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Association Rule Mining Across Multiple Domains: Systematic Literature Review

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Abstract: This Systematic Literature Review (SLR) synthesizes 50 studies published between 2020 and 2025 that applied Association Rule Mining (ARM) across multiple domains, using the PRISMA 2020 framework. The review examines application areas, algorithm choices, implementation tools, parameter settings, and emerging trends. Results indicate that transportation and market analysis are the most prominent domains, followed by healthcare, manufacturing, and governance, with smaller contributions from tourism, agriculture, energy, and the environment. Apriori remains the most widely used algorithm due to its simplicity, FP-Growth is preferred for efficiency, and hybrid or modified approaches are adopted to address scalability issues. Python dominates as the primary implementation tool, alongside RapidMiner and R-Studio, with parameter thresholds generally adapted to dataset size and domain-specific needs. The novelty of this review lies in providing a cross-domain synthesis of ARM, filling the gap left by prior reviews that were limited to specific fields or algorithms. This broader perspective reveals temporal trends and recurring challenges, particularly scalability and interpretability, while identifying opportunities such as integration with deep learning, real-time ARM, and cross-domain adaptation. By offering a structured overview of developments in ARM, this study contributes both conceptual insights and practical guidance, serving as a reference for optimizing applications and informing future research directions.

Keywords: Association Rule Mining, Data Mining, Multi-domain Applications, Systematic Literature Review, PRISMA

INTRODUCTION

Advances in science and technology have resulted in the accumulation of extensive unstructured and semi-structured data. To derive meaningful insights from such datasets, data mining methods are indispensable(Shahin et al., 2021). Association Rule Mining (ARM) is one of the core techniques in data mining, focusing on discovering relationships or patterns of co-occurrence among items within large datasets. ARM was first introduced by Agrawal, Imieliński, and Swami (1993), who formalized the use of support and confidence as fundamental measures for extracting association rules(Agrawal et al., 1993). This technique identifies frequent itemsets and generates association rules that reveal correlations between attributes (Waseem & Abidin, 2024). ARM has demonstrated its effectiveness across diverse domains, including consumer behavior analysis in the retail sector, disease pattern identification in healthcare, criminal pattern detection in law enforcement, process optimization in industrial settings, and cybersecurity monitoring. Its main advantage lies in its ability to uncover hidden insights from complex and heterogeneous data, enabling informed and data-driven decision-making.

Several review studies have attempted to synthesize the applications of ARM. For example, in (Diallo et al., 2024) focused on healthcare datasets. In (Aldino et al., 2021) compared Apriori and FP-Growth algorithms, while in (Chopvitayakun et al., 2024) examined ARM for market-based analysis. While insightful, these reviews remain narrow, restricted to single domains, limited algorithm comparisons, or short timeframes. To date, few studies have systematically mapped ARM trends across multiple domains while also comparing algorithmic variations, parameter settings, and implementation tools. Addressing this gap, the present Systematic Literature Review (SLR) aims to provide a comprehensive synthesis of ARM research between 2020 and 2025. Specifically, this study identifies trends in domain applications, algorithm adoption, and tool utilization, while highlighting emerging challenges and opportunities. By doing so, this review not only consolidates current knowledge but also offers practical guidance for researchers and practitioners in applying ARM effectively across diverse domains.

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The remainder of this paper is structured as follows: Section 2 describes the methodology adopted for conducting this SLR, including research questions, search strategy, and selection criteria. Section 3 presents the results of the literature analysis, followed by a discussion of key findings in Section 4. Finally, Section 5 provides the conclusions and recommendations for future research.

METHOD

This review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines to ensure transparency, consistency, and completeness in reporting. The adoption of PRISMA 2020 strengthens the methodological rigor of this study, allowing the review process to be more reproducible and systematically documented (Sohrabi et al., 2021).

Research Question (RQ)

The review is guided by the following questions:

A. RQ1: Which domains have most frequently implemented Association Rule Mining (ARM)?
B. RQ2: Which algorithms and variations are most commonly used across these domains?
C. RQ3: What tools and parameter configurations are prevalent in ARM research?
D. RQ4: What trends, challenges, and opportunities exist for future ARM research?

Review Process

This study adopted the PRISMA (Preferred Reporting Items for Systematic reviews and MetaAnalyses) 2020 methodology. The use of the PRISMA 2020 guidelines enhances the transparency, consistency, and comprehensiveness of systematic review reporting (Sohrabi et al., 2021). The process was divided into five stages:

Stage 1: Defining Article Eligibility Criteria

Articles were considered eligible if they (i) reported original research, (ii) were released between 2020 and 2025, and (iii) applied Association Rule Mining (ARM) techniques for pattern identification in any domain. Only journal and conference papers were included. Similar to the approach of previous systematic reviews, eligibility was determined using *Inclusion Criteria* such as requiring articles to represent original studies, be published within a defined time range, and directly analyze methods or tools relevant to the research scope(Ananda Mustari et al., 2024).

Stage 2: Defining Information Sources

Literature searches were conducted in ACM Digital Library, ScienceDirect, Scopus, IEEE Xplore, and Google Scholar. Forward and backward citation tracking was also used to identify additional relevant studies.

Stage 3: Literature Selection

The search retrieved 64,728 records. After removing duplicates and irrelevant items, 108 studies remained for screening. The selection process followed the PRISMA framework. The primary search keyword used was “association rule mining”, along with related terms such as “Apriori,” “FP-Growth,” and “ECLAT.” Titles of all retrieved records were first screened to exclude irrelevant studies, followed by abstract screening to assess alignment with the predefined inclusion criteria. Finally, full-text assessment was conducted to confirm methodological quality and relevance, resulting in a final dataset of 50 articles that met all requirements for analysis. The overall process is illustrated in the PRISMA 2020 flow diagram (Figure 1).

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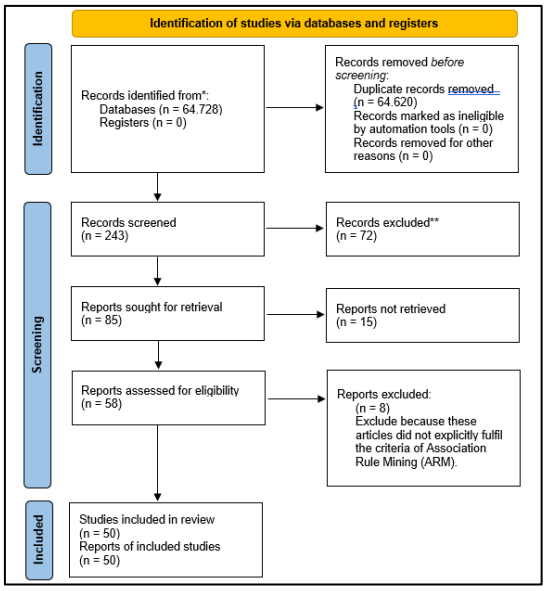

Fig. 1 Stages of The Systematic Literature Review (PRISMA Executive, n.d.)

Stage 4: Data Collection and Extraction

Data were extracted manually using a structured data extraction form designed to ensure consistency and reliability. For each included study, detailed information was recorded, including: (i) bibliographic data (title, authors, year, and country); (ii) research domain where ARM was applied (e.g., healthcare, transportation, e-commerce, environment); (iii) algorithms and variations implemented (e.g., Apriori, FP-Growth, ECLAT, or hybrid methods); (iv) tools or software platforms employed (such as Python, R-Studio, RapidMiner, or WEKA); (v) datasets and data sources used; (vi) parameter configurations (minimum support, confidence, or lift threshold); and (vii) evaluation metrics and key findings reported. This comprehensive approach allowed both quantitative mapping (e.g., frequency of algorithm usage or domain distribution) and qualitative synthesis (e.g., identifying emerging trends and research challenges). To minimize bias and maintain transparency, all extracted data were double-checked and organized into summary tables, which served as the foundation for the subsequent analysis. 50 articles were included in the final dataset. The details of the collected data are summarized in Table 1.

Table 1. Data Collection

Source	Studies Found (based on title and keywords) Association Rule Mining	Candidate	Selected
ACM Digital Library	17.480	12	4
Google Scholar	17.900	35	13
ScienceDirect	24.883	33	14
Elsevier (SCOPUS)	200	10	7
IEEE	2.765	9	7
Crossref	1.000	4	2
PubMed	500	5	3
Total			**50**

Stage 5: Data Item Selection and Quality Assessment

To ensure reliability, each study was assessed on: (i) clarity of research objectives, (ii) adequacy of methodological description, and (iii) relevance to ARM applications. Studies meeting at least two criteria were retained. The extracted data were synthesized quantitatively (frequency counts by year, domain, algorithm, tools) and qualitatively (analysis of trends, challenges, and opportunities).

RESULT

Overview of Selected Studies

This research aims to explore approaches used by previous studies to identify case patterns using data mining. In line with this objective, the study examines key elements for pattern and trend analysis in selected literature,

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including publication sources, years of publication, classification variables, and data mapping related to case pattern identification. Table 2 presents the publication resources.

Table 2. Publication Resources

No.	Title	Year	Type	Algorithm	Tools
1.	Association Rule Mining-based...(Diallo et al., 2024)	2024	Conference	Apriori	Not specified
2.	Apriori Algorithm-based...(Hu et al., 2023)	2023	Conference	Apriori	Python
3.	Association Mining Techniques for...(Y. Wang, 2024)	2024	Conference	Apriori	Not specified
4.	Analyzing Purchase Behavior…(Chopvitayakun et al., 2024)	2024	Conference	FP-Growth	RapidMiner
5.	Predicting Determinants of Mental…(Musa et al., 2025)	2025	Journal	Apriori	Not specified
6.	An Association Rule Mining Approach…(Hasan et al., 2024)	2024	Journal	FP-Growth	Python
7.	An Improved ECLAT Algorithm...(L. Wang et al., 2023)	2023	Conference	ECLAT	Python
8.	Resilience and Social Change…(Kim et al., 2023)	2023	Journal	FP-Growth	Python
9.	Association Rule Mining for Island…(Ziakopoulos et al., 2023)	2023	Conference	Apriori	R-Studio
10.	Mining Association Rules between...(Lawal et al., 2023)	2023	Journal	Apriori	R-Studio
11.	Identifying Patterns of Pedestrian ...(Sivasankaran et al., 2020)	2020	Conference	Apriori	R-Studio
12.	Association Rule Mining for Dynamic...(Schoch et al., 2024)	2024	Conference	Predictive Apriori	Python
13.	Association Mining of Coastline…(Yan et al., 2024)	2024	Journal	FP-Growth	MATLAB
14.	Analyzing Customer Reviews…(Awad & Mahmoud, 2021)	2021	Journal	FP-Growth	RapidMiner
15.	Product Bundling for Online...(Fang et al., 2022)	2022	Conference	Apriori	MATLAB
16.	Association Analysis of Causative…(Guo et al., 2025)	2025	Journal	Apriori	Gephi software
17.	Critical Patterns Associated with Vehicle...(Tamakloe & Adanu, 2024)	2024	Journal	Apriori	R-studio
18.	Investigating Patterns of Freeway…(Jaradat et al., 2025)	2025	Journal	Apriori	R-studio
19.	A Data Mining Approach to Investigate…(Montella et al., 2020)	2020	Journal	Apriori	RapidMiner
20.	A Parallel FP-Growth Mining Algorithm...(Yang et al., 2022)	2022	Journal	FP-Growth	R-studio
21.	Analyzing Factors that Influence...(Chen et al., 2020)	2020	Journal	FP-Growth	RapidMiner
22.	Association Rule Learning to Improve …(Chung et al., 2020)	2020	Journal	Apriori	Python
23.	Characteristics Analysis of...(Huang et al., 2023)	2023	Journal	Apriori	RapidMiner
24.	Applying Association Rule Mining...(Machfudiyanto et al., 2023)	2023	Journal	Apriori	Python
25.	Association Rule Implementation...(Kristiana et al., 2020)	2020	Journal	Apriori	RapidMiner
26.	An Apriori Algorithm-Based...(Lu et al., 2021)	2021	Journal	Apriori	R-studio
27.	Apriori Algorithm for the Data Mining…(Li et al., 2021)	2021	Journal	Apriori	Python
28.	Application of Association Rules to…(Maneiro et al., 2025)	2025	Journal	Apriori	R-studio

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29.	Analysis of Agricultural Product P…(Masdiyasa et al., 2022)	2022	Conference	FP-Growth	RapidMiner
30.	Implementation of Association Rule...(Widodo et al., 2025)	2025	Conference	FP-Growth	R studio
31.	Association Rules Mining in Crime…(Kovalchuk et al., 2024)	2024	Conference	FP-Growth	RapidMiner
32.	Implementation of Text Association…(Bahaweres & Nugrahanti, 2022)	2022	Conference	FP-Growth	RapidMiner
33.	Cause Analysis of Traffic Accidents...(Cai, 2020)	2020	Journal	Apriori	Not specified
34.	Research on Academic Warning...(Du et al., 2024)	2024	Conference	Apriori	Not specified
35.	Association Rule Mining for Require…(Gobov & Sokolovskiy, 2023)	2023	Conference	Apriori	Not specified
36.	Identifying Rural Development…(Primanda & Oktora, 2024)	2024	Journal	Apriori	R-studio
37.	Application of the ECLAT Algorithm...(Setiawan et al., 2024)	2024	Journal	ECLAT	R-studio
38.	Applying Association Rule Mining...(Shastri, 2020)	2020	Journal	Apriori	R-studio
39.	Analysis of Rural Tourism Demand...(Jiang, 2021)	2021	Journal	FP-Growth	Not specified
40.	An Apriori Algorithm-Based Association …(Hassan et al., 2023)	2023	Journal	Apriori	R-studio
41.	Unveiling the Causes of Fatal Road...(Riyadh Alboalebrah & Al-augby, 2025)	2025	Journal	Apriori	Python
42.	An Improved Apriori Algorithm for…(Peng et al., 2023)	2023	Journal	Apriori	Python
43.	Application of Data Mining in the...(Recommender System et al., 2024)	2024	Journal	FP-Growth	RapidMiner
44.	Implementation of Apriori Algorithm…(Triayudi, 2022)	2022	Journal	Apriori	Not specified
45.	Implementation of Data Mining Using...(Almira et al., 2021)	2021	Journal	FP-Growth	WEKA
46.	Data Tracer Study Analysis in Higher…(Septianto & Musodo, 2024)	2024	Journal	FP-Growth	Orange
47.	Correlation Between Migrant Worker…(Elfira Iriani et al., 2024)	2024	Journal	Apriori	WEKA
48.	Occupational Correlation to the Level...(Adlin Revaldi et al., 2023)	2023	Journal	Apriori	WEKA
49.	Data Mining Applications: The Sample...(Kiraz & Hüseyin, 2020)	2020	Journal	FP-Growth	RapidMiner
50.	Analysis of The Relationship of Tourist...(Bunsaman et al., 2021)	2021	Conference	FP-Growth	RapidMiner

The temporal distribution shows a steady increase in ARM-related publications between 2020 and 2025, peaking in 2024 with 14 studies (28% of the dataset). However, 2025 records a slight decline (4%), likely because the year was still ongoing at the time of data collection. This upward trajectory reflects the growing adoption of ARM across domains and suggests that research interest continues to expand.

RQ1 – Which domains have most frequently implemented Association Rule Mining (ARM)?

The selected studies were categorized into several application domains based on the primary focus of each research. Manual classification was performed using the titles, abstracts, and keywords of each study.

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Table 3. Mapping of Domains

No.	Domain	Resources
1.	Healthcare and Safety	(Diallo et al., 2024; Guo et al., 2025; Hassan et al., 2023; Lu et al., 2021; Musa et al., 2025)
2.	Market and E-commerce	(Awad & Mahmoud, 2021; Chopvitayakun et al., 2024; Fang et al., 2022; Setiawan et al., 2024; Triayudi, 2022; Y. Wang, 2024; Widodo et al., 2025)
3.	Education	(Du et al., 2024; Kiraz & Hüseyin, 2020; Peng et al., 2023; Recommender System et al., 2024; Septianto & Musodo, 2024)
4.	Agriculture	(Kristiana et al., 2020; Masdiyasa et al., 2022)
5.	Transportation	(Cai, 2020; Chen et al., 2020; Chung et al., 2020; Huang et al., 2023; Jaradat et al., 2025; Montella et al., 2020; Riyadh Alboalebrah & Al-augby, 2025; Sivasankaran et al., 2020; Yang et al., 2022; Ziakopoulos et al., 2023)
6.	Manufacturing	(Hasan et al., 2024; Hu et al., 2023; Machfudiyanto et al., 2023; Schoch et al., 2024; L. Wang et al., 2023)
7.	Tourism	(Bunsaman et al., 2021; Jiang, 2021)
8.	Crime and Law	(Bahaweres & Nugrahanti, 2022; Kovalchuk et al., 2024; Tamakloe & Adanu, 2024)
9.	Governance/Social	(Adlin Revaldi et al., 2023; Elfira Iriani et al., 2024; Kim et al., 2023; Li et al., 2021; Primanda & Oktora, 2024)
10.	Environment	(Lawal et al., 2023; Yan et al., 2024)
11.	Sports	(Maneiro et al., 2025; Shastri, 2020)
12.	Energy/Utilities	(Almira et al., 2021)

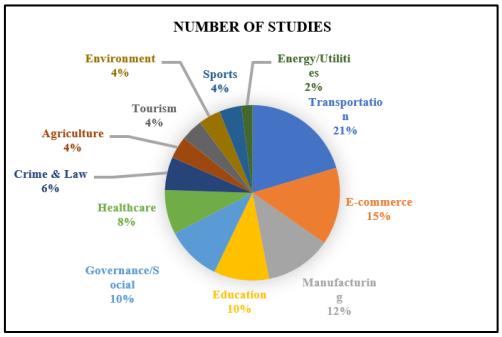

Fig. 2 Proportion of Application Domains in ARM Studies (2020 – 2025)

From the 50 selected studies, ARM applications were distributed across diverse domains. The most frequent domain was transportation (21%, 11 studies), followed by e-commerce (15%, 8 studies), manufacturing (12%, 6 studies), governance/social (10%, 5 studies), education (10%, 5 studies), healthcare (8%, 4 studies), and crime & law (6%, 3 studies). Smaller proportions were found in tourism (4%, 2 studies), agriculture (4%, 2 studies), environment (4%, 2 studies), sports (4%, 2 studies), and energy/utilities (2%, 1 study). This distribution highlights the dominance of ARM in transportation and commercial contexts, where large-scale transaction and mobility data are abundant. At the same time, the presence of ARM in domains like healthcare, governance, and law enforcement shows its expanding applicability beyond market-driven areas (Figure 2).

RQ2 – Which algorithms and variations are most commonly used across these domains?

Selected studies indicate that a small group of algorithms dominates ARM implementations. Apriori is the most frequently applied, appearing in over half of the reviewed works, primarily due to its conceptual simplicity, straightforward implementation, and suitability for small to medium datasets. FP-Growth follows as the second most common algorithm, valued for its efficiency in handling larger datasets without candidate generation. ECLAT is applied less frequently but remains relevant in scenarios requiring intersection-based computation of frequent itemsets. Hybrid and modified methods, such as Predictive Apriori and Parallel FP-Growth combinations with text mining, indicating a trend toward optimization for speed, scalability, and domain-specific constraints.

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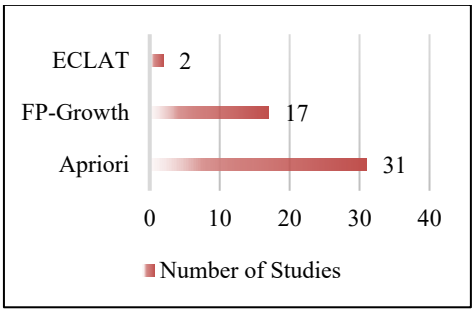

Fig. 3 Usage Distribution of ARM Algorithms in Selected Studies (2020 – 2025)

The analysis shows that Apriori dominates with 31 studies (62%), followed by FP-Growth (17 studies, 34%), ECLAT (2 studies, 4%). Apriori remains popular due to its ease of interpretation, although FP-Growth and ECLAT are increasingly chosen for large-scale data because of their efficiency. Among the identified algorithms, Apriori, FP-Growth, and ECLAT dominate the implementation of ARM across studies, reflecting their robustness and wide applicability (Figure 3). Variations of these core algorithms, such as improved versions or modifications, were also noted in some studies, though not explicitly visualized in the figure.

RQ3 – What tools and parameter configurations are prevalent in ARM research?

Based on the data presented in Table 2, the selected studies utilized a range of tools to implement Association Rule Mining (ARM). With respect to tools, Python emerged as the most widely adopted (21 studies, 42%), followed by R-Studio (9 studies, 18%), RapidMiner (6 studies, 12%), WEKA (3 studies, 6%), MATLAB (2 studies, 4%), Orange (2 studies, 4%), and Gephi (1 study, 2%). Meanwhile, 6 studies (12%) did not specify the tool used.

The predominance of Python reflects its versatility and rich ecosystem, while R-Studio is valued for statistical modeling. RapidMiner, WEKA, and Orange were mainly employed in educational or small-scale analytical studies. A number of studies did not specify the tools used, which may indicate the use of custom-coded solutions or built-in functionalities within larger data processing environments.

Figure 4 illustrates the proportion of tools applied in the selected studies, highlighting the predominance of Python while also showing the diversity of software environments employed in ARM research.

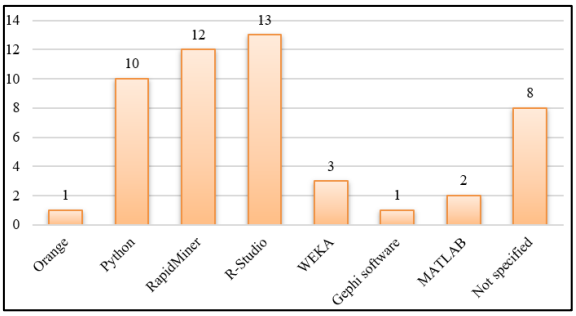

Fig. 4 Distribution of Tools Used in Selected Studies (2020 – 2025)

In addition to the tools used, the selected studies reported varying parameter configurations depending on dataset size, domain requirements, and target rule strength. The minimum support threshold typically ranged from 0,1% to 5% in large datasets and 10% to 20% in smaller datasets, balancing the discovery of relevant rules with computational efficiency. Minimum confidence values were most often set between 50% and 80%, with higher thresholds applied in sensitive domains such as healthcare or accident prevention to ensure robust and actionable rules. Some studies also employed additional measures such as lift (usually > 1) to identify positively correlated itemsets and conviction (> 1) to evaluate directional dependency. These configurations reflect a trade-off between capturing rare but critical associations and maintaining rule quality for decision-making purposes.

Table 4. Common Parameter Configurations in Selected Studies

Parameter	Typical Range	Observed Usage Context
Minimum Support	0.1% – 5% / 10% – 20%	Low thresholds (0.1–5%) for large datasets to capture rare but important patterns; high thresholds (10–20%) for small datasets to ensure statistical relevance

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Minimum Confidence	50% – 80%	Higher thresholds (>70%) in critical domains such as healthcare, traffic safety, and fraud detection to ensure actionable reliability
Lift	> 1	Applied to ensure positive correlation between antecedent and consequent, often used in market analysis and product bundling
Conviction	> 1	Measures the strength of implication; used in domains requiring directional dependency such as accident causation studies

Based on Table 4, parameter settings such as minimum support and confidence thresholds were commonly reported, although several studies did not explicitly mention their configurations.

RQ4 – What trends, challenges, and opportunities exist for future ARM research?

The publication trend shows a clear temporal pattern: 8 studies in 2020, 6 in 2021, 5 in 2022, 11 in 2023, 14 in 2024, and 6 in 2025. The number of publications peaked in 2023–2024, followed by a decline in 2025. This indicates increasing research interest in ARM during the early 2020s, coinciding with advancements in computational tools and the post-pandemic digitalization wave. Challenges identified include scalability to very large datasets, algorithm optimization, and interpretability of results for decision-making. Opportunities lie in applying ARM to emerging domains such as smart cities, sustainability, and cybersecurity, where big data continues to expand rapidly.

The analysis of 50 selected studies shows a growing diversification of ARM applications beyond its traditional roots in market basket analysis. The most active domains are transportation & market-related analysis, healthcare, and public safety/crime prevention, indicating ARM's adaptability to both commercial and societal problem-solving contexts. Several works demonstrate the customization of ARM algorithms, such as improved Apriori, weighted rule mining, and parallel implementations, mainly to improve efficiency and scalability. Another notable trend is the expansion into non-traditional data sources, including unstructured social media text, spatial-environmental datasets, and accident investigation reports, reflecting the method's flexibility. ARM has also begun to appear in emerging data-rich environments like IoT-enabled monitoring systems and smart cities, though still in early stages compared to more mature domains.

DISCUSSIONS

Trend analysis based on publication year (Figure 5) shows that the number of ARM-related publications has generally increased over the years, with a noticeable rise between 2023 and 2024, followed by a slight decline in 2025. This trend suggests growing research interest in ARM applications across various sectors, potentially driven by advancements in computational tools and the increasing availability of large-scale datasets.

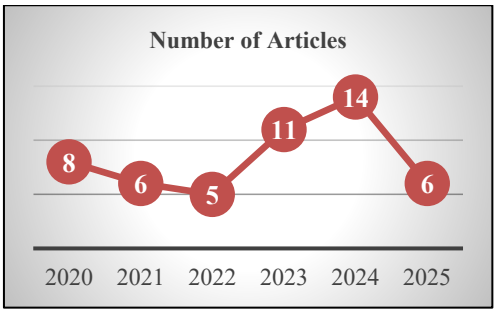

Fig. 5 Publication Trend of ARM Studies (2020 – 2025)

The temporal trend shows a steady rise in ARM-related publications, peaking in 2024 (14 studies) before a slight drop in 2025. This reflects both growing interest and potential saturation in certain domains.

RQ1 – Which domains have most frequently implemented Association Rule Mining (ARM)?

The review indicates that Transportation and e-commerce jointly dominate ARM applications, representing over one-third of the selected studies, consistent with earlier reviews that emphasized its role in crash-risk analysis and market basket strategies (Aldino et al., 2021; Diallo et al., 2024). Concrete applications include traffic accident prediction in China, Greece, and India, as well as consumer behavior modeling for digital marketing. The temporal trend shows a steady increase from 2020 to a peak in 2024 (14 studies, 28%), before a slight drop in 2025. Beyond these dominant areas, ARM has been applied in healthcare for mental health assessment, in governance for community development, and in crime analysis for detecting criminal patterns. The novelty of this review lies in mapping ARM across multiple domains rather than a single sector, providing a comprehensive perspective.

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Practically, the findings highlight ARM's value for policymakers and practitioners in traffic safety, healthcare resource planning, marketing optimization, and public-sector decision-making.

RQ2 – Which algorithms and variations are most commonly used across these domains?

The analysis shows that Apriori remains the most widely applied algorithm (46%), followed by FP-Growth (34%) and Eclat (20%). Previous reviews (e.g., Aldino et al., 2021) also found Apriori's dominance, mainly due to its simplicity and interpretability. However, our findings emphasize a temporal shift: while Apriori was heavily used in early 2020s studies, recent works increasingly adopt FP-Growth and Eclat for efficiency in handling larger datasets. Concrete examples include FP-Growth applied in retail product bundling and Eclat used in manufacturing diagnostics. This broader, cross-domain mapping distinguishes the present review from prior domain-specific studies, providing evidence of gradual diversification. From a practical standpoint, the results suggest that although Apriori remains the default for entry-level ARM, future research and applications may lean toward hybrid or optimized variations that balance accuracy with scalability.

RQ3 – What tools and parameter configurations are prevalent in ARM research?

The predominance of Python highlights a strong shift toward open-source, script-based workflows in ARM research, offering flexibility and reproducibility across domains. Visual tools such as RapidMiner and R-Studio also maintain relevance, particularly in educational and applied settings. Parameter configurations are rarely applied uniformly; instead, thresholds are adjusted based on domain priorities. For example, low support values are adopted in healthcare studies to detect rare but critical associations, while higher confidence thresholds ensure reliability in transportation safety analyses. The frequent use of lift and conviction adds interpretability, ensuring that generated rules are both statistically significant and practically meaningful. These practices emphasize the movement toward more domain-sensitive and application-driven ARM implementations.

RQ4 – What trends, challenges, and opportunities exist for future ARM research?

The reviewed studies consistently highlight scalability and data imbalance as major challenges, particularly in large-scale domains such as transportation and healthcare, where rare but critical patterns are easily overlooked. These findings align with prior SLRs that noted similar limitations in high-dimensional datasets. Concrete examples include accident analysis studies struggling with imbalanced crash data and healthcare research constrained by privacy restrictions. The unique contribution of this review lies in mapping these recurring issues across multiple domains, rather than within a single sector, providing a broader perspective. Temporal analysis further shows that while early studies focused mainly on market analysis, recent works increasingly explore real-time ARM, IoT-enabled analytics, and cross-domain adaptation. Practically, this suggests that future ARM research should emphasize integrating deep learning for complex data, adopting streaming approaches for rapid decision-making, and leveraging interactive visualization tools to support policymakers and practitioners in traffic safety, healthcare management, and public policy.

CONCLUSION

This systematic literature review of 50 studies (2020–2025) demonstrates the novelty of providing a comprehensive cross-domain mapping of Association Rule Mining (ARM), going beyond prior reviews that were often confined to single domains or algorithms. The findings show transportation and market-based analysis as the dominant application areas, followed by healthcare, crime prevention, education, and other emerging fields. Apriori remains the most widely used algorithm for its simplicity, while FP-Growth addresses efficiency, and modified variants tackle scalability challenges. Python dominates as the primary implementation tool, supported by RapidMiner and R-Studio, with parameter settings adapted to domain-specific needs. The contribution of this review is twofold: theoretically, it consolidates fragmented ARM research into a structured cross-domain perspective, and practically, it offers actionable guidance for researchers and practitioners in applying ARM to contexts such as traffic safety, healthcare diagnostics, manufacturing optimization, and e-commerce personalization. Looking forward, future research should integrate ARM with deep learning, enable real-time applications, promote cross-domain adaptation, and advance visualization methods to enhance decision-making and practical adoption.

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