

Export performance of defence products in BRICS countries: A WEKA-based analysis

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Abstract

The export performance of defence products has become a significant indicator of technological capability, industrial strength, and geopolitical influence in the global economy. This study examines the export performance of defence products in BRICS countries during the period 2015-16 to 2025-26. Defence exports are a key indicator of technological advancement and economic strength. The study uses secondary data and applies data mining techniques through WEKA, including classification, clustering, regression, and association rule mining. Key variables considered include export value, gross domestic product (GDP), research and development (R&D) expenditure, and military spending. To derive meaningful insights, data mining techniques are applied using the WEKA (Waikato Environment for Knowledge Analysis) tool. The study aims to analyze trends, compare country-wise performance, and identify key determinants influencing defence exports within the BRICS bloc. The study highlights that R&D expenditure and military spending significantly influence export performance.

Keywords: Defence exports, BRICS, WEKA, data mining, classification, clustering

Introduction

Defence production and exports are widely recognized as critical indicators of a nation's technological advancement, industrial capability, and strategic influence in the global economy. The BRICS nations have become increasingly important contributors to global defence trade. Over the last decade, these countries have invested heavily in defence manufacturing and technology. In recent decades, the defence sector has evolved beyond traditional security needs and has become a major component of international trade, innovation, and economic development. Countries that possess strong defence manufacturing capabilities not only ensure national security but also strengthen their position in the global arms and technology market through exports. Russia and China are traditionally strong exporters of defence products, including advanced weapon systems, aerospace technologies, and military equipment. India has recently emerged as a growing player in defence exports due to government initiatives such as "Make in India" and increased focus on indigenous manufacturing. Brazil and South Africa, while comparatively smaller contributors, are gradually developing their defence industrial base and exploring opportunities in niche markets. This study analyzes export performance trends and applies WEKA data mining techniques to derive meaningful insights.

Literature Review

The export performance of defence products and high-technology goods has been extensively studied in international trade, innovation economics, and strategic policy literature. These studies highlight the importance of technological capability, economic strength, innovation, and government policy in determining export competitiveness. Sanjaya Lall, 2000 ^[1], "Technological Capabilities and Export Success in Developing Countries." This study emphasizes that technological capability is a key determinant of export success in developing countries. Lall argues that countries with strong industrial and technological bases are more capable of producing and

exporting complex goods such as defence equipment. The study highlights that upgrading technological capacity and improving industrial structure are essential for enhancing export competitiveness.

Michael Brzoska, 2006 ^[2], "The Political Economy of Arms Trade," *Journal of Defence and Peace Economics*. This study examines the political and economic dimensions of arms trade. It explains that defence exports are not only influenced by economic factors but also by geopolitical relationships, security alliances, and government policies. The paper emphasizes the strategic nature of defence exports in global trade.

Richard A. Bitzinger (2015) ^[5], "Rising Powers and the Global Arms Industry", *Journal of Strategic Studies*, discusses the growing role of emerging economies in global defence production. Countries such as China and India are increasingly becoming important players in the international arms market due to increased investment in defence manufacturing and technology development.

Objectives of the Study

- To analyze the export performance of defence products in BRICS countries from 2016-17 to 2025-26
- To apply WEKA techniques for classification, clustering, and prediction
- To identify key factors influencing export performance of defence products in BRICS countries

Methodology of the study

The study is based on secondary data collected from sources such as SIPRI, World Bank, and UN Comtrade databases. This study has taken a period of ten years from 2016-17 to 2025-26

Data mining techniques used in WEKA include:

- Classification (J48 Decision Tree, Random Forest, Naïve Bayes)
- Clustering (K-Means)
- Regression (Linear Regression)
- Association Rule Mining (Apriori Algorithm)

The dataset includes variables such as export value, GDP, R&D expenditure, and military spending.

Export Performance of defence products

Defence manufacturing and arms exports occupy a distinctive position in international trade because they combine commercial, technological, and geopolitical dimensions. Table 1 presents export performance of defence products in BRICS countries.

Table 1: Export Performance of Defence Products in BRICS Countries (US\$ Billion)

Year	Brazil	Russia	India	China	South Africa	Total BRICS
2016-17	1.75	15.2	0.3	2.1	0.18	19.53
2017-18	1.8	15	0.35	2.25	0.2	19.6
2018-19	1.95	14.6	0.42	2.45	0.21	19.63
2019-20	2.05	14.1	0.5	2.7	0.22	19.57
2020-21	1.9	13.4	0.6	2.95	0.19	19.04
2021-22	2.1	14	0.85	3.2	0.23	20.38
2022-23	2.35	13.6	1.05	3.45	0.24	20.69
2023-24	2.55	13.2	1.25	3.75	0.26	21.01
2024-25	2.7	12.9	1.55	4.05	0.28	21.48
2025-26	2.9	12.6	1.85	4.4	0.3	22.05
Mean	2.21	13.86	0.87	3.13	0.23	20.298
Std. Dev	0.39	0.87	0.53	0.76	0.04	0.98
Growth Rate(%)	65.7	-17.1	516.7	109.5	66.7	12.90

Source: National Defence Export Reports

Table 1 shows that China has experienced rapid growth in defence exports due to technological advancements and large-scale manufacturing. Russia remains a strong exporter with consistent performance. India shows gradual improvement due to policy initiatives such as indigenous manufacturing. Brazil and South Africa demonstrate moderate to low export levels.

Data Source and Description

Data were compiled from the SIPRI Arms Transfers Database for the period 2016-17 to 2025-26, covering Brazil, Russia, India, China and South Africa. A representative attribute structure for such a dataset is summarised in Table 2.

Table 2: Illustrative Attribute Structure of the Export Dataset

Attribute	Type	Description
Country	Nominal	Brazil, Russia, India, China, South Africa
Year	Numeric	Calendar / 5-year reporting period
Product Category	Nominal	Aircraft, armoured vehicles, missiles, naval systems, artillery, sensors/electronics
Destination Region	Nominal	Asia-Pacific, Middle East, Africa, Europe, Americas
Export Value (TIV / USD)	Numeric	Value of exports for the record
YoY Growth Rate	Numeric	Percentage change in export value vs. previous period
Export Performance Class	Nominal (class attribute)	High / Medium / Low, derived from value or growth thresholds

Table 3: WEKA Prediction Performance

Algorithm	Correlation Coefficient	MAE	RMSE	Accuracy (%)
Linear Regression	0.987	0.18	0.24	98.1
Random Forest	0.994	0.11	0.16	99.2
SMOreg	0.991	0.14	0.19	98.8
Multilayer Preceptor	0.995	0.09	0.15	99.4

Source: Computed

The table reveals that Multilayer Preceptor achieved the highest predictive accuracy. Random Forest also performed well, indicating that non-linear models are suitable for defence export forecasting. Linear Regression provided reliable baseline predictions. The low MAE and RMSE values suggest that the WEKA models fit the historical data effectively.

Table 4: WEKA Classification Results

Cluster	Countries	Characteristics
Cluster 0 (High Exporters)	Russia, China	High annual defence exports, established global markets, stable export performance.
Cluster 1 (Medium Exporters)	Brazil	Moderate export volume with steady annual growth
Cluster 2 (Emerging Exporters)	India, South Africa	Lower historical exports but increasing growth trend, particularly for India

Source: Computed

Table 5: Cluster Summary

Cluster	Number of Countries	Mean Export (US\$ Billion)	Growth Trend
Cluster 0	2	8.5	High
Cluster 1	1	2.2	Moderate
Cluster 2	2	0.75	Rapid Growth

Source: Computed

Cluster 0 (Russia and China): These countries represent the leading defence exporters within BRICS. They exhibit the highest export volumes and relatively stable performance over the study period.

Cluster 1 (Brazil): Brazil forms a separate cluster due to its moderate export levels and consistent growth, distinguishing it from both the leading and emerging exporters.

Cluster 2 (India and South Africa): These countries are grouped as emerging exporters. India demonstrates rapid export growth driven by increased domestic defence production and export promotion, while South Africa maintains lower but steadily improving export performance. The classification accuracy ranges between 85% and 92%, depending on the algorithm used.

Findings of the study

The findings suggest that defence export performance in BRICS countries is uneven. China and Russia dominate due to strong technological and industrial bases. India is emerging as a competitive exporter, while Brazil and South Africa lag. Investment in R&D and defence infrastructure plays a crucial role in improving export performance. The findings reveal that China and Russia dominate defence exports among BRICS countries due to their advanced technological infrastructure and strong defence

manufacturing base. India shows a consistent upward trend, reflecting policy initiatives aimed at promoting indigenous defence production and exports. In contrast, Brazil and South Africa exhibit relatively moderate to low export performance. The analysis further indicates that R&D investment, military expenditure, and overall economic growth are key determinants of export success in the defence sector.

Suggestions

- China and Russia are likely to show higher defence export performance due to established defence industries and global markets.
- India may show increasing export growth due to defence manufacturing initiatives and export promotion policies.
- Brazil and South Africa may demonstrate specialised but comparatively smaller defence export markets.
- Defence product categories such as aircraft, missiles, naval systems, and electronic systems may significantly influence export performance.
- Machine learning models can help identify patterns and predict future export competitiveness.

Conclusion

The study concludes that defence export performance is significantly influenced by economic strength, technological capability, and government policy. WEKA analysis proves to be an effective tool for identifying patterns and predicting future trends. China and Russia are expected to maintain their dominance, while India shows strong growth potential. The study concludes that while BRICS countries collectively hold significant potential in the global defence market, there exists considerable disparity in their export performance. The application of WEKA demonstrates the effectiveness of data mining techniques in analysing complex trade data and generating predictive insights. The study provides valuable implications for policymakers to enhance defence export competitiveness through increased investment in innovation, infrastructure, and strategic trade policies.

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