uncover clusters of related works and delineate common research areas (Ghen, 2021).

Beyond mapping the intellectual structure, citation analysis plays a vital role in evaluating the impact and significance of academic publications (Karobari et al., 2021). By analyzing citation patterns, researchers can identify influential works, trace the evolution of ideas, and gain a deeper understanding of knowledge diffusion within a field. Citation analysis is often combined with other bibliometric methods, such as co-author analysis, co-citation analysis, and co-keyword analysis, to provide a more holistic and nuanced view of research trends and interrelationships (Aktürk, 2021). The applications of citation analysis extend beyond academia, proving valuable in diverse domains, such as its use in examining data sharing practices within biomedical research (Park et al., 2018).

RESULTS

This section presents the study's findings, organized under two primary headings that align with the types and analyses employed in this bibliometric investigation. The structure of this section mirrors the flowchart depicted in Figure 2, providing a clear and systematic presentation of the results.

Descriptive Bibliometrics / Analysis Findings of the General Data Structure

Basic Information

This section provides a general overview of the dataset and presents key descriptive statistics derived from the analysis of 1683 publications related to "decision-making in sport"

Table 1. Descriptive characteristics of publications on decision-making in sport (1988–2024)

Data	Results	Authors	Results
Time Interval	1988-2024	Authors	5107
Resources (articles, books, papers)	112	Author appearances	7180
Documents	1683	Single-author articles	122
Average number of publications per year	8.42	Number of authors per document	3.03
Number of citations per document	34.34	Number of documents per author	0.33
Average annual citations per document	3,002	Multiple-author articles	4995
References	47644	Collaborative Index	3.2
Key words	3163	Collaboration per article	4.27
Article	1395		
Article; early access	274		
Article; book of proceedings	14		

An initial search in the WoS database yielded 6,760 articles. After applying inclusion and exclusion criteria to ensure relevance to the research scope, a final set of 1683 articles was selected for analysis. These articles, published between 1988 and February 27, 2024, represent a 36-year period of scholarship on decision-making in sport. Key findings from the descriptive analysis are as follows: The articles garnered an average of 34.34 citations per article, indicating a moderate level of influence within the field. With an average of 0.33 articles per author, the data suggest a diverse range of contributors to the field, with relatively few authors producing a large number of publications. The articles were

retrieved from the WoS database. The analysis encompasses authorship patterns, publication trends over time, and an examination of prominent sources. Table 1 summarizes the essential bibliometric characteristics of the dataset, offering a concise snapshot of the key features of this body of literature. This foundational information serves as a basis for subsequent, more in-depth analyses.

published across 112 different sources, highlighting the multidisciplinary nature of research on decision-making in sport. While collaborative authorship is prevalent, a substantial portion of the works (122 articles) were single-authored, suggesting a mix of individual and collaborative research efforts. The analyzed articles amassed a total of 47,644 citations within the WoS database, underscoring the growing interest and scholarly engagement with this topic. Figures 3a and 3b provide a visual representation of the citation trends over time, offering further insights into the evolving impact and visibility of research on decision-making in sport.

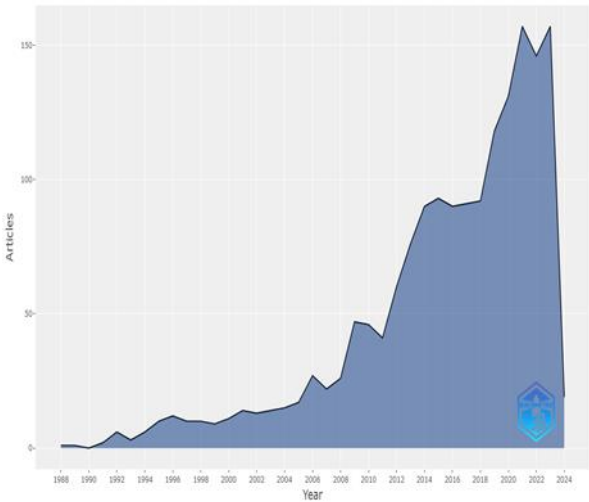


Figure 3a. Publication rates by year

Analysis of Figure 3a reveals a significant surge in publications on decision-making in sport after 2012, with a particularly rapid acceleration observed between 2011 and 2014. This period marks a significant increase in scholarly interest and output in this area. Following this initial surge, publication activity maintains a steady upward trajectory, with a further peak observed between 2018 and 2022. The years 2021 and 2023 stand out as particularly productive, with each year exceeding 150 publications, underscoring the growing prominence of this research area. These findings

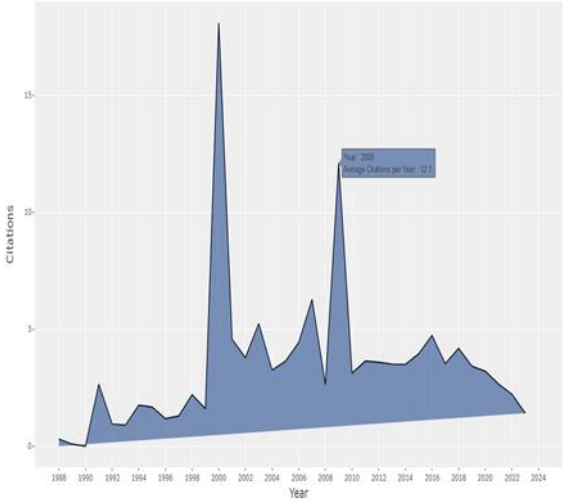


Figure 3b. Annual Average Citation Chart

collectively indicate that decision-making in sport has emerged as a popular and increasingly important topic within the broader field of sports science. Examination of Figure 3b, which depicts the average annual citations, reveals a fluctuating pattern. The highest average citation count was reached in 2000, followed by another peak in 2012. While the lowest average citation rate occurred in 1990, the overall trend demonstrates a consistent increase in citations over time. This suggests that research

on decision-making in sport is gaining traction and accumulating influence within the academic community.

Resources

Table 2 provides an overview of the most prominent publication outlets for research on decision-making in sport.

Table 2. The journals with the highest number of publications on the topic and the most cited sources (1988–2024)

Most Relevant Magazines	Articles (f)	Sources with the most citations	Citations (f)
Journal of Sports Sciences	131	Hopkins WG, 2009, MED SCI SPORT EXER	6111
Psychology of Sport and Exercise	106	Hopkins WG, 2000, SPORTS MED	3352
Journal of Athletic Training	62	Mann DTY, 2007, J SPORT EXERCISE PSY	823
International Journal of Sport Psychology	53	Harmon KG, 2013, BRIT J SPORT MED	704
Frontiers in Sports and Active Living	50	Guskiewicz KM, 2000, AM J SPORT MED	568
Journal of Sport Management	49	Swann C, 2015, PSYCOL SPORT EXERC	553
British Journal of Sport Medicine	47	Araujo D, 2006, PSYCOL SPORT EXERC	524
International Journal of Performance Analysis in	42	Guskiewicz KM, 2001, J ATHL TRAINING	523
Journal of Science and Medicine in Sport	42	Andern CL, 2016, BRIT J SPORT MED	418
American Journal of Sports Medicine	41	Maughan RJ, 2018, BRIT J SPORT MED	417
Journal of Sports & Exercise Psychology	41	Piner RA, 2011, J SPORT EXERCISE PSY	390
European Journal of Sport Science	37	Baker J, 2003, J APPL SPORT PSYCHOL	370
Knee Surgery Sports Traumatology Arthroscopy	37	De Souza MJ, 2014, BRIT J SPORT MED	350
Sports Medicine	37	Williams AM, 1998, RES Q EXERCISE SPORT	347
Clinical Journal of Sport Medicine	36	Riemann BL, 2000, J ATHL TRAINING	328
Orthopaedic Journal of Sports Medicine	36	Akenhead R, 2016, INT J SPORT PHYSIOL	324
Research Quarterly for Exercise and Sport	33	Nevill AM, 2002, PSYCHOL SPORT EXERC	320
Journal of Orthopaedic & Sports Physical Therapy	30	Williams AM, 2005, HUM MOVEMENT SCI	289
International Journal of Sports Physical Therapy	28	Knowles SB, 2006, J ATHL TRAINING	284
Human Movement Science	27	Tudor-Locke C, 2001, SPORT MED	275

An analysis of decision-making in sports literature published between 1988 and 2024 revealed that the Journal of Sports Sciences featured the highest number of articles (n=131) on this topic. This was followed by Psychology of Sport and Exercise (n=106) and the Journal of Athletic Training (n=62). Among the analyzed works, the most frequently cited sources were: Hopkins WG (2009) in Medicine and

By ranking journals based on their effectiveness, which likely considers factors such as publication frequency, citation impact, and overall influence within the field, the table offers researchers a guide to the core journals shaping this area of study.

Science in Sports and Exercise (n=6111 citations), Hopkins WG (2000) in Sports Medicine (n=3352), and Mann DTY (2007) in the Journal of Sport and Exercise Psychology (n=823). Figure 4 presents a graphical representation of the distribution of journals related to decision-making in sports, in accordance with Bradford's law.

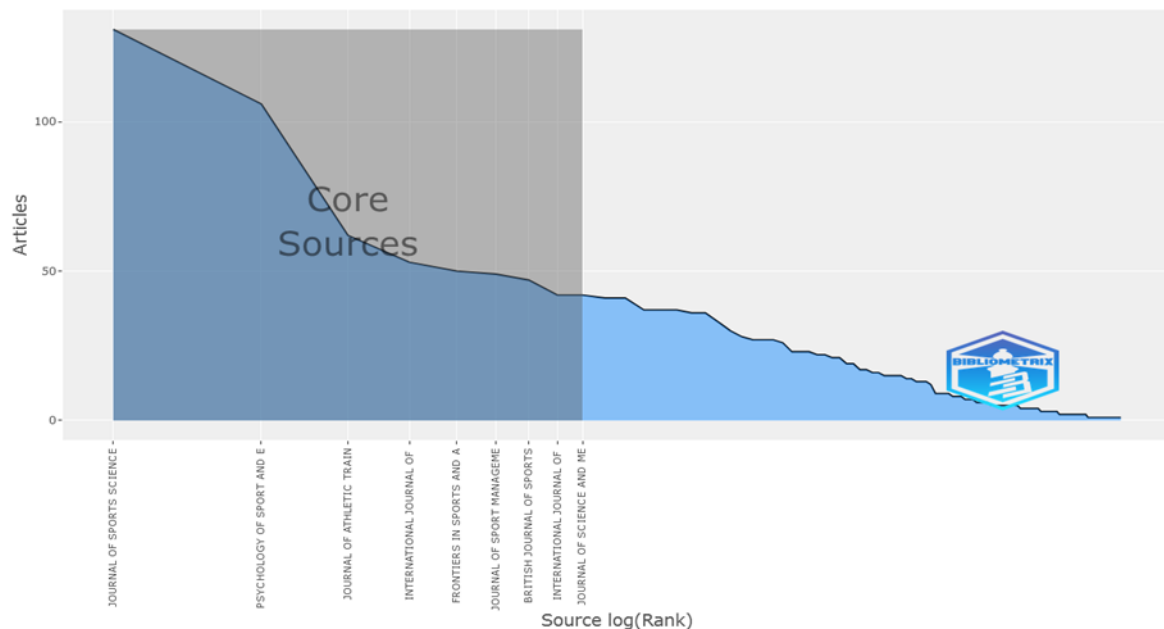


Figure 4. Bradford's law

Bradford's law, a bibliometric principle, describes the distribution of literature on a given topic across academic journals. This law posits that when journals are grouped according to the number of articles they publish on a topic,

productivity decreases as one moves from the core group to subsequent groups. This suggests that a small number of journals contain a disproportionately large amount of relevant research within a specific field. Consequently,

examining journals beyond this core group yields exponentially diminishing returns in terms of relevant articles (Bennett, 2016). In the present analysis of decision-making in sports, The Journal of Sports Sciences constitutes the largest share of the core group of journals, followed by Psychology of Sport and Exercise and the Journal of Athletic Training. This ranking of core journals aligns with

the data presented in Table 2, which highlights the journals with the highest publication counts on this topic.

Authors

The charts illustrating the number of articles produced by authors during the analysis period and their respective h-indices are presented below in Figures 5a and 5b.

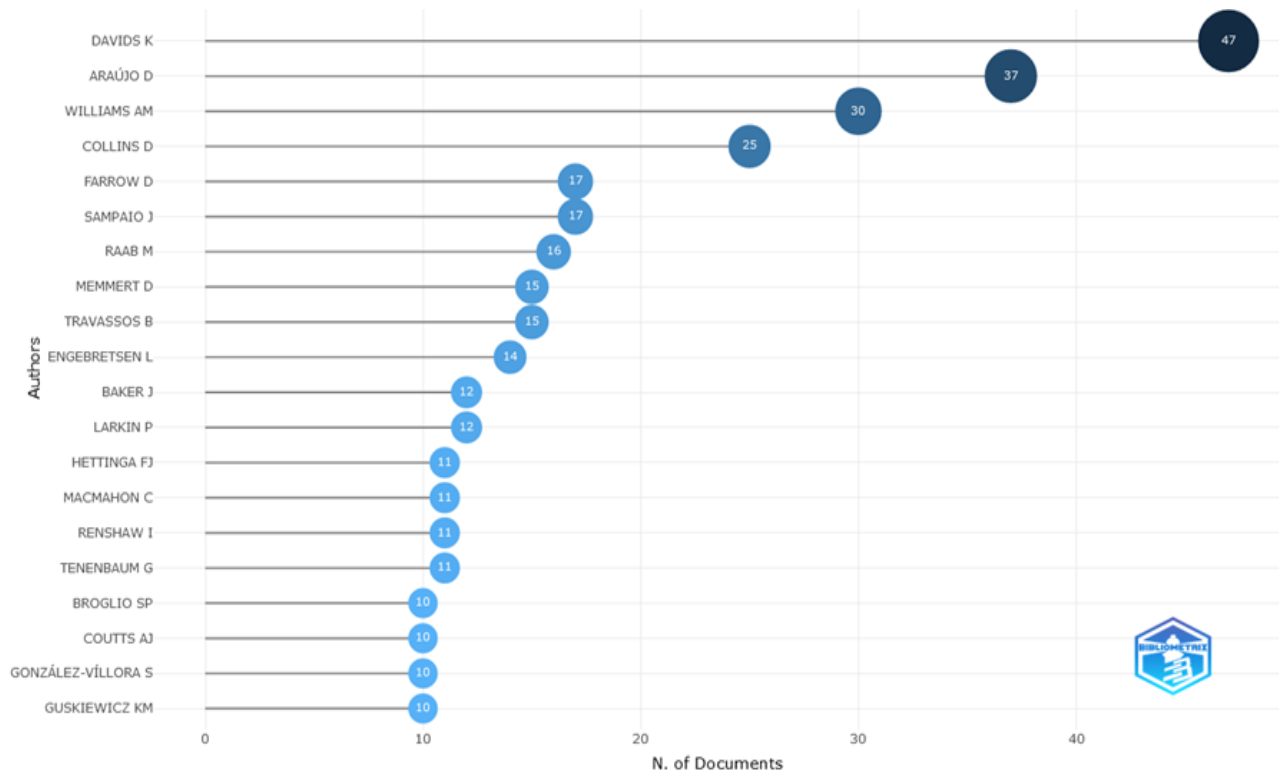


Figure 5a. The production of articles by author over time

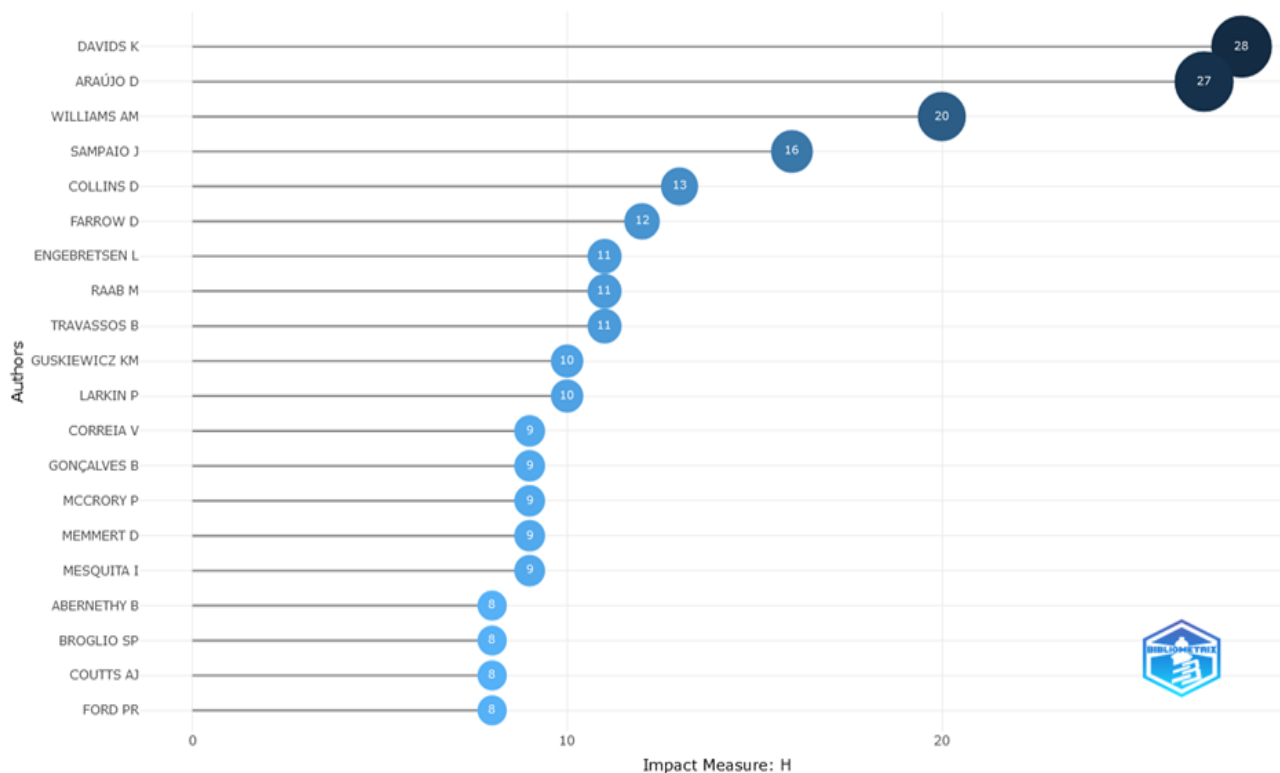


Figure 5b. H-index by author

Among the authors with publications on the theme of decision-making in sports, the most prolific author is Davids K. ($n=47$), followed by Araujo D. ($n=37$) and Williams AM. ($n=30$). In the h-index analysis presented in Figure 5b, Davids K. also had the highest index value (h-index = 28), followed by Araujo D. (h-index = 27) and Williams AM. (h-index = 20). The h-index is widely used in academia as a metric to evaluate the productivity and impact of a researcher's output. It reflects the number of papers (h)

authored by an individual that have received at least h citations each, while the remaining papers have fewer than h citations (Egghe & Rao, 2008). Based on these findings, it is suggested that researchers consider the work of these noted authors. Another relevant aspect is the scientific productivity of the authors. In this context, the productivity of the authors, evaluated using Lotka's law, is depicted in the graph presented in Figure 6.

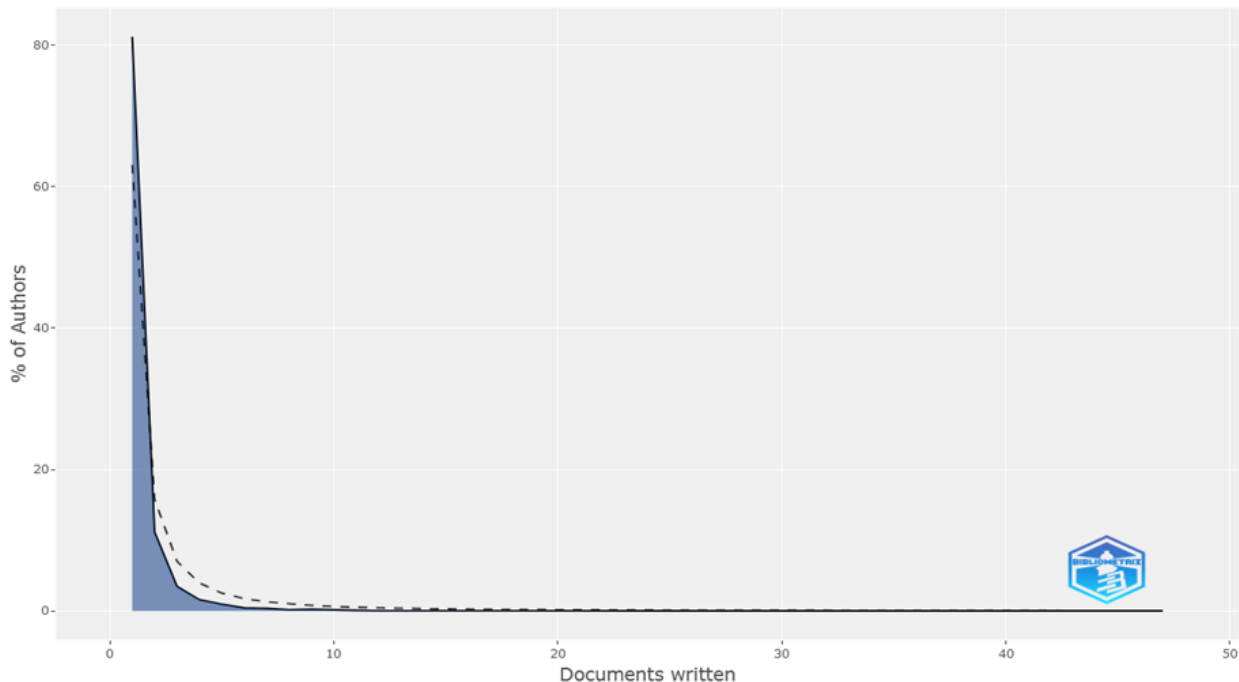


Figure 6. Lotka's law, scientific productivity of authors

Analysis of author productivity in the field of decision-making in sports, as depicted in Figure 6, reveals a considerable trend. Applying Lotka's law, a bibliometric principle used to assess research visibility, it is evident that the majority of authors (81.2%, $n=1366$) have contributed only one publication to this domain. Authors with two publications comprise 11.2% ($n=188$) of the total, while those with three represent 3.5% ($n=59$). The remaining 75 authors account for those with four to six publications. This distribution aligns with Lotka's law, which posits that a small proportion of authors generate the majority of publications within a field, while most contribute minimally. While Chung and Cox (1990) suggested that approximately 60% of authors in a field should have a single publication, the current analysis reveals a higher proportion (81.2%) in the domain of decision-making in sports. This finding underscores a potential need for increased specialization within this area of research. To foster further development and advancement in the study of decision-making in sports,

encouraging greater author specialization is crucial. Increased commitment to this field, as evidenced by a higher number of publications per author, could potentially lead to enhanced scientific collaboration, knowledge generation, and innovation.

Evaluative Bibliometrics / Findings of Intellectual Structure Analysis of Data

This study examines the intellectual structure of the research on decision-making in sport through a bibliometric analysis. The findings are presented in three sections: conceptual, social, and intellectual structure analyses. Intellectual structure analysis aims to map and understand the organization and relationships within a field of study. This is achieved through various techniques, including co-citation analysis, author co-citation analysis, bibliographic link analysis, and keyword analysis. These methods help to identify influential works, delineate the intellectual landscape of the field, and visualize the relationships between different concepts and authors (Nerur et al., 2007).

Conceptual Structure

The conceptual structure of the research on decision-making in sports was examined through keyword analysis. This involved identifying the most frequently used keywords from 1683 publications to reveal the prevalent research topics within this field and their evolution over time. This



Figure 7a. Keyword visualization

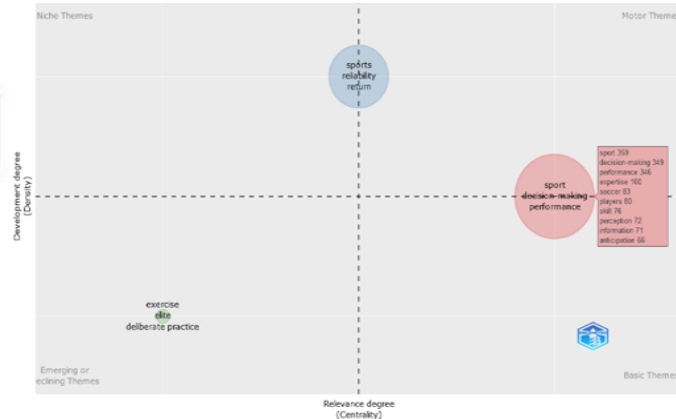


Figure 7b. Thematic map, quadrants

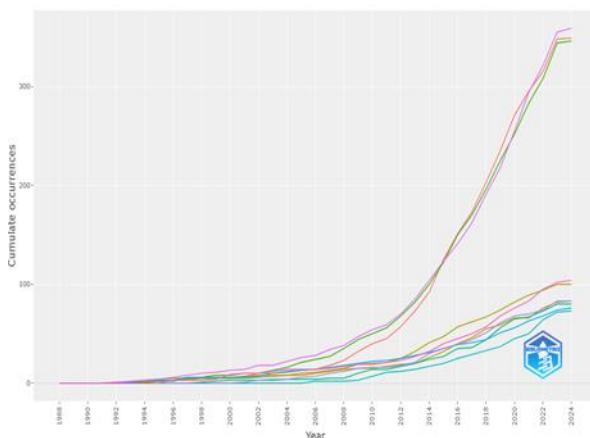


Figure 7c. Word growth

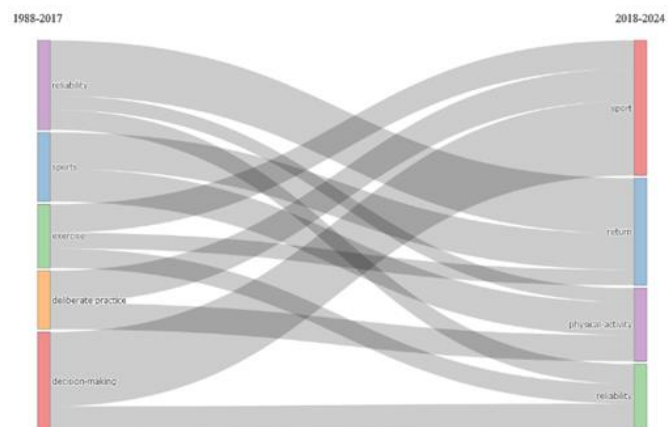


Figure 7d. Thematic evolution

Figure 7d illustrates the evolution of prominent keywords over distinct time intervals. From 1988 to 2017, "reliability" was the most frequently used keyword, followed by "sports," "exercise," and "deliberate practice." However, between 2018 and 2024, "sports" emerged as the most prominent, followed by "return," "physical activity," and "reliability." Figure 7b presents a strategic diagram that maps keywords based on their centrality (x-axis) and density (y-axis). This visualization highlights the importance and development of various themes within the field of decision-making in sports. The upper right quadrant represents "motor themes," indicating emerging and evolving concepts. As depicted, "sports," "performance," and "decision-making" occupy this quadrant, suggesting their growing

significance and interconnectedness within the field. This observation is supported by the high internal consistency and strong relationships observed among these themes. Conversely, the lower right quadrant represents established "main themes" within the field, which, in this case, also include "sports," "performance," and "decision-making." The upper left quadrant highlights "marginal themes" such as "sports," "reliability," and "return," indicating their moderate importance and peripheral role. Finally, the lower left quadrant identifies "weakly developed and marginal themes" like "exercise," "elite," and "deliberate," suggesting their limited influence and development within the current research landscape.

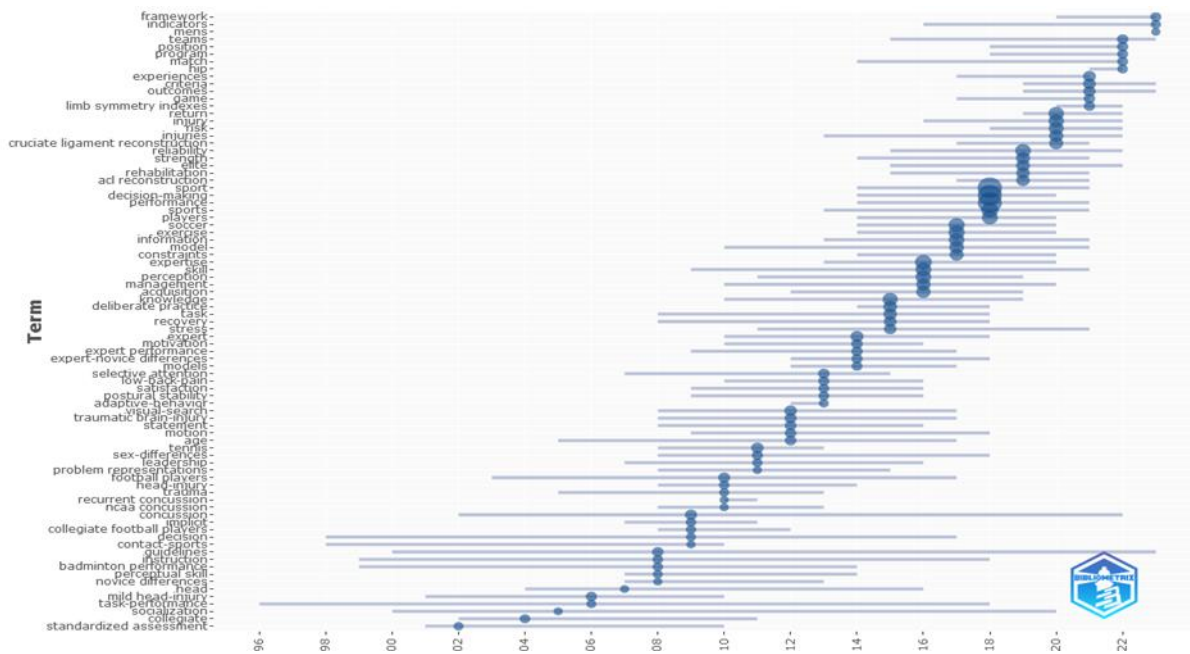


Figure 8. Trending topics by year

Figure 8 provides a visualization of the evolving conceptual structure within the field of decision-making in sport over the past 28 years. Analysis of this figure reveals a peak in research intensity in 2018, with a focus on themes such as "rehabilitation," "reconstruction," "sports," "decision-making," "performance," "players," and "soccer."

Social Structure

The social structure of research collaboration in decision-making in sport is visualized in Figure 9, which depicts a country collaboration map. In this map, thicker lines indicate stronger collaborative relationships and strong connections are evident among the United States, Canada, and European countries, thus suggesting robust research partnerships and cooperative efforts within these regions.



Figure 9. Country collaboration map

Figure 9 illustrates the international collaboration network within the field of decision-making in sports. As the figure demonstrates, international partnerships are prevalent in this research area. The United Kingdom exhibits a high degree of collaborative activity, engaging with numerous countries across the globe. The most prominent collaborative

United Kingdom	Australia	56
USA	Canada	49
USA	United Kingdom	45
United Kingdom	Germany	35
USA	Australia	32
United Kingdom	Ireland	29
Australia	Canada	28
United Kingdom	Portugal	27
United Kingdom	Canada	26
Australia	Portugal	23
USA	Germany	22
United Kingdom	Netherlands	19
USA	Spain	18

partnerships, as evidenced by the number of joint publications, are the United Kingdom and Australia with 56 collaborations, the United States and Canada with 49 collaborations, and the United States and United Kingdom with 45 collaborations.

Intellectual Structure

Co-citation analysis offers a valuable and impartial approach to evaluating the intellectual structure of research on decision-making in sports. This technique, widely employed in bibliometric studies for knowledge domain analysis and science mapping (Chen, 2016), provides insights into the relationships between documents, authors, and sources (Benckendorff, 2009). We can identify influential journals,

authors, and publications within the field through in-depth analysis of co-citation networks. Figure 10 presents a visualization of these connections, incorporating a historical dimension to illustrate the evolution of research in decision-making in sports. This visualization highlights key authors and their works, offering a comprehensive overview of their contributions and illuminating the intellectual foundations of this research domain.

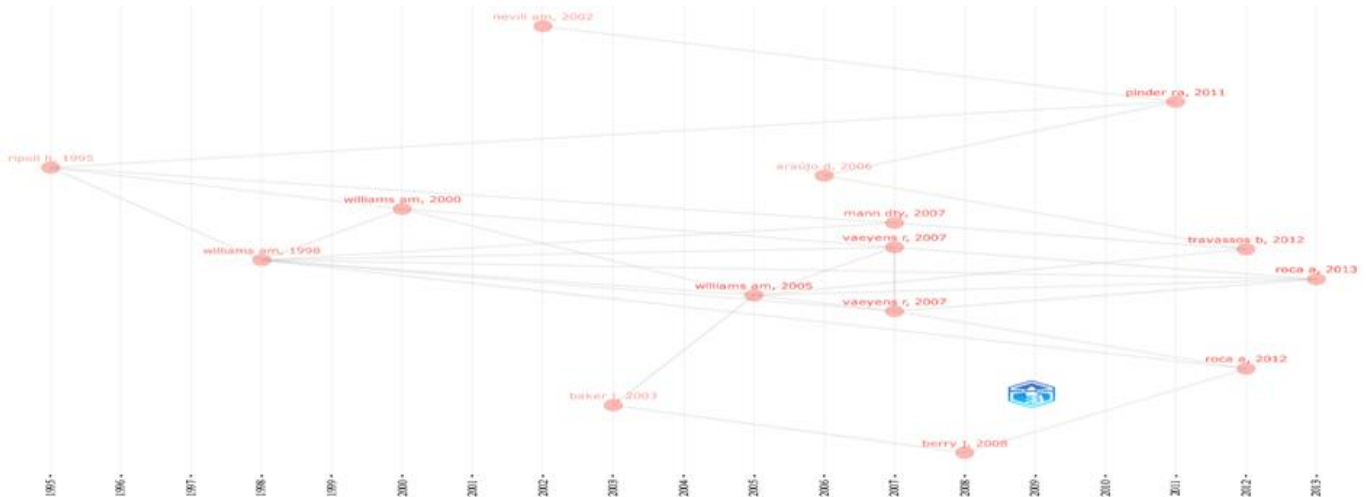


Figure 10. Historical direct citation networks by author names

Analysis of Figure 10 clearly shows that there is a single clustering in direct citation networks. It can be stated that in

the 29-year period covering the years 1995-2024, the clustering is concentrated around AM Williams

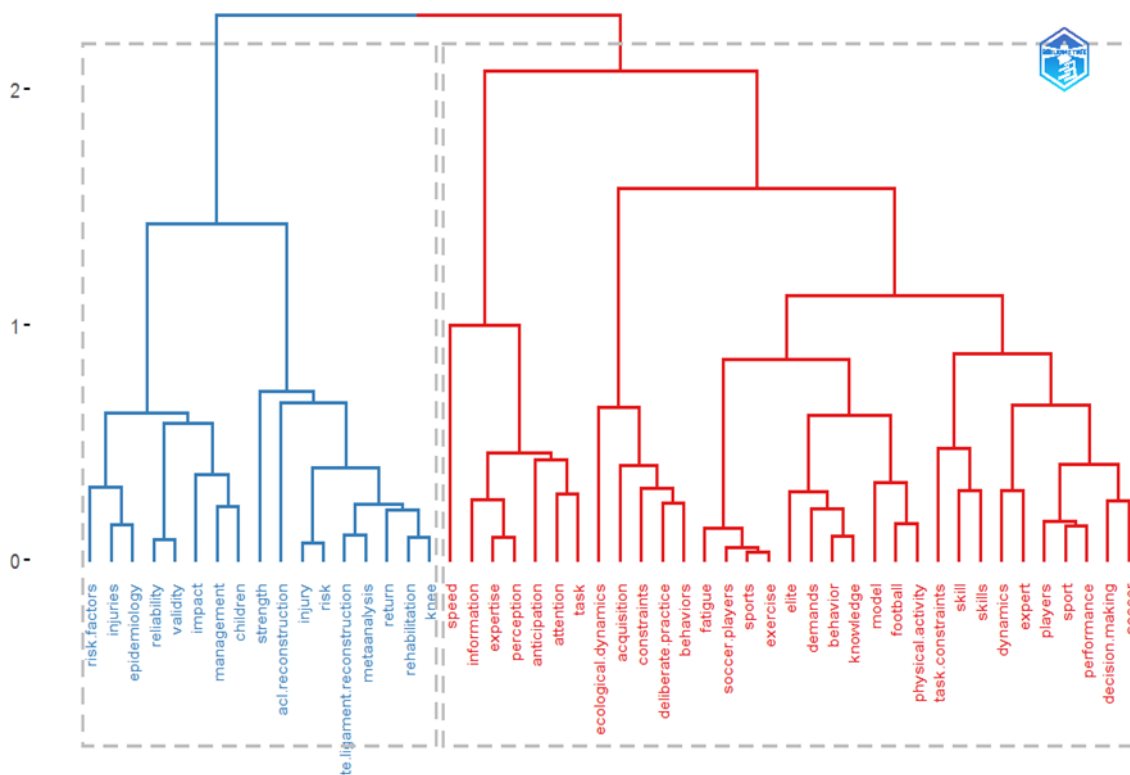


Figure 11. Keyword dendrogram

Analysis of the keyword dendrogram in Figure 11 reveals two distinct clusters within the research on decision-making in sports. The first cluster (represented in red) encompasses

themes related to the performance and execution of sports skills, including keywords such as "speed," "behaviors," "sports," "exercise," "model," "skills," and "decision-

making." The second cluster (represented in blue) focuses on methodological and health-related aspects, with prominent keywords like "epidemiology," "reliability," "validity," "children," "risk," and "rehabilitation."

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

This study employed bibliometric analysis, a quantitative method, to examine the current state and developmental trends in research on decision-making in sport. To provide a comprehensive overview, the analysis incorporated both quantitative and qualitative approaches. Data were retrieved from the WoS database, encompassing 1683 articles published between 1988 and February 2024. The analysis was conducted using the R programming language and the Biblioshiny interface.

The retrieved data revealed that research on decision-making in sport, spanning the fields of physical education, sport science, and sport psychology, comprises 1683 articles published in 112 journals by 5107 authors between 1988 and 2024. The average annual article production is 8.42, with an average of 3.002 citations per document and 34.34 citations per article. Of particular note, 122 studies were single-authored, indicating a predominance of collaborative authorship in this field. Analysis of publication trends reveals a general increase in article production over time, with dramatic peaks between 2011-2014 and 2018-2022. Peak citation rates were observed in 2000 and 2009. These findings highlight the need for continued growth in both the quantity and quality of research on decision-making in sport. These findings also provide practical implications for coaches, sport psychologists, and administrators seeking to enhance athletes' decision-making skills.

The results of the journal ranking on decision-making in sport revealed that the Journal of Sports Sciences (131 articles) and Psychology of Sport and Exercise (106 articles) were the most prolific journals in this field, while Davids K. was found to be the most productive author with 47 articles and an h-index of 28.

Keyword analysis revealed shifts in research focus over time. Between 1988 and 2017, the most frequent keywords were "decision-making" and "reliability," followed by "sports," "exercise," and "deliberate practice." Between 2018 and 2024, the dominant keywords shifted to "sports," "return," "physical activity," and "reliability." This shift aligns with recent research emphasizing the multifaceted nature of decision-making in sport (Hepler & Feltz 2012; Lastella et al., 2020), encompassing cognitive, psychological, and physical factors. Studies have highlighted the role of decision-making self-efficacy (Hepler & Feltz, 2012), the ability to make decisions under pressure (Roca & Williams, 2017), and the influence of mental endurance (Gürer et al., 2019), experience (Waelle et al., 2021), and sleep quality (Lastella et al., 2020) on athletes'

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- decision-making skills. Furthermore, the increasing prominence of "return" reflects the growing interest in return-to-play decision-making processes, which involve assessing physical and psychological readiness and implementing structured rehabilitation programs (Mayer et al., 2020; Fontánez et al., 2023).
- Analysis of international collaborations revealed a high degree of inter-country research partnerships, with the United Kingdom as the most active collaborator. The most frequent collaborations were between the United Kingdom and Australia (56 collaborations), the United States and Canada (49 collaborations), and the United States and the United Kingdom (45 collaborations). "Victoria University of Wellington" (53 publications) and "German Sport University Cologne" (46 publications) were the most productive institutions. It is important to acknowledge that these findings are based on data from a single database (WoS), which may represent a limitation of this study.
- The study provides a comprehensive bibliometric analysis of decision-making in sport research indexed in the Web of Science database. To further advance this field of inquiry, several recommendations for future research are offered. First, replicating this study using other databases, such as Scopus or PubMed, would allow for cross-database comparisons and a more comprehensive understanding of the research landscape. This could reveal potential database-specific biases and provide a more robust overview of the field. Second, exploring alternative bibliometric analysis tools, such as VOSviewer and CiteSpace, could offer complementary perspectives on the intellectual structure and research trends in decision-making in sport. Each tool employs unique algorithms and visualization techniques, potentially uncovering nuanced patterns and relationships within the literature. Third, expanding the scope of analysis beyond journal articles to include conference papers, books, book chapters, and research projects would provide a richer and more nuanced understanding of the field. This broader perspective could reveal influential works and research trends not captured in a solely article-based analysis. Finally, future research should continue to employ mixed-methods approaches, combining quantitative bibliometric analyses with qualitative interpretations. This integrated approach can provide a deeper understanding of the factors driving research trends, the evolution of key concepts, and the impact of influential works in the field of decision-making in sport. By understanding the key trends and influential works in this domain, sport professionals can align their practices with scientifically grounded approaches to decision-making.
- Ethics Statement:** In this article, the research process was conducted in accordance with the journal's writing guidelines, publication principles, research and publication ethics, and ethical standards of the journal. The author bears full responsibility for any potential violations related to the article.
- Conflict of Interest:** There is no personal or financial conflict of interest between the authors in the present study.

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GENİŞLETİLMİŞ ÖZET

Giriş

Karar verme, bireylerin çeşitli seçenekler arasında bilinçli tercihlerde bulunduğu ve kişisel değerlerle şekillenen çok boyutlu bir süreçtir (Koçoğlu, 2010; Papamichail & Robertson, 2003). Sporda bu süreç; sporcu, antrenör ve sağlık profesyoneli gibi birçok paydaşı kapsamakla birlikte, en belirleyici aktörler sporculardır (Ardern et al., 2016). Sporda karar verme, bilişsel yapılarla doğrudan ilişkili olup

spor psikolojisinin önemli bir araştırma alanıdır (Deniz, 2004). Çetin ve Kara (2024), sporda karar verme davranışını, tüm spor dinamikleri dikkate alınarak yapılan bilinçli seçimler olarak tanımlamış ve bu alana Sporda Etkili Karar Verme Ölçeği'ni kazandırmıştır. Ayrıca, literatürde karar verme süreçlerini etkileyen içsel (motivasyon, dikkat, deneyim) ve dışsal (koç yönlendirmesi, çevresel baskılar) faktörler öne çıkmaktadır (Waelle et al., 2021; Kara, 2020;

Smith & Keegan, 2023). Bu bağlamda, karar verme kavramının spora özgü değişkenlerle bütüncül biçimde ele alınması, hem uygulayıcılar hem de araştırmacılar için giderek daha kritik hale gelmiştir. Bu gereklilik doğrultusunda, mevcut çalışma spor alanındaki karar verme literatürünü sistematik bir biçimde analiz etmeyi amaçlamaktadır.

Çalışmanın Amacı

Bu çalışma, sporda karar verme konusundaki bilimsel yayınların eğilimlerini, temel yapılarını ve entelektüel gelişimini bibliyometrik yöntemlerle analiz ederek araştırmacılara yol gösterici bilgiler sunmayı amaçlamaktadır.

Araştırma Problemleri

Çalışma şu sorulara odaklanmaktadır: 1) Yayınların yıllara göre dağılımı nasıldır? 2) En üretken yazar, kurum ve ülkeler kimlerdir? 3) En çok yayın yapan ve atıf alan dergiler hangileridir? 4) Öne çıkan anahtar kelimeler ve temalar nelerdir? 5) Literatürdeki işbirlikleri ve entelektüel kümelenmeler nasıl bir yapıdadır?

Yöntem

Web of Science veri tabanında 1988–2024 arası yayımlanan 1683 makale analiz edilmiştir. PRISMA protokolü uygulanmış, yalnızca spor bilimleri alanındaki İngilizce makaleler dâhil edilmiştir. Analizler Biblioshiny (R) ile yürütülmüş, betimsel istatistikler ve sosyal ağ analizleri gerçekleştirilmiştir (Zanon et al., 2022).

Sonuç ve Değerlendirme

Çalışma, 2011 sonrası yayınlarda artış olduğunu, Davids K.'nin en üretken yazar olduğunu ve temel temaların 'karar verme', 'performans' ve 'spor' olduğunu ortaya koymuştur. İngiltere en aktif işbirlikçi ülke olurken, Victoria University en üretken kurumdur. Sonuçlar, alandaki gelişim eğilimlerini ve araştırma boşluklarını ortaya koyarak literatüre önemli katkılar sunmaktadır.