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FOOD SECURITY RESEARCH MAPPING IN BARRU DISTRICT: A BIBLIOMETRIC ANALYSIS FOR FORMULATION OF REGIONAL FOOD SECURITY GUIDELINES

A. Aminah
ITBA Al Gazali Barru
aaminah@algzali.ac.id
Hj. Aidah .S
ITBA Al Gazali Barru
aidah@algazali.ac.id

ABSTRACT

This study aims to analyze the development and structure of food security-related research through a bibliometric approach using network, overlay, and density visualizations on international publication data. Network visualization analysis reveals two main research clusters: one focused on fundamental themes such as production, availability, development, and bibliometric analysis, and the other focused on contemporary issues such as prevalence and region-based studies, including Latin America. These findings indicate that food security research is evolving dynamically, moving from technical studies to more specific and contextual issues. The overlay visualization results demonstrate temporal changes, with food production and availability dominating publications in previous years, while the prevalence of food security began to emerge as a new research trend in 2024. Meanwhile, the density map reinforces these findings by showing the highest density in the food production and availability cluster, while new subthemes exhibit lower densities, indicating a broader direction of research development. Overall, this study confirms that food security research has undergone significant thematic diversification. These bibliometric findings provide important insights for researchers, practitioners, and policymakers to understand trends, gaps, and future research directions to strengthen global food security strategies.

Keywords: food security; bibliometrics; network visualization; density map; overlay visualization



A. INTRODUCTION

Food security is a strategic issue in regional development because it is directly related to the availability, access, and stability of food for all levels of society. Barru Regency, as a region supported by the agricultural sector, faces quite complex challenges such as climate change, production fluctuations, and limited food support infrastructure (Supriyadi, 2023). This situation is reinforced by national findings that food production dynamics are significantly influenced by land fertility, agricultural technology, and population growth (Saptana, 2019). Therefore, an in-depth analysis is needed to understand how research on food security has developed, particularly in the context of a region like Barru, to support the development of relevant food security guidelines.

Globally, the concept of food security has evolved along four main dimensions: availability, access, utilization, and stability, as explained by Hidayat and Prasetyo (2021). This multidimensional approach demonstrates that food security issues are not solely focused on production but also encompass distribution, household economic conditions, nutritional quality, and the long-term stability of the food system. Studies examining various cases of food insecurity in developing countries show that food security is also influenced by external shocks such as geopolitics, the climate crisis, and food price volatility (Putri et al., 2022). Therefore, research mapping is needed to ensure regional interventions align with global conceptual developments.

Bibliometric analysis is a scientific method capable of mapping research trends, linkages, and gaps based on a collection of publications in a field (Saragih et al., 2021). This method allows researchers to identify popular topics, conceptual evolution, collaborative networks, and research development directions, thus providing a basis for developing policy recommendations. In the context of food security, bibliometrics is particularly relevant for understanding how this issue has developed nationally and globally and the extent to which research can be applied in local contexts such as Barru (Fahmid et al., 2020). This analysis also helps ensure that regional food security guidelines are based on the latest scientific evidence.

The food industry is a complex and multidimensional sector encompassing a wide range of activities, from primary agricultural production to processing, distribution, and consumption

(Abbasov & Gurbanzade, 2025). Although food security has been extensively researched, most publications still focus on the national level or comparative studies between countries (Hidayat & Prasetyo, 2021). Research specifically examining food security in a small district like Barru is still very limited. Consequently, regional policies are often generic and not based on scientific studies that reflect local situations (Ernawati et al., 2021). This situation creates a knowledge gap (research gap) between available research and regional needs. Therefore, bibliometric-based mapping of research on food security relevant to Barru is crucial.

Barru Regency is characterized by agrarian characteristics, with main commodities such as rice, corn, horticulture, and livestock. However, dependence on weather conditions and minimal local food diversification result in a relatively high level of food vulnerability (Nasution & Harahap, 2022). Changing consumption patterns also add to the challenges, as food security is no longer solely about production but also about nutritional quality, economic access, and production sustainability (Priyono & Nurmala, 2020). Therefore, comprehensive, evidence-based research-based food security guidelines are needed.

The literature shows that food security is influenced by numerous factors, such as government policies, village governance, distribution infrastructure, nutrition education, and farmer adaptation to climate change (Putri et al., 2022). However, no study has systematically mapped this literature in the context of Barru Regency. The lack of scientific mapping has led to food security program development relying largely on assumptions and unmeasurable impacts (Mahmud et al., 2023). This underscores the need for bibliometric analysis as a policy foundation.

Recent research has shown increasing scientific attention to food security issues, particularly since the COVID-19 pandemic disrupted global supply chains (Supriyadi, 2023). Research trends also indicate a shift from a focus on agricultural production to issues of governance, household economics, and food system sustainability (Putri et al., 2022). However, there have been relatively few publications directly related to the conditions in Barru Regency. This makes bibliometrics increasingly relevant for understanding Barru's position in the context of the region.

Bibliometric results can provide a strong basis for formulating regional food security guidelines because they illustrate how scientific knowledge is evolving and what is most relevant for local implementation (Saragih et al., 2021). Concept mapping also identifies areas that still need development, such as local food diversification, increasing sustainable productivity, mitigating climate risks, and strengthening community economic access (Ernawati et al., 2021). Through bibliometric studies, Barru can develop guidelines tailored to the local geographic, social, and economic conditions.

Based on this description, this study aims to systematically map scientific publications related to food security through bibliometric analysis and relate them to the conditions in Barru Regency. The mapping results are expected to be used to formulate regional food security guidelines that are evidence-based, contextual, and can be implemented sustainably (Mahmud et al., 2023). This research also contributes to addressing the limitations of local literature and strengthening the scientific foundation of food security policies in Barru Regency.

C. RESEARCH METHODS

This study uses a bibliometric approach to map developments, keyword trends, and collaborative networks in food security-related research relevant to the context of Barru Regency. Bibliometric analysis was chosen because it allows for systematic processing of publication data through quantitative measurements of scientific documents, citation patterns, and interrelationships between topics. The primary data sources were obtained from international and national databases such as Scopus, Crossref, Google Scholar, and Garuda to ensure a wider variety and coverage of publications. Data collection was conducted through keyword search strategies such as "food security," "food security," "local food resilience," and "rural food system." Document selection was based on inclusion criteria that included articles published within a specific year and relevant to regional food security.

Data analysis was conducted in several stages, starting with publication metadata extraction using Publish or Perish (PoP) software to obtain bibliographic information such as title, author, year of publication, journal, and citations. This metadata was then processed using VOSviewer to produce network visualizations, such as co-authorship, co-occurrence between

keywords, and a map of research theme relationships. The next step was data processing using the Bibliometrix R package for descriptive analysis, including annual publication trends, author productivity, and the intellectual structure of the food security field. The combination of these three tools provides a comprehensive overview of the research landscape and allows for the identification of dominant, emerging, and understudied research areas.

To ensure the relevance of the bibliometric results for the development of regional food security guidelines, the mapping data was then analyzed qualitatively by comparing the bibliometric findings with the actual conditions in Barru Regency. This stage involved data integration through content analysis of the dominant themes emerging in the bibliometric map and interpretation of their academic and practical relevance to local government needs. Data validity was maintained through triangulation of publication sources and cross-checking of network visualization results before interpretation. This integrative approach is considered capable of connecting global scientific evidence with policy needs at the local level (Saragih et al., 2021).

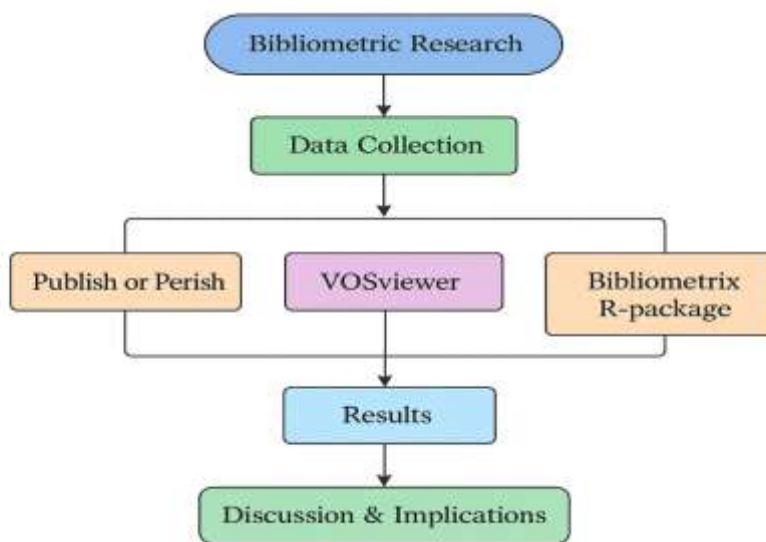


Figure 1 Bibliometric framework diagram

C. RESEARCH RESULTS AND DISCUSSION

➤ Research Results

The network visualization results show that the network structure of keywords in food security research forms two large clusters connected through the central node "year." On the left side of the network, a cluster of red nodes such as "production," "availability," "development," and "bibliometric analysis" is visible, indicating a concentration of research on technical aspects of production and scientific analysis. These nodes are close together and overlap, indicating a high level of interconnectedness and the frequent co-occurrence of these themes in publications. Meanwhile, the right side of the network displays a green cluster with nodes such as "prevalence" and "Latin America," illustrating the research's focus on the geographic context and prevalence issues in food security. The thin lines connecting the clusters indicate moderate thematic integration between the production-availability aspect and prevalence issues in specific regions. Overall, this network visualization illustrates a research direction that focuses more on technical analysis and less attention to local contexts such as Barru Regency.

In the overlay visualization, differences in node color reflect the development of research over time. The red and orange nodes on the left side, such as "bibliometric analysis," "production," and "development," indicate that these themes are relatively older research topics and have been extensively studied since their inception. Conversely, the green nodes on the right side of the network, such as "prevalence" and "Latin America," represent newer themes, indicating that research in recent years has shifted to issues of measuring incidence rates and studying specific regions. The "year" node in the center serves as a temporal transition point, connecting older and newer themes, making it easier for researchers to see the conceptual evolution of the food security field. This color scheme emphasizes that the focus of global research is shifting from technical approaches to geographic and social issues, but research at the regional level, such as Barru Regency, is still minimal and needs to be strengthened through new studies.

The density visualization displays the intensity of keyword occurrences based on gradient colors, with bold red areas indicating the highest frequency. On the left side of the visualization, nodes such as "production," "availability," and "development" are located in the bright red-yellow

area, indicating that these themes are dominant areas of study in the literature. In contrast, the right side, particularly the nodes "prevalence" and "Latin America," appear greener, indicating that these themes are emerging research categories but not as dense as the left cluster. Other nodes, such as "year," are in the middle position, with transition colors indicating medium intensity. This density pattern confirms that global food security research still focuses more on the technical aspects of food production and availability analysis than on prevalence mapping and specific geographic contexts. This further reinforces the urgency of regional-based food security research, such as in Barru Regency, to fill the still-unexplored literature gap.

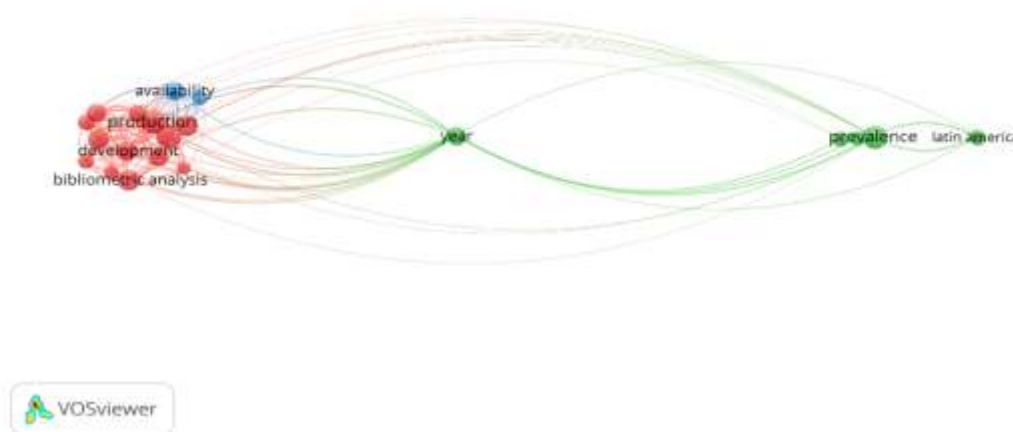


Figure 2 Network visualization

The network visualization generated using VOSviewer shows the structure of interrelationships between keywords in publications related to food security. This visualization shows that two main clusters dominate the research network: the red cluster, which focuses on the themes of production, development, bibliometric analysis, and availability. This cluster illustrates how research in recent years has largely focused on technical issues related to food production, agricultural systems development, and bibliometric analysis that evaluates research performance in these areas. The dense connections between nodes in this cluster indicate that these topics form the core of the research, often appearing frequently and complementing each other.

Meanwhile, the green cluster displays a different theme, with keywords such as prevalence and Latin America. This cluster illustrates the research focus directed at examining the prevalence of food security in a specific region, particularly Latin America. The green cluster's position, which tends to be separate but still connected by network lines to the red cluster, indicates that despite the different research focuses, there is still a conceptual connection—particularly through the year variable, which serves as the main connecting node. This indicates that the development of research on the prevalence of food security is emerging as a new branch of previous research that focused more on food production and availability.

In addition to these two clusters, the year node plays a crucial role as a connecting node that integrates the two main clusters. The network pattern flowing from the red cluster to the green cluster through the time node indicates a shift in research topics based on publication chronology. In other words, research on food production and availability formed the initial foundation that later evolved into prevalence research and regional-based food security analysis. This network demonstrates the comprehensive dynamics of research evolution, confirming that food security research is moving toward exploring more specific and regional issues in line with the growing need for more detailed and focused mapping of food security issues.

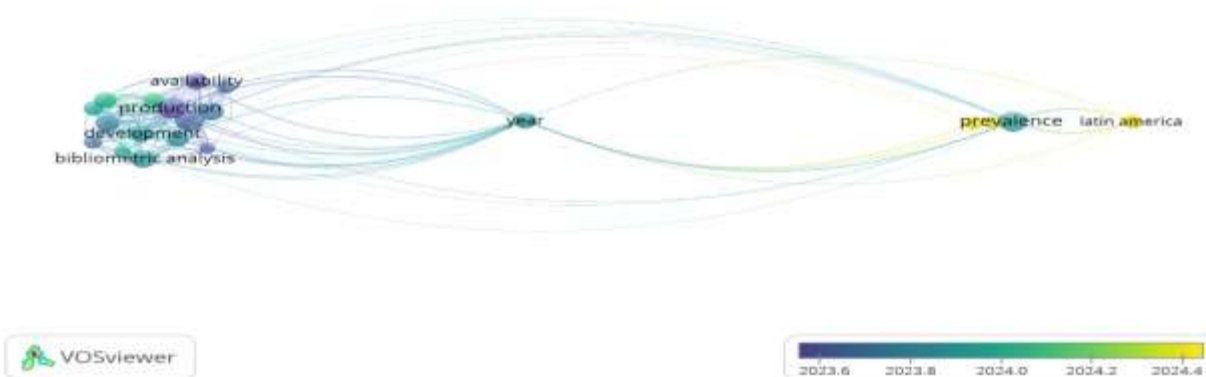


Figure 3 Overlay visualization

The overlay visualization provides an overview of the temporal development of food security research, particularly regarding changes in research focus based on publication year. In this visualization, nodes colored blue to purple represent research published in an older period (around 2023), while nodes colored green to yellow represent recent publications in 2024. This color pattern shows that topics such as production, availability, development, and bibliometric analysis dominated food security research in the early period before 2024, forming a blue-purple core of the literature centered on the left side of the graph.

As the color shifts toward green, the year node becomes a transition node, connecting older topics with new research directions. This green node indicates that the research focus in the 2023.8–2024 period underwent adjustments and opened up pathways to more specific topics. The intensity of the lines connecting the core nodes with the time nodes indicates that research development occurred gradually, not abruptly, but followed a consistent path from production themes to broader food security issues.

On the right side of the visualization, yellow nodes such as prevalence and Latin America indicate emerging topics that will be of primary research interest in 2024. The yellow color indicates that these terms are emerging trends in current scientific discourse. This reflects the shift in research focus from technical issues such as production, availability, and development to analyzing the prevalence of food security at a regional level. This shift reflects a shift in research paradigm, from a focus on production projections to mapping the impact and distribution of food security issues based on specific geographic regions.

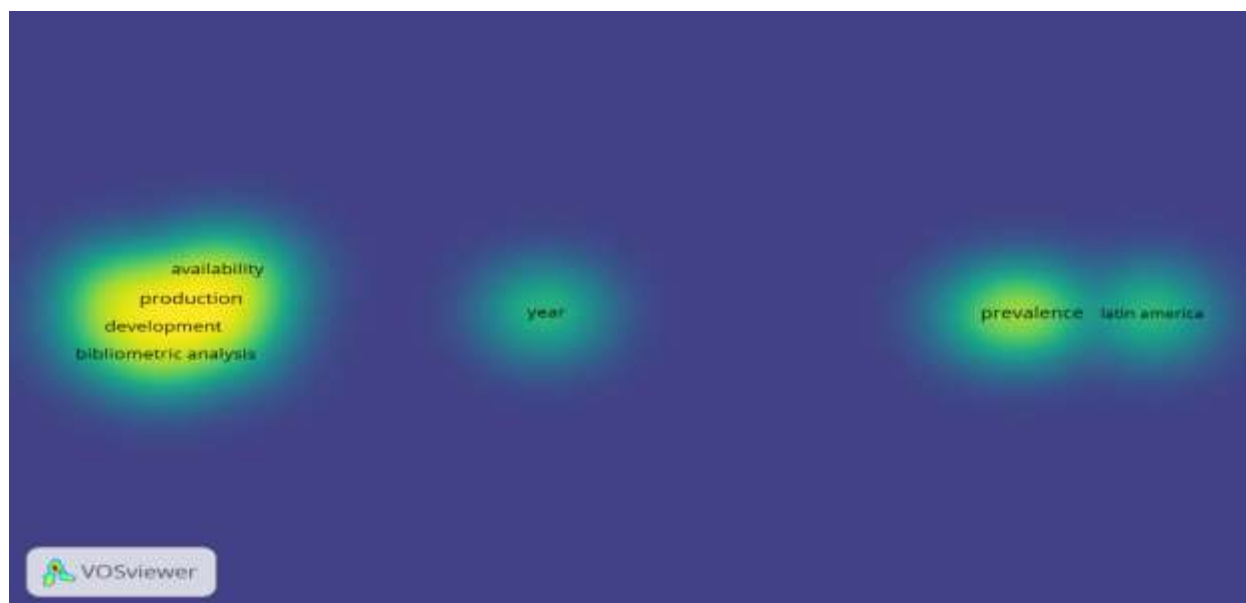


Figure 4 Density visualization

Density Map Interpretation: The density map provides an overview of the density of keyword occurrences in food security research. Areas colored yellow or light yellow indicate the highest density, indicating that these keywords are used most frequently and have the strongest relationships with other terms. In this visualization, keywords such as production, development, availability, and bibliometric analysis emerge as centers of highest density, reflecting the dominant focus in the literature. The density of these clusters indicates that these topics form the main foundation of the knowledge structure of food security research.

Areas colored green to yellow indicate intermediate density. On the right side of the map structure, keywords such as prevalence and Latin America appear in areas less dense than the core cluster, but still possess significant connectivity. This indicates that these topics are part of emerging research subthemes, although they are not yet as intensely used as the main cluster. This lower density indicates that research related to prevalence and regional mapping of food security remains a growing area and is attracting the attention of contemporary researchers.

The pattern of density distribution from left to right demonstrates a layered distribution of concepts. The high-density clusters on the left indicate a robust knowledge base, while the lower-density areas on the right indicate emerging areas of research. This suggests that food

security research is undergoing an expansionary phase, with the theoretical foundations and publications focused on production and availability issues established, and researchers now beginning to expand their focus to include prevalence and geographic analysis. Overall, this density map confirms that the food security literature is moving away from traditional focus areas toward exploring new, more contextual and specific issues.

➤ Discussion

The results of the bibliometric analysis displayed through network visualization indicate that research related to food security exhibits a strong inter-topic structure organized into several clusters. The main cluster is dominated by keywords such as production, availability, development, and bibliometric analysis. These keywords are located at the center of the network with a high degree of connectivity, indicating that most research in the field of food security still focuses on fundamental issues such as food production and availability. The very close interconnections between nodes indicate that these studies not only appear frequently but also conceptually reinforce each other.

Another cluster on the right side of the visualization displays keywords such as prevalence and Latin America, which tend to be positioned more separately from the main cluster. This situation indicates a shift in research focus toward studying the prevalence of food security based on specific regions. Although its connection to the main cluster is not as strong as the production and availability themes, the emergence of this cluster indicates that research is beginning to examine the impact of food security geographically and demographically. This shift in research direction also confirms that food security issues are viewed not only from a production perspective, but also from a distribution, equity, and vulnerability perspective in specific regions.

The overlay visualization results reinforce these findings by showing the chronological development of research. The blue and purple colors in the main cluster indicate that production and availability topics received greater attention in previous years. Conversely, the green to yellow colors in the right cluster indicate that research on prevalence and the Latin American region were emerging topics in the most recent publications in 2024. This confirms the research evolution from conceptual foundations to more specific and contextual empirical studies. Thus, the overlay

coloration pattern not only reflects research trends but also demonstrates the dynamic direction of research, shifting from generalization to localization.

The density map interpretation also demonstrates the consistency of this development direction. The dense red areas in the main cluster indicate that production, availability, and development are the most dominant focus of the literature and have a high keyword intensity. Meanwhile, the green to yellow areas in the new clusters show lower density, indicating that research on prevalence and regional aspects is still in the development stage. The varying levels of density across regions in this density map illustrate that food security research is in the process of diverging toward new subthematic focuses.

Overall, the results of this bibliometric analysis indicate that food security research has experienced significant development in recent years. A strong research foundation on aspects of food production and availability has provided a foundation for the development of new study focuses, such as the prevalence of food security and area-based analysis. The combination of network connectivity, temporal development, and thematic density provides a comprehensive understanding of how food security research has evolved globally. These findings are important as a basis for future researchers to identify research gaps, establish new research directions, and strengthen scientific contributions to strategic food security issues in various local and global contexts.

D. CONCLUSIONS AND SUGGESTIONS

➤ Conclusion

Based on the results of the bibliometric analysis, it can be concluded that research on food security is developing in two main streams. The first stream encompasses fundamental themes such as production, availability, development, and bibliometric analysis, which form the core of the research and demonstrates the dominance of studies on aspects of food production and availability. These themes are strongly interconnected, as seen in the network visualization and density map, which display a high density in these clusters. Thus, the technical aspects of food production remain a primary focus in the global scientific literature.

The second stream shows the development of research toward more specific, region-based contemporary issues, such as prevalence and Latin America. In the overlay visualization, this topic emerged as the latest trend, dominated by publications in 2024. This shift in focus indicates that food security research no longer solely focuses on food availability but also examines distribution, equity, and regional vulnerability to food security threats. This shift is significant because it indicates the need to understand food security in a more in-depth social, economic, and geographic context. Overall, current food security research shows an increasingly complex and multidimensional development. Previous research provides a strong foundation for new studies that focus more on regional issues and the prevalence of food security. These bibliometric findings can serve as a basis for researchers and policymakers in formulating new, more relevant, data-driven strategies to comprehensively improve food security.

➤ Recommendations

1. Based on the density of food production and availability themes in the bibliometric map, the government needs to strengthen food production strategies with sustainable technologies such as precision agriculture, modern irrigation, and innovative climate-resistant seeds. Agricultural modernization programs should be supported by incentives and training for farmers to ensure long-term production stability. Regional-Based Food Vulnerability Mapping. The emergence of prevalence topics and regional areas such as Latin America emphasizes the importance of mapping food vulnerability by region. Regional governments need to conduct regular food security prevalence surveys to map conditions on the ground, particularly in food-insecure areas. This data can be used to design more targeted interventions. Strengthening Food Distribution and Availability Systems. Because food availability and access remain the primary focus of the literature, food logistics policies need to be strengthened through the development of distribution infrastructure, storage warehouses, and cold chain systems to ensure food supplies remain secure despite weather disruptions or economic crises.
2. Given that bibliometric methods emphasize the importance of analyzing the latest scientific data, the government is advised to integrate big data, artificial intelligence, and integrated information systems to monitor food security in real time. Accurate data-driven policies will increase the effectiveness of intervention programs. Research trends moving toward

the regional level demonstrate the need for cooperation between countries on food security issues. The government needs to strengthen food diplomacy through regional and global partnerships, including technology exchange, joint research, and stable food trade.

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