MAPPING THE FUTURE OF PUBLIC SECURITY, JUSTICE AND THE LAW ENFORCEMENT: A BIBLIOMETRIC PERSPECTIVE ON PROSPECTIVE ANALYSIS

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Abstract: This article presents a thorough analysis of the evolution and future prospects in the field of public security, employing both bibliometric and prospective methods. The bibliometric analysis examines the historical development of research up to 2023, identifying patterns, main areas of study, and influential authors. This deep understanding of the past lays the groundwork for prospective analysis, which uses foresight methods to predict possible scenarios and emerging trends in public security. By combining these approaches, the study offers a comprehensive view of the past and future dynamics of the field. The results of the bibliometric analysis provide a solid understanding of the foundations upon which future research can be built. Through prospective analysis, the article explores potential future directions, critical challenges, and opportunities in the realm of public security.

Keywords: public security; foresight; bibliometric analysis; justice; criminal.

INTRODUCTION

In the dynamic landscape of public security, it is essential to anticipate challenges and identify opportunities to develop effective strategies. This article discusses the critical role of Foresight Analysis in this context, exploring its evolution and contributions to the literature. The research problem centers on understanding how Foresight Analysis can inform and

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shape responses to contemporary challenges in public security, justice, and law enforcement.

Foresight Analysis is presented as an indispensable tool for mapping the future of this dynamic field. The study aims to explore the intersection between foresight analysis and the bibliometric understanding of the topic's history. In a global environment where public security faces various complexities, understanding the past and anticipating the future are vital for formulating robust and adaptable strategies.

The existing literature on foresight analysis in public security lays a solid theoretical foundation, highlighting the importance of anticipating emerging trends and challenges. Michel Godet[1] notably emphasizes the necessity for forward-looking strategies that go beyond traditional reactive approaches. Integrating these insights with bibliometric analysis enables us not only to comprehend the current state of knowledge on the subject but also to identify research gaps and patterns over time.

Inspired by Tyler's[2] definition of foresight analysis as an "assessment of learning," this study seeks to understand the future of public security and learn from the past. It aims to conduct a comprehensive bibliometric analysis, tracing the evolution of discussions on public security in recent years, thus laying a solid foundation for subsequent foresight analysis.

Foresight analysis emphasizes a systematic understanding of the future, coupled with the future vision offered by bibliometric analysis, enabling us not just to predict possible scenarios but also to contextualize these projections within a historical framework.

Chermack[3] underscores the value of prospective scenarios in exploring possible, probable, and preferable futures, making it an invaluable tool for leaders and researchers in public security.

By merging foresight analysis with a bibliometric approach, this study seeks to provide a comprehensive and integrated view of the past, present, and future of public security.

This approach not only enhances our understanding of the field but also offers practical guidance for those involved in policy formulation, research, and practice in public security. This integrated perspective highlights the importance of learning from the past while strategically anticipating the dynamic future of public security.

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[1] Godet, M. (2006). *Creating Futures*: Scenario Planning as a Strategic Management Tool. Economica.

[2] Tyler, R. (1975). Foresight: Its Models and Methods. *Futures*, 7(2), 110–133.

[3] Chermack, T. J. (2011). *Scenario Planning in Organizations*: How to Create, Use, and Assess Scenarios. Berrett-Koehler Publishers.

I. LITERATURE REVIEW

Bibliometric analysis, as a systematic method for quantifying and evaluating scientific production, is crucial in identifying trends within a specific field of study. Such studies are vital for grasping the evolution of knowledge and pinpointing the most significant areas. Authors like White and McCain[4] underscore the value of this approach, offering a comprehensive overview of contributions, connections, and gaps in a particular field.

Beyond providing a historical retrospective, the integration of foresight, or prospective analysis, is essential for envisioning the future within the realm of public security. Authors such as Georghiou and Keenan[5] argue that foresight not only predicts potential scenarios but also shapes the direction of scientific, technological, and social development. Foresight analysis facilitates a forward-looking understanding, enabling the creation of more effective strategies in line with upcoming trends.

The employment of prospective scenarios is recognized as an effective method for exploring possible, probable, and preferable futures in public security. Authors like Godet[6] illustrate the practical use of foresight methods in public security, highlighting the necessity of anticipation and strategic planning amid emerging complexities.

The literature points to various emerging trends and challenges in public security, such as rapid technological evolution, globalization, and shifts in criminal patterns. Prospective analysis deepens the understanding of these factors and their possible effects on the future.

In the sphere of public security, incorporating technological trends is critical for a comprehensive view of the future. As noted by Molas-Gallart and Castro-Martínez[7], swift technological advancement not only transforms traditional methods but also introduces new challenges and opportunities. Integrating the analysis of technological trends with bibliometric analysis and foresight offers a holistic perspective that goes beyond the present, preparing for future challenges.

Therefore, the reviewed literature emphasizes that utilizing prospective scenarios is an effective way to explore possible, probable, and preferable

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[4] White, H. D., & McCain, K. W. (1998). Visualizing a discipline: An author co-citation analysis of information science, 1972-1995. *Journal of the American Society for Information Science*, 49(4), 327-355.

[5] Georghiou, L., & Keenan, M. (2006). Evaluation of foresight work: Practical aspects and operational experiences. *Technological Forecasting and Social Change*, 73(5), 464-482.

[6] Godet, M. (2006). *Creating Futures*: Scenario Planning as a Strategic Management Tool. Economica.

[7] Molas-Gallart, J., & Castro-Martínez, E. (2007). Tensions in public research policy: Challenges for the diffusion of knowledge. *Research Policy*, 36(5), 723-735.

futures in public security[8]. The synergy of these methodologies—bibliometric analysis, foresight, and technological trends—enhances the understanding of developments in public security and facilitates the development of more effective and adaptable future strategies.

II. METHODOLOGY

The methodology of this work is organized into two sections: data collection and analysis, and research refinement.

Data collection was conducted through a search on the Scopus database, using the search expression: (("judiciary" OR "*judiciário*" OR "justice system" OR "*sistema de justiça*" OR "criminal justice" OR "*justiça criminal*" OR "*crime*" OR "*prevenção de crimes*" OR "law enforcement" OR "*aplicação da lei*" OR "national security" OR "*segurança nacional*" OR "public security" OR "*segurança pública*" OR "security information" OR "*segurança da infromação*") AND ("foresight" OR "*previsão*" OR "Scenario planning" OR "*planejamento por cenários*" OR "prospective analysis" OR "*análise prospectiva*" OR "future studies" OR "*Estudo de futuros*" OR "*Futurista*" OR "futurist")).

The search expression, highlighting terms in Portuguese and English, demonstrates an inclusive approach, considering different linguistic nuances. Including terms such as "judiciary," "justice system," "criminal justice," "law enforcement," "public security," and others ensures that a broad range of publications related to public security is covered. Simultaneously, terms associated with prospective analysis, such as "foresight," "scenario planning," and "prospective analysis," contribute to the specific focus of the research.

The obtained results totaled 895 references, covering the entire time period, and were refined based on criteria such as the English language, scientific articles, review articles, conference papers, resulting in a total of 847 documents, including articles from 2000 to 2023. Metadata was exported in CSV format for analysis, following approaches suggested by Moresi, Pinho, and Costa[9], and imported into data visualization tools such as Gephi[10],

[8] Chermack, T. J. (2011). *Scenario Planning in Organizations*: How to Create, Use, and Assess Scenarios. Berrett-Koehler Publishers.

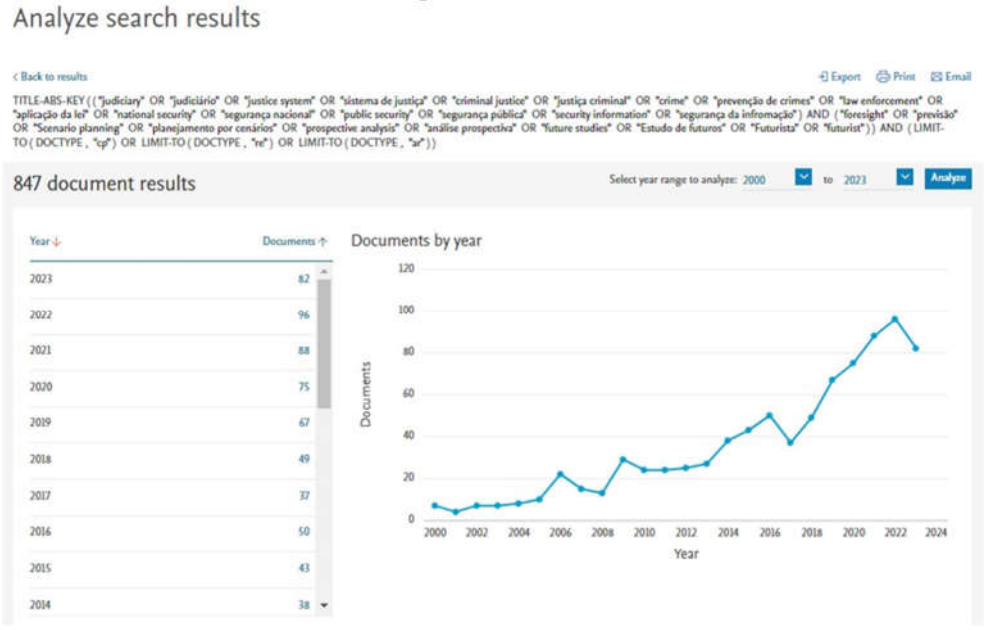
[9] Moresi, E. A. D., & Pinho, I. (2021). Proposta de abordagem para refinamento de pesquisa bibliográfica. *New Trends in Qualitative Research*, 9, 11–20. https://doi.org/10.36367/ntqr.9.2021.11-20

[10] Gephi is an open-source software platform that enables the visualization and analysis of complex networks. It is commonly used in bibliometric research to visually represent co-authorship networks, citations, among others. Cfr. Bastian, M., Heymann, S., & Jacomy, M. (2009). *Gephi*: An open source software for exploring and manipulating networks.

VOSViewer[11], and Bibliometrix[12].

The research results reveal a growing interest in the area over the years, reflected in the increasing number of articles published on the topic, as shown in Figure 1.

Figure 1 – Scopus Database Search
Publications per Year (2000 to 2023)



Source: Scopus Data. Compiled by the authors.

After the initial data collection and analysis, a refinement of the references was carried out to identify the most relevant studies to deepen the understanding of the subject. When exploring the most cited bibliographic references, a variety of essential topics for prospective analysis in the context of mapping the future of public security become apparent. Notably, the work of Gottfredson and Hirschi[13], "A General Theory of Crime," stands out as one of the most influential references, notable for its comprehensive theoretical

[11] VOSviewer is a network visualization tool commonly employed for the analysis and visual representation of terms, authorships, and co-occurrences within bibliometric datasets.

[12] Bibliometrix is a software tool for bibliometric analysis within the R statistical programming environment. It is employed to assess academic output, citation patterns, co-authorship networks, and other metrics related to scientific research. Cfr. Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, 11(4), 959-975.

[13] Gottfredson, M. R., & Hirschi, T. (1990). *A General Theory of Crime*. Stanford University Press.

approach to the underlying factors of criminal behavior. This theory can provide possibilities for anticipating challenges in public security, addressing the deeper roots of criminality.

Another significant work is the article by Sampson, Raudenbush, and Earls[14], "Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy," which explores the relationship between environmental characteristics and violent crimes. This research is crucial for scenario planning, as it offers an in-depth understanding of how contextual factors impact collective effectiveness in crime prevention. By integrating these fundamental references into prospective analyses, it is possible to enrich public security strategies by anticipating social, economic, and cultural dynamics that may influence crime rates[15].

Furthermore, the work of Braun and Clarke[16], "Using Thematic Analysis in Psychology," provides a valuable method for the qualitative analysis of data, something crucial when considering multidisciplinary perspectives in prospective analysis. By applying thematic analysis, researchers can understand nuances in public perceptions of security and justice, improving the sensitivity of prospective strategies.

This methodology can be applied to understand public perceptions of security and justice, enriching the analysis of qualitative metrics used in evaluating the effectiveness of security strategies. By integrating these references into bibliometric analysis, the goal is to provide a more holistic and informed approach to the future of public security, considering both theoretical and practical aspects[17].

III. BIBLIOMETRIC RESEARCH RESULTS

The bibliometric research conducted through a search in the Scopus database was pivotal in mapping the main trends and approaches within the field of public security. Utilizing advanced data analysis tools such as VOSViewer, Bibliometrix, and Gephi enabled a comprehensive visualization of the co-occurrence structure of terms within the articles, as discussed by

[14] Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy. *Science*, 277(5328), 918-924.

[15] Gottfredson, M. R., & Hirschi, T. (1990). *A General Theory of Crime*. Stanford University Press.

[16] Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101.

[17] Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101.

Aria and Cuccurullo[18] and van Eck and Waltman[19]. These tools facilitated the identification of the primary topics and research areas related to public security, thereby contributing to an enhanced understanding of the knowledge dynamics within this field.

The use of Bibliometrix allowed for more sophisticated analyses, including the generation of keyword clouds, identification of trending topics, creation of thematic maps, and factorial analysis for clustering articles. According to Aria and Cuccurullo[20] and van Eck and Waltman[21], this multidimensional approach provides significant insights into the conceptual structure of research in public security. The exploration of article clusters enabled a synthesis of results, underscoring the main trends and approaches within each cluster.

The analysis revealed a diversity of themes, mirroring the complexity and breadth of public security. Each cluster represented a collection of studies with similar characteristics and themes, offering a comprehensive overview of the most pertinent research areas and scientific advancements. Supported by the analyses of Aria and Cuccurullo[22] and van Eck and Waltman[23], this method provided valuable insights into the thematic evolution of scientific literature on public security. It enriched our understanding of the current state of the field and will guide future research endeavors in public security.

A. Analysis of conceptual structure

Conceptual analysis in bibliometrics is an approach designed to understand and explore the concepts, topics, and trends present in the scientific literature related to a specific research theme within a particular field of study. This analysis is grounded in the quantitative examination of scientific documents and incorporates techniques such as keyword co-occurrence analysis on density maps, citation network analysis, and factor and cluster analysis, among others. These techniques facilitate the identification of patterns in scientific communication, pinpoint areas of

[18] Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, 11(4), 959-975.

[19] van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84(2), 523-538.

[20] Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, 11(4), 959-975.

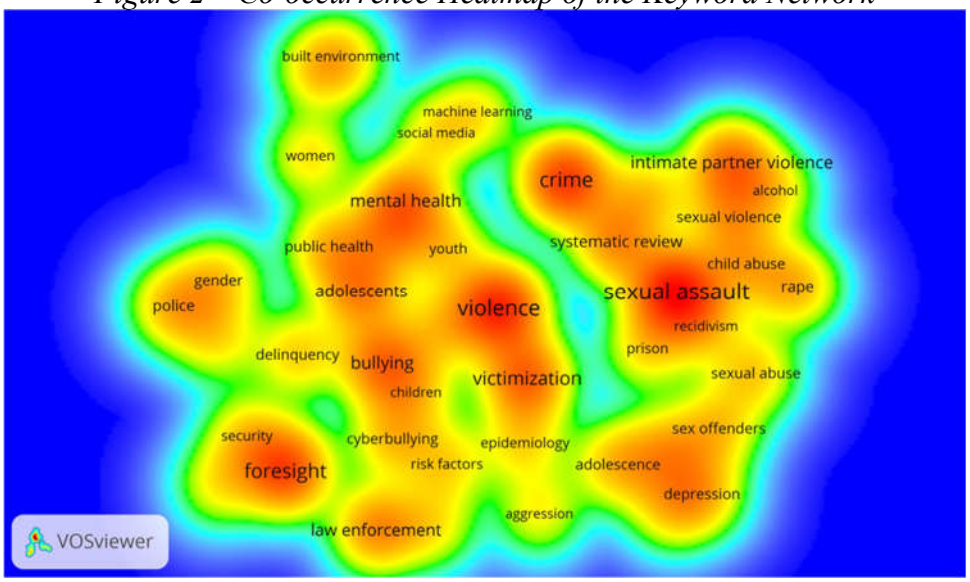
[21] van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84(2), 523-538.

[22] Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, 11(4), 959-975.

[23] van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84(2), 523-538.

significant relevance and influence, and analyze the evolution and trends of concepts over time.

Figure 2 – Co-occurrence Heatmap of the Keyword Network



Source: Data from VOSViewer. Developed by the authors.

Figure 2 displays the co-occurrence heatmap of the keyword network generated using VOSViewer, a tool renowned for its capability in visualizing and analyzing bibliometric networks. Previous studies underscore its usefulness in identifying emerging themes, assessing interdisciplinarity, and analyzing research evolution over time[24]. The tool facilitated the identification of patterns, connections, and emerging trends in keyword co-occurrences, with a focus on the most pertinent keywords such as Violence, Sexual Assault, Foresight, Law Enforcement, Crime, Bullying, and Intimate Partner Violence.

Additionally, the Bibliometrix software[25] was utilized in this study, enabling the visualization of the field's structure, identification of key authors and their collaborations, the most frequent keywords, cited references, and other relevant information.

In summary, conceptual analysis through bibliometric tools like VOSViewer, Gephi, and Bibliometrix offers a comprehensive insight into the

[24] van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84(2), 523-538; Waltman, L., Van Eck, N. J., & Noyons, E. C. (2010). A unified approach to mapping and clustering of bibliometric networks. *Journal of Informetrics*, 4(4), 629–635.

[25] Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, 11(4), 959-975.

principal topics, trends, and developments in the field of digital governance. These tools facilitate the identification of clusters of similar studies, map the evolution of research themes over time, and visualize annual scientific production, thereby indicating research directions in this field.

Annual scientific production is a crucial metric for evaluating academic activity within a specific field of study[26]. Utilizing Bibliometrix for bibliometric analysis allows for the observation of scientific production's evolution over the years, identifying trends and patterns.

In this research, Bibliometrix was instrumental, providing essential data from 2000 to 2023. The analysis of 847 documents from the Scopus database, sourced from various academic outlets, revealed a consistent annual growth rate of 11.29%, indicating sustained interest in the nexus of public security, criminal justice, and foresight analysis. With an impressive average citation rate of 21.61 per document and an average age of 6.49 years, the findings underscore the significance and impact of the theoretical foundation within this domain. The table below offers a comprehensive overview of the bibliometric research findings.

Table 1 - Visualization of Main Information

Main data	
Timeframe	2000:2023
Authors	2964
Author Keywords	2633
Sources	589
Single-Author Documents	137
References	42306
Documents	847
International Co-authorship	17.95%
Average Age of Documents (years)	6.49
Annual Growth Rate	11.29%
Co-authorships per Document	3.76
Average Citations per Document	21.61

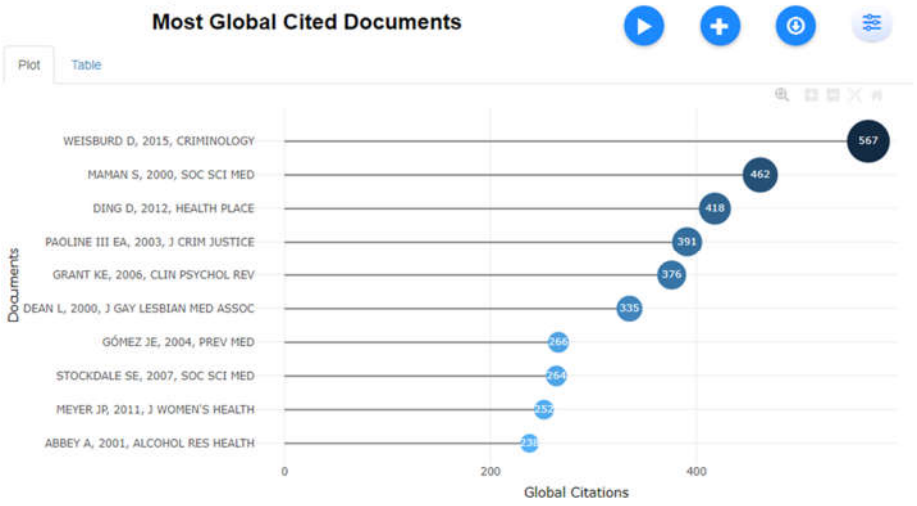
Source: Bibliometrix Data. Prepared by the authors.

The search expression applied in Scopus, focusing on terms related to justice, public security, and foresight analysis, uncovered a comprehensive body of academic work. Additional keywords and author terms associated with these core concepts facilitated the precise integration of the research scope with the selected database. This detailed mapping of documents, encompassing articles, conference papers, and reviews, highlights the diversity of perspectives and the depth of approaches within the interdisciplinary field of public security and foresight analysis.

[26] Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, 11(4), 959-975.

The most globally cited documents in Bibliometrix, as illustrated in Figure 3, offer essential insights into the primary research areas and the most influential themes in the field of public security. Among these, the work of Weisburd[27] published in Criminology is notably prominent, amassing a remarkable total of 567 citations. Weisburd's research addresses critical issues in criminology, providing a robust foundation for understanding the dynamics of criminal behavior.

Figure 3 – Most Cited Documents in Bibliometrix



Source: Bibliometrix Data. Developed by the authors.

Another notable work is the article by *Maman et al. (2000)* published in Social Science & Medicine, which has garnered 462 citations. Maman's study explores social and medical issues, indicating a significant link between public security and public health aspects. The citation of *Ding et al. (2012)* in Health & Place, with 418 citations, underscores the intersection between health and geography in the context of public security analysis.

Upon examining the top ten most cited articles, a balance is evident across various themes, including health, psychology, interpersonal violence, and health promotion. These cited works demonstrate the multidisciplinarity of the public security field, showing that research in this area extends beyond traditional boundaries to cover a wide range of vital topics for understanding and tackling contemporary challenges.

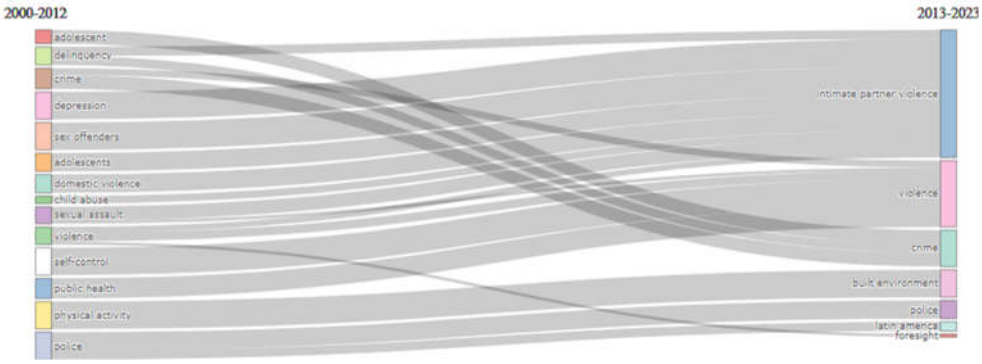
The analysis of thematic evolution in Bibliometrix reveals notable shifts in focus from 2000 to 2012 compared to the subsequent period from 2013 to 2023. In the earlier timeframe, research on justice, public security, and

[27] Weisburd, D. (2015). The law of crime concentration and the criminology of place. *Criminology*, 53(2), 133–157. https://doi.org/10.1111/1745-9125.12070

foresight analysis appeared more fragmented, possibly reflecting the lack of a cohesive agenda in this domain. Although authors like Godet[28] and Chermack[29] were already emphasizing the importance of foresight analysis in public security, thematic convergence was less apparent.

However, from 2013 onwards, there was a consolidation of themes and a rise in interdisciplinary academic production, indicating a stronger integration of justice, public security, and foresight analysis. This transition is likely due to an increased acknowledgment of the necessity for foresight strategies to address the complex challenges facing public security. Recent works shed light on the evolving landscape, offering valuable insights into how forward-looking perspectives are being integrated more prominently into discussions on public security and criminal justice. This thematic progression, documented by Bibliometrix and illustrated in Figure 4, reflects the growing sophistication of the field and a deeper understanding of how foresight analysis can strategically shape the future of public security.

Figure 4 – Conceptual Structure – Thematic Evolution in Bibliometrix (Temporal Cuts 2000-2012 and 2013-2023, by Author Keywords)



Source: Bibliometrix Data. Developed by the authors.

The word cloud generated from author keywords offers a visual depiction of the core themes tackled in this research. Terms such as "sexual assault," "violence," "foresight," "victimization," and "bullying" stand out as dominant, reflecting a focus on the nexus between public security, prospective analysis, and critical social issues like violence and victimization. The inclusion of phrases like "law enforcement," "police," and "criminal justice" indicates a comprehensive approach that also integrates aspects of criminal justice and the functions of law enforcement agencies[30].

[28] Godet, M. (2006). Introduction to Prospective and Foresight. *Futures*, 38(7), 513-26.

[29] Chermack, T. J. (2011). *Scenario Planning in Organizations*: How to Create, Use, and Assess Scenarios. Berrett-Koehler Publishers.

[30] Weisburd, D. (2015). The law of crime concentration and the criminology of place.

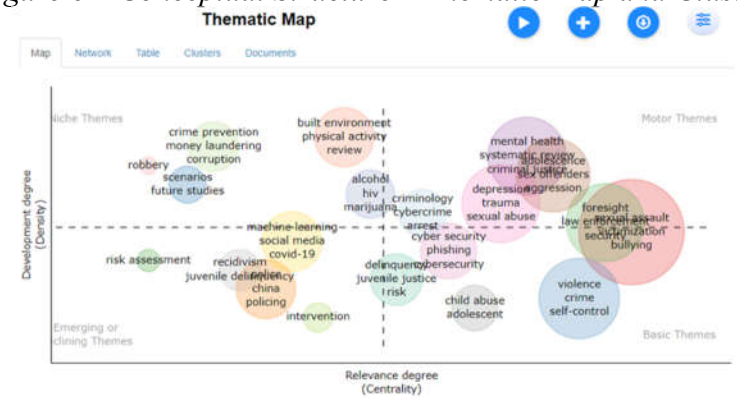
Additionally, terms such as "mental health," "depression," and "trauma" underscore the acknowledgment of psychological and mental health considerations in the discourse, suggesting a broad and holistic perspective on the subject[31]. The presence of "public health" as a keyword emphasizes the significance of preventive and public health strategies in research concerning security and justice. This multifaceted approach demonstrates the diverse and interrelated factors that contribute to understanding and addressing issues within public security and justice fields.

Figure 5 – Word Cloud – by author keywords

Source: Bibliometrix Data. Developed by the authors.

This word cloud shown in Figure 5 not only provides a visually rich overview of the addressed themes but also guides researchers in identifying key areas for further exploration.

Figure 6 – Conceptual Structure – Thematic Map and Cluster



Source: Bibliometrix Data. Developed by the authors.

Criminology, 53(2), 133–157. https://doi.org/10.1111/1745-9125.12070;

[31] Kessler, R. C., et al. (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Arch Gen Psychiatry*. 2005 Jun;62(6):593-602.

The thematic clustering depicted in the Bibliometrix thematic map in Figure 6 provides a detailed insight into the emerging trends and patterns within the research. In the "Sexual Assault" cluster, keywords such as "victimization," "bullying," and "intimate partner violence" indicate a holistic approach to sexual violence, covering various contexts and forms of aggression. The significance of these terms within the conceptual framework is underscored by betweenness centrality indices and PageRank indices, highlighting their relevance[32].

Another prominent cluster is "Foresight," where terms like "law enforcement," "security," and "scenario planning" suggest a convergence between prospective analysis, security measures, and strategic planning in the realm of public security policy application[33]. The term "foresight" stands out as a key concept, emphasizing the critical role of this approach in formulating future strategies within public security research. This thematic analysis, centered around the frequency of occurrences, plays a vital role in elucidating the conceptual structure and the interrelationships among the topics discussed in the literature[34].

B. Analysis of intellectual structure

Intellectual analysis in bibliometrics involves interpreting the results obtained through bibliometric metrics and indicators, aiming for a deeper understanding of the addressed themes, emerging trends, and the relationships between various elements within the citation network[35]. This analysis blends quantitative outcomes with a qualitative review of document content, facilitating the identification of key research themes, influential authors, knowledge gaps, and future directions[36].

Exploration of the co-citation network among authors in Bibliometrix, using the Walktrap algorithm for clustering, uncovers thematic groupings. Cluster 1 reveals a significant interconnection among authors like

[32] Newman, M. E. (2010). *Networks*: An introduction. Oxford University Press.

[33] Chermack, T. J. (2011). *Scenario Planning in Organizations*: How to Create, Use, and Assess Scenarios. Berrett-Koehler Publishers; Godet, M. (2006). *Creating Futures*: Scenario Planning as a Strategic Management Tool. Economica.

[34] van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84(2), 523-538.

[35] De Winter, J. C., et al. (2018). Using bibliometrics to explore the bias against women researchers in environmental sciences. *PLoS ONE*, 13(11), e0208598.

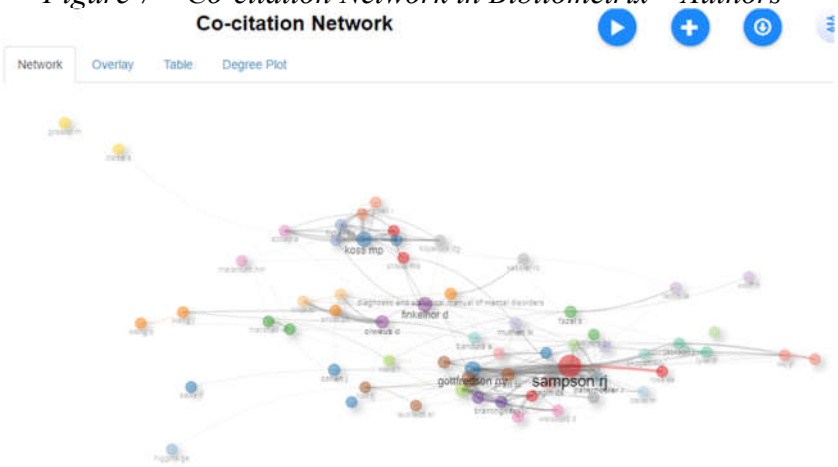
[36] Janssen, M., et al. (2012). Advancing the understanding of behavior in social-ecological systems: Results from lab and field experiments. *Ecology and Society*, 17(1), 1.

Weisburd[37], Felson[38], and Cohen[39], showcasing thematic closeness in their contributions, notably in areas of justice, public security, and prospective analysis. This strong cluster significantly enriches theoretical development in these fields, laying a solid groundwork for ongoing research.

In Cluster 2, an evident interconnection emerges among works like the "Diagnostic and Statistical Manual of Mental Disorders" and authors such as Kessler[40], pointing to a theme overlap concerning mental health, crime, and justice. This cluster illuminates the intricate ties between mental health issues and criminal behavior, suggesting areas ripe for interdisciplinary research. Influential figures like Bandura are highlighted as pivotal to the crossroads of mental health and criminal justice, underscoring their importance in this realm.

Figure 7 presents an analysis of the co-citation network, pinpointing intellectual connections, trends, and knowledge voids within the ambit of the proposed study.

Figure 7 – Co-citation Network in Bibliometrix – Authors



Source: Bibliometrix Data. Developed by the authors.

The co-citation network analysis generated from metadata in Bibliometrix is a relevant approach for exploring the intellectual structure of a research field[41]. It enables the visualization of the distribution of connection

[37] Weisburd, D. (2015). The law of crime concentration and the criminology of place. *Criminology*, 53(2), 133–157. https://doi.org/10.1111/1745-9125.12070

[38] Felson, M. (2006). *Crime and nature*. Sage.

[39] Cohen, J., et al. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.). Lawrence Erlbaum Associates Publishers.

[40] Kessler, R. C., et al. (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Arch Gen Psychiatry*. 2005 Jun;62(6):593-602.

[41] Bélanger, Y., et al. (2011). A bibliometric analysis of scientific research in

degrees between articles, identification of the most influential works, and thematic groupings[42].

C. Social structure analysis

Collaboration network analysis is an essential approach to understanding the structure and interaction patterns among actors in a social network. In this context, the global collaboration map in the social network structure is a visual representation that reveals collaboration relationships between different countries or regions worldwide[43]. This analysis is particularly relevant in the context of Bibliometrix, where the global collaboration map in the social structure visualizes the collaboration network between countries based on the analysis of scientific publications.

In the global collaboration map, as shown in Figure 8, countries or regions are represented as nodes or points, and the connections between them indicate the existence of scientific collaboration. The more connections between two countries, the higher the level of collaboration between them. This visual representation provides important insights into key centers of scientific collaboration and the most collaborative knowledge areas on a global scale[44].

Figure 8 – Collaboration Network Among Countries.

Source: Bibliometrix Data. Developed by the authors.

information systems. *Electronic Journal of Information Systems Evaluation*, 14(1), 2-12.

[42] Mardani, A., et al. (2015). Using bibliometric method for engineering education research: A case study on IEEE Xplore database. *European Journal of Engineering Education*, 40(6), 625-639.

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The table below presents the collaboration network among countries in Bibliometrix, highlighting the most frequent collaborations:

Table 2 – Worldwide Collaboration Map among Countries in Bibliometrix, Sorted by Frequency – Top 25 Listed.

From	To	Frequency
USA	Australia	12
USA	Canada	12
USA	China	11
USA	S. Korea	6
USA	Spain	6
USA	United Kingdom	6
China	Hong Kong	5
USA	Brazil	5
United Kingdom	China	4
United Kingdom	Netherlands	4
USA	Belgium	4
USA	Hong Kong	4
USA	India	4
USA	Iran	4
USA	Sweden	4
Australia	Hong Kong	3
Australia	Malaysia	3
Canada	Australia	3
Canada	Brazil	3
Canada	France	3
Germany	Switzerland	3
Malaysia	Indonesia	3
Norway	Hong Kong	3
United Kingdom	Australia	3
United Kingdom	Brazil	3

Source: Bibliometrix Data. Developed by the authors.

This table reflects the intensity of collaborations among different countries, highlighting the most recurrent relationships in scientific production. The analysis provides a comprehensive view of collaborative relationships on a global scale, offering enriching insights for researchers and scholars interested in scientific collaboration among countries and regions[45].

[45] Wasserman, S., & Faust, K. (1994). *Social network analysis*: Methods and applications. Cambridge University Press; Scott, J. (2017). *Social network analysis*. Sage;

IV. FUTURE VISION – "FORESIGHT"

By incorporating the concepts of "foresight" and future studies, supported by key works such as Godet[46], the bibliometric analysis establishes a robust foundation for charting the evolution and application of these methodologies in public safety. The forward-looking perspective introduced by Godet, together with Gartner's forecasts on Law Enforcement and Public Safety, offers a detailed and actionable understanding of future strategies.

The Gartner 2023 report, "Predictions 2023: Justice and Public Safety Seize New Opportunities to Address Evolving Demands,"[47] underscores the challenges confronting justice and public safety organizations (J&PS), emphasizing talent, cybersecurity, and productivity. With foundational technologies like cloud computing, the Internet of Things (IoT), and analytics already in place, the emphasis shifts towards capitalizing on opportunities through data, technology, and innovative methods to address these challenges.

Significant findings include an increasing reliance on IaaS (Infrastructure as a Service), PaaS (Platform as a Service), and SaaS (Software as a Service) solutions to cater to the specific needs of J&PS, as well as the adoption of IP-based emergency services, such as Next Generation 911/112/999 (NG911), to utilize data and technology in enhancing productivity. The report also points out the necessity for J&PS personnel to upgrade their skills to effectively handle incidents involving individuals with varied social, emotional, and mental health needs, in line with rising public expectations.

Further, the Gartner 2023 article on J&PS suggests that government CIOs leading digital transformations in J&PS organizations should promote cloud adoption with defined governance criteria, initiate machine-driven calls using IoT and AI solutions following the implementation of NG911 services, and investigate new training methodologies, such as augmented and virtual reality training, in cooperation with human resources and training departments. Figure 9 illustrates the 2023 Predictions for Justice and Public Safety. This report acts as a roadmap for CIOs to navigate the constantly changing terrain of justice and public safety, offering practical advice to meet the sector's shifting demands.

Borgatti, S. P., Everett, M. G., & Johnson, J. C. (2018). *Analyzing social networks*. SAGE Publications; Newman, M. E. (2010). *Networks*: An introduction. Oxford University Press; Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, 11(4), 959-975.

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[47] Gartner 2023, *Predictions 2023: Justice and Public Security* - https://www.gartner.com/document/4023201

Figure 9 – Predictions 2023: Justice and Public Safety, 2023.

Source: Gartner 2023, Justice and Public Safety Predictions.

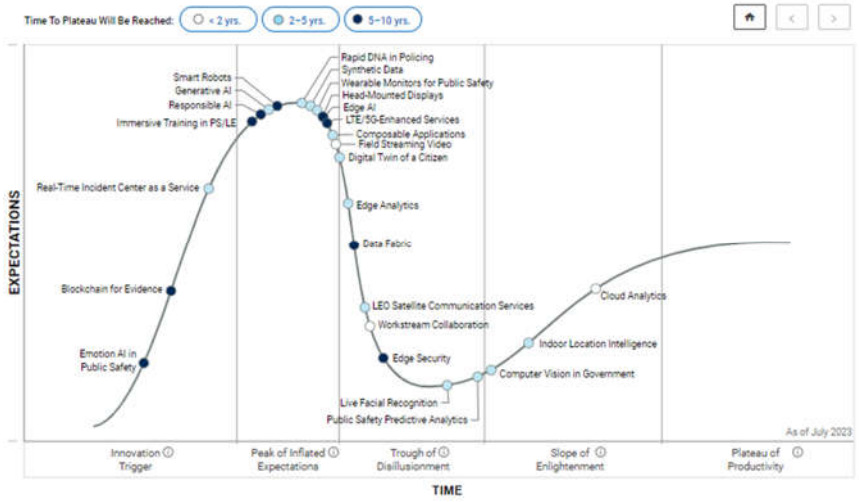
The Hype Cycle in Figure 10, provided by Gartner[48], offers insights into the risks and adoption rates of various technologies and methodologies in the domain of public safety and law enforcement. This resource enables government CIOs to make well-informed decisions regarding the timing of investments to enhance their digital strategies.

According to Gartner's findings, 84% of participants in Public Safety and Law Enforcement (PS&LE) within the public sector believe digital capabilities will propel operational excellence, with 60% expecting an increase in their IT budgets.

The operational landscape of PS&LE faces challenges such as highly competitive job markets, but it also encounters opportunities like heightened innovation, which are underscored at the peak of this Hype Cycle. This tool assists CIOs, executives, and program leaders in comprehending the relative maturity of emerging technologies, refining strategic plans, and fulfilling their objectives. For instance, a public safety organization looking to reduce recidivism rates through smart integrated justice would find the data fabric profile in this Hype Cycle particularly useful.

[48] Gartner 2023, *Predictions 2023: Justice and Public Security* - https://www.gartner.com/document/4023201

Figure 10 – Hype Cycle for Public Safety and Law Enforcement, 2023.



Source: Gartner 2023, Law Enforcement and Public Safety.

According to Gartner's definitions (2023), here is a succinct overview of the terms used in Figure 10 (Hype Cycle):

- *Hype Cycle*: The "Hype Cycle" is a graphical representation developed by Gartner to illustrate the life cycle of emerging technologies and trends. It outlines the evolution of a technology's expectations and maturity over time, dividing the cycle into various phases. The Hype Cycle applies to both technologies and concepts across different fields, serving as a tool to help understand the maturity and adoption levels of various innovations.
- *Time to Plateau*: In Gartner's "Hype Cycle" model, the term "Time to Plateau" refers to the estimated duration for a technology to achieve widespread adoption or maturity. The "plateau" signifies a stage of stability where the technology has met initial expectations, surpassed the early hype's challenges, and is now consistently used. "Time to Plateau" predicts how long it will take for the technology to reach this stable phase.
- *Innovation Trigger*: This phase is initiated by an event such as a discovery, public demonstration, or product launch, generating significant media and industry interest.
- *Peak of Inflated Expectations*: Characterized by heightened enthusiasm and often unrealistic projections, this phase sees some successes but more failures as the limits of innovation are tested. The primary beneficiaries tend to be conference organizers and content publishers.
- *Trough of Disillusionment*: Innovation fails to meet inflated expectations, leading to a decrease in interest. Media coverage dwindles,

save for a few cautionary stories.

- *Slope of Enlightenment*: Through focused experimentation, a broader range of organizations starts to comprehend the innovation's real-world applications, risks, and benefits. Commercially available methodologies and tools aid in development.
- *Plateau of Productivity*: The tangible benefits of the innovation are recognized and accepted. As tools and methodologies mature, organizations become more comfortable with the associated risks, triggering a phase of rapid adoption growth. By this phase, approximately 20% of the target audience has adopted or is in the process of adopting the technology.

The Gartner Priority Matrix serves as a strategic framework, offering a holistic view of emerging technologies in terms of their transformative potential and the timeline for widespread adoption. It aids Public Safety and Law Enforcement (PS&LE) agencies in pinpointing both immediate and future investment opportunities. Technologies that provide quick benefits and are highly mature are prioritized for immediate investment, whereas those of moderate maturity present strategic opportunities. This matrix, in alignment with strategic goals, directs investment choices in response to market trends and technology advancements, offering an adaptable strategy for efficient deployment in the dynamic environment.

Next, we will delve into the Priority Matrix for Public Safety and Law Enforcement in 2023, outlining the terminologies and envisaging their future applications.

1. *Transformational Generative AI*. Terminology: Generative Transformational Artificial Intelligence. Applicability: Refers to AI systems capable of autonomously generating content and innovative solutions. In public safety, it's applied to analyze large datasets, predict patterns, and generate crime prevention and emergency response forecasts, aiding data-driven decision-making.

2. *Live Facial Recognition*. Terminology: Real-Time Facial Recognition. Applicability: Enables instant identification through facial feature analysis, useful in law enforcement for suspect identification, access control to restricted areas, and public surveillance enhancement.

3. *Public Safety Predictive Analysis*. Terminology: Predictive Analytics in Public Safety. Applicability: Employs algorithms and statistical models to predict future events based on historical data, useful for identifying high-risk areas, resource allocation, and predicting criminal trends.

4. *Real-Time Incident Center as a Service*. Applicability: Provides real-

time incident monitoring and response coordination, facilitating updated information sharing and real-time decision-making.

5. *Data Fabric*. Applicability: Enables data integration and interoperability from various sources for a comprehensive data view, aiding in analysis and emergency response coordination.
6. *Emotion AI in Public Safety*. Applicability: AI's capability to recognize human emotions, useful for detecting signs of agitation or stress in crowds, aiding in riot or danger prevention.
7. *Immersive Training in PS/LE*. Terminology: Immersive Training in Public Safety and Law Enforcement. Applicability: Utilizes virtual reality for realistic scenario-based training, enhancing security professionals' skills and decision-making.
8. *LTE/5G-Enhanced Services*. Applicability: Enhances services using LTE and 5G technologies, offering faster, more reliable communication for efficient emergency responses.
9. *Responsible AI*. Terminology: Responsible Artificial Intelligence. Applicability: Ensures AI-based decisions are transparent, fair, and ethically aligned, critical in public safety applications.
10. *Advanced Cloud Analytics*. Applicability: Performs complex data analyses in the cloud, enabling rapid, accurate dataset processing for quicker analyses in public safety.
11. *Edge AI. Applicability*: Processes data directly on devices (at the edge), enabling faster, more efficient real-time decision-making in public safety.
12. *Real-Time Field Video*. Terminology: Field Streaming Video. Applicability: Transmits real-time videos from field devices, useful for law enforcement's real-time event and situation monitoring.
13. *Workflow Collaboration*. Applicability: Facilitates real-time collaboration among agencies and professionals during complex public safety operations.
14. *Composable Applications*. Applicability: Builds applications from modular components using APIs and microservices, allowing for customized public safety solutions.
15. *Computer Vision in Government*. Applicability: Applies computer vision algorithms for pattern recognition in surveillance images within government contexts, including public safety.
16. *Digital Twin of a Citizen (DToC)*. Applicability: Advanced

technological representation of a person's state, integrating data from various sources for personalized government services, with significant implications for health and safety management.

17. *Edge Analytics.* Applicability: Conducts real-time data analysis at the source, enabling faster incident response through real-time surveillance data processing.
18. *Indoor Location Intelligence*. Applicability: Maps and analyzes location data within buildings, aiding in enclosed environment incident responses.
19. *Rapid DNA in Policing*. Applicability: Accelerates suspect or victim identification in criminal cases through rapid DNA analysis technology.
20. *Synthetic Data*. Applicability: Generates artificial data for training AI models in public safety without compromising privacy, enhancing surveillance systems and incident response.
21. *Wearable Monitors for Public Safety*. Applicability: Enhances situational awareness and monitors the safety of public safety personnel through IoT devices, aiding in real-time health and safety monitoring.
22. *Head-Mounted Displays*. Applicability: Uses augmented reality glasses for real-time visual information during public safety operations.
23. *Smart Robots.* Applicability: Employs robots with advanced capabilities for surveillance or responding to hazardous situations in public safety.
24. *Moderate Low Earth Orbit (LEO) Satellite Communication Services*. Applicability: Offers efficient global connectivity with low latency for broadband internet services and IoT connectivity, transforming operational capabilities in various sectors, including public safety.
25. *Blockchain for Evidence*. Applicability: Uses blockchain technology to ensure digital evidence's integrity and authenticity in legal proceedings and police investigations.
26. *Edge Security.* Applicability: Implements security measures at the network's edge to protect real-time sensitive data, relevant in public safety measures.

These technological advancements have the potential to significantly transform public safety and law enforcement, offering more efficient and sophisticated tools to address complex challenges. They include a range of

advanced technologies poised to positively impact public safety and law enforcement in the upcoming years.

V. RESULTS

Analyzing Gartner's predictions for 2022 and 2023, especially the reports "Justice and Law Enforcement Vision 2022: Intelligent Integrated Justice" and "Predictions 2023: Justice and Public Safety," [49] provides possible scenarios for formulating investment strategies in emerging technologies for Public Safety and Law Enforcement (PS&LE) agencies.

The Priority Matrix, highlighting the maturity and widespread adoption of technologies, emerges as a crucial tool in strategic decision-making. For PS&LE agencies, characterized by readiness and urgency in their digital government journeys, identifying technologies capable of providing immediate transformative benefits is imperative. In this context, investing in technologies such as cloud analytics and indoor location intelligence can result in quick and tangible victories.

However, it is essential to weigh the maturity of technologies before making investments. The correlation between the "Justice and Law Enforcement Vision 2022"[50] article and the Priority Matrix suggests that solutions like smart robots and blockchain for evidence, while promising, are in more immature stages. This implies that the time required to realize the value of these technologies may be extended, involving significant complexities.

The investment approach should be strategically aligned with global and regional initiatives, considering the ever-changing market dynamics. Understanding geographical, vertical, and government level specificities is vital, as the position of these technologies in the Priority Matrix can vary substantially. This variation highlights the importance of a careful assessment of potential benefits in specific contexts.

In summary, Gartner's research provides a roadmap for PS&LE agencies in outlining investment strategies. By focusing on quick wins aligned with strategic initiatives and understanding the maturity specifics of technologies, agencies can effectively position themselves to embrace digital transformation and address emerging challenges in the justice and public safety domain.

Figure 10 provides a comprehensive overview of emerging technologies and their adoption prospects in the Public Safety and Law Enforcement sector

[49] Gartner 2022, *Justice and Law Enforcement Vision 2022: Intelligent Integrated Justice* - https://www.gartner.com/document/4015790

[50] Gartner 2022, *Justice and Law Enforcement Vision 2022: Intelligent Integrated Justice* - https://www.gartner.com/document/4015790

over the next 10 years. In this context, it is crucial to analyze some of these trends to better understand the unfolding landscape.

Firstly, we highlight Transformational Generative AI, which promises a significant transformation in artificial intelligence capabilities. However, it is relevant to note that its estimated time for widespread adoption is over 10 years. This projection indicates that, although it holds transformative potential, the widespread incorporation of this technology will require an extended period.

Next, we have Live Facial Recognition, offering the benefit of real-time facial recognition for law enforcement. With an estimated adoption time between 2 to 5 years, this technology emerges as a trend with more immediate implementation compared to Transformational Generative AI.

Another relevant technology is Public Safety Predictive Analytics, utilizing predictive analytics to anticipate security events. With a predicted adoption time between 5 to 10 years, this tool demonstrates a moderate implementation horizon, highlighting the growing importance of predictive analytics in public safety.

Considering Real-Time Incident Center as a Service, providing real-time incident centers as a service, we observe an adoption time of 2 to 5 years. This technology offers a more immediate approach to improving efficiency in real-time incident response.

Efficient data integration and management are addressed by the Data Fabric technology, with an estimated time for widespread adoption between 5 to 10 years. This projection suggests that effectiveness in data integration will be a growing priority in the considered time horizon.

Emotion AI in Public Safety, focusing on emotion recognition for public safety applications, has an adoption time exceeding 10 years, indicating that this technology, while promising, will face prolonged challenges before widespread implementation.

Immersive training for security professionals, known as Immersive Training in PS/LE, has an adoption time of 2 to 5 years, emphasizing the growing importance of immersive approaches in the training of security professionals.

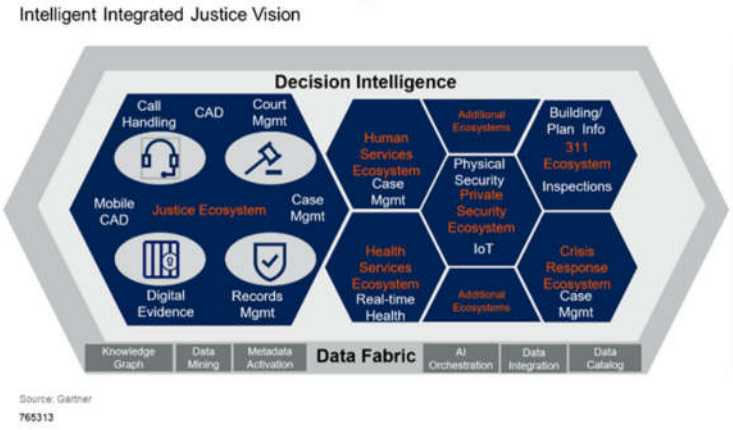
Services enhanced by 5G network technology, such as LTE/5G-Enhanced Services, have a predicted adoption time between 2 to 5 years, reflecting expectations of significant advancements in security service delivery driven by 5G technology.

The ethical and responsible use of artificial intelligence, represented by Responsible AI, has an adoption time between 2 to 5 years. This projection highlights the increasing importance of ethical approaches in the application of artificial intelligence technologies in public safety.

Finally, cloud-based advanced analytics, known as High Cloud Analytics,

have an adoption time between 2 to 5 years. This suggests an ongoing shift towards cloud-based solutions for advanced analytics in the field of public safety.

Figure 11 – Intelligent Integrated Justice Vision, 2022.



Source: Gartner 2022, Justice and Law Enforcement Vision 2022: Intelligent Integrated Justice.

Figure 11, extracted from the Gartner 2022 article on "Justice and Law Enforcement Vision 2022: Intelligent Integrated Justice," [51] addresses the challenges faced by integrated approaches to justice and public safety and proposes a vision of intelligent integrated justice for the future. Currently, integrated justice approaches struggle to scale as they require an expansion of partners in the ecosystem to meet expectations of how governments keep society safe.

In summary, the analysis of these trends reveals a diverse landscape of emerging technologies, each with its own estimated time for widespread adoption. This scenario indicates the complexity and dynamics of technological advancement in the Public Safety and Law Enforcement sector, requiring a strategic and adaptive approach for effective implementation.

CONCLUSION

The bibliometric and global collaboration research conducted provided an in-depth view of the intellectual structure and emerging trends in the field of public safety. The analysis of co-citation networks among authors revealed significant thematic clusters, highlighting areas such as justice, public safety,

[51] Gartner 2022, *Justice and Law Enforcement Vision 2022: Intelligent Integrated Justice* - https://www.gartner.com/document/4015790

and the nexus between mental health and crime. Furthermore, an analysis of global collaboration pinpointed major centers of scientific collaboration, with the United States emerging as a leader in international partnerships.

The Hype Cycle on Public Safety and Law Enforcement for 2023, as outlined by Gartner, forecasts the future landscape, spotlighting emerging technologies and their anticipated timelines for widespread adoption. These projections offer strategic and disruptive insights for researchers, professionals, and policymakers engaged in the advancement of public safety and criminal justice.

Moreover, there is a suggestion to explore the practical application of bibliometric findings in the development of public policies. This entails investigating how scientific research can translate into effective measures to enhance public safety. The bridge between research and practical application is vital for the success of governmental strategies.

By outlining a vision for the future of public safety and law enforcement, the study intrinsically links to the bibliometric analysis of these fields. Bibliometric analysis, by uncovering trends and gaps in academic research, lays a solid foundation for identifying emerging directions and prioritizing areas of study. The future clearly indicates that technological innovations, as highlighted in the Hype Cycle, will significantly transform these sectors.

The strategic focus presented by Gartner, supported by bibliometric analysis, underscores a strategic alignment in key areas for public safety and law enforcement. The emphasis on artificial intelligence and predictive analytics not only forecasts emerging scenarios but also enables agencies to adopt proactive measures in crime prevention and emergency responses. Technologies such as facial recognition and wearable devices facilitate real-time monitoring, enhancing the capacity for immediate reactions to evolving situations. Additionally, global connectivity through low Earth orbit satellites greatly extends operational capabilities beyond geographical limitations.

Aligned with the gaps identified in bibliometric analysis, Gartner's publications, including "Gartner 2023, Law Enforcement and Public Safety" and "Gartner 2022, Justice and Law Enforcement Vision 2022: Intelligent Integrated Justice," not only reflect the sectors' continuous evolution but also serve as a comprehensive roadmap for future innovations. Adopting this holistic ecosystem perspective equips decision-makers, researchers, and professionals with the tools to drive significant progress, ensuring not just security but also operational excellence and effectiveness across the spectrum of public safety and law enforcement. The recent Gartner publication, "Gartner 2023, Predictions 2023: Justice and Public Security," further enriches this proactive stance by underscoring the emerging opportunities and challenges that will define the future landscape of these critical sectors.

In conclusion, this study not only charted the current research landscape

in public safety but also established a foundation for future studies that could direct the application of scientific insights towards fostering more efficient, ethical, and globally collaborative public safety initiatives.

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