Title: Analysis of U.S. Army Ground Combat System Spending (2016-2020)

Understanding how military spending evolves over time is critical for assessing defense readiness and strategic priorities. This project analyzes departmental expenditures on major Ground Combat Systems (GCS) programs, focusing on the Abrams tank (M1A1), Bradley fighting vehicle (M2A1), and Stryker armored personnel carrier (M1130) from 2016 to 2020. The study examines key vendors, funding sources, contracting offices, and technological acquisitions while evaluating the long-term outlook of these systems. A notable finding is the sharp rise in spending for the Abrams Tank, peaking in 2018 at $1,526,727,171.02, signaling a transition from procurement to modernization. This shift suggests that while the Abrams remains a vital asset, future funding will prioritize upgrades rather than new purchases. Understanding these patterns helps assess the efficiency of military investments and their alignment with evolving defense needs.

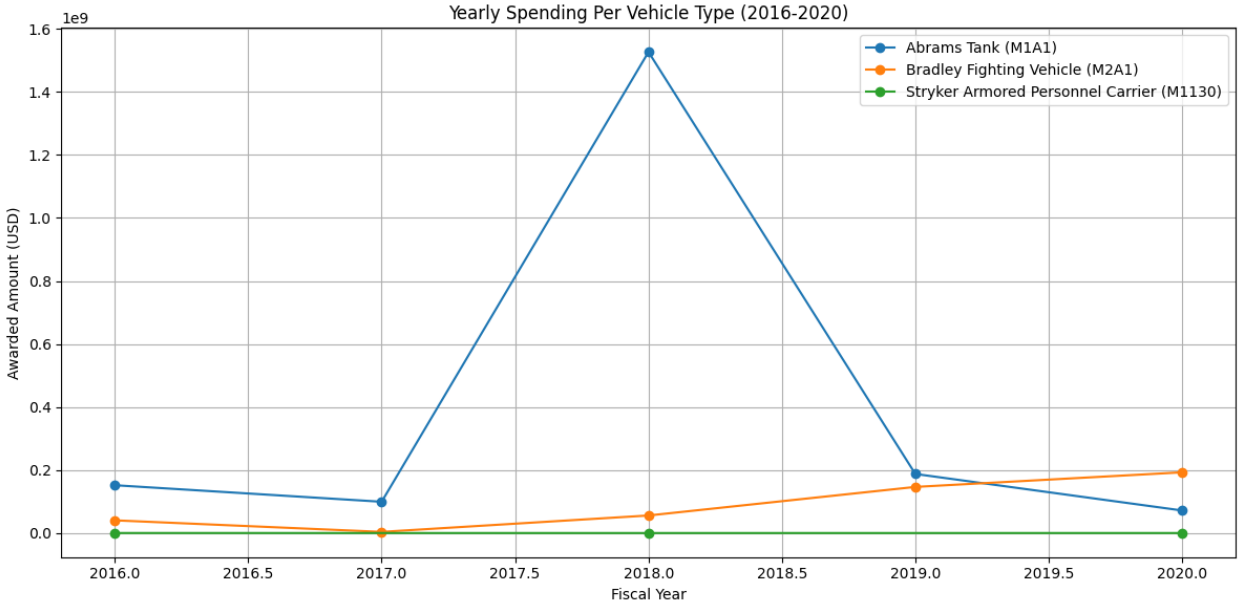
One of the major challenges from the outset was normalizing and cleaning the data to ensure it was usable for analysis. I began by refining the dataset in Excel, organizing the data from 2016 to 2020 while removing any irrelevant entries that could affect accuracy. The data was then split into three categories—Abrams Tank, Bradley Fighting Vehicle, and Stryker Armored Personnel Carrier—using Excel's "Filter" function and keyword searches, such as "Abrams Tank" and "M1A1." This process streamlined the dataset, making it more structured and readable before further refinement in Python. Next, I uploaded the cleaned dataset into a Google Colab notebook, where I programmed loops to categorize, filter, and analyze the data by year, breaking down costs and obtaining a count and total for each vehicle type. By creating substrings for relevant rows, converting titles into standardized strings, removing duplicate IDs, and applying specific filters, I ensured data integrity. Finally, I verified my findings by cross-referencing the counts in Excel and computing the total awarded amounts for each vehicle type, providing a structured and reliable view of yearly spending:

Yearly Spending Per Vehicle Type (2016-2020):

	Fiscal Year	Vehicle Type	Awarded Amount
0	2016	Abrams Tank (M1A1)	$151,788,506.55
1	2016	Bradley Fighting Vehicle (M2A1)	$40,331,662.50
2	2016	Stryker Armored Personnel Carrier (M1130)	$93,795.80
3	2017	Abrams Tank (M1A1)	$99,325,682.09
4	2017	Bradley Fighting Vehicle (M2A1)	$3,681,281.56
5	2018	Abrams Tank (M1A1)	$1,526,727,171.02
6	2018	Bradley Fighting Vehicle (M2A1)	$55,731,234.33
7	2018	Stryker Armored Personnel Carrier (M1130)	$0.00
8	2019	Abrams Tank (M1A1)	$187,504,854.77
9	2019	Bradley Fighting Vehicle (M2A1)	$146,409,963.70
10	2020	Abrams Tank (M1A1)	$71,578,475.35
11	2020	Bradley Fighting Vehicle (M2A1)	$192,740,929.58
12	2020	Stryker Armored Personnel Carrier (M1130)	$50,000.00

Total Counts and Awarded Amounts per Vehicle Type (2016-2020):

	Vehicle Type	Total Count	Awarded Amount
0	Abrams Tank (M1A1)	314	$2,036,924,689.78
1	Bradley Fighting Vehicle (M2A1)	105	$438,895,071.67
2	Stryker Armored Personnel Carrier (M1130)	6	$143,795.80



After analyzing the data, I generated supporting graphs, which revealed that the Abrams tank was undergoing a procurement shift, transitioning from upgrades to full-scale modernization. In contrast, spending on the Bradley Fighting Vehicle and Stryker Armored Personnel Carrier was significantly lower, prompting me to investigate further. I found a 2016 Congressional Research Service report titled The Army's M-1 Abrams, M-2/M-3 Bradley, and M-1126 Stryker: Background and Issues for Congress. This report detailed the roles of these vehicles in the U.S. Army, modernization efforts, and potential replacements, such as the Future Fighting Vehicle (FFV) for the Bradley. It also highlighted concerns about sustaining the domestic armored vehicle industrial base due to force reductions and limited foreign sales. Congress was weighing critical decisions on upgrades, Active Protection Systems (APS) integration, and enhanced weaponry for the Stryker. The spending trends in 2018 confirmed that the Abrams modernization was a strategic priority, while the Bradley was being phased out, with potential plans for Stryker upgrades in the future.

The modernization of military ground vehicles emphasizes the integration of Active Protection Systems (APS) for the Abrams and Bradley, as well as significant investments in software upgrades and digitization to enhance combat effectiveness. These advancements aim to improve battlefield survivability, streamline operations, and ensure adaptability to emerging threats. However, vendor concentration remains a critical concern, with General Dynamics serving as the dominant contractor for these programs. This high level of reliance on a single supplier introduces risks, including potential cost inflation, supply chain vulnerabilities, and

limited innovation due to reduced competition. Expanding the vendor base and diversifying suppliers could mitigate these risks by fostering competitive pricing, encouraging technological advancements, and ensuring supply chain stability. By addressing both modernization and vendor diversification, the military can enhance the long-term sustainability and effectiveness of its armored vehicle programs.

In conclusion, the analysis highlights key spending trends across major GCS programs, with the Abrams tank experiencing peak spending in 2018, followed by a decline as the platform transitioned from procurement to modernization. The Bradley Fighting Vehicle maintained steady funding, indicating a focus on sustainment rather than major upgrades. Meanwhile, spending on the Stryker Armored Personnel Carrier remained significantly lower, likely reflecting shifting priorities and reduced short-term modernization needs. One key insight is that the Abrams spending cycle aligns with historical procurement patterns, where heavy investment is followed by a period of reduced spending focused on sustainment and incremental improvements. Another critical takeaway is the risk of vendor concentration, as General Dynamics dominates the contracting landscape, potentially limiting competition and cost efficiency. Expanding the supplier base could mitigate long-term risks while fostering competitive pricing and innovation. These findings offer valuable insights for future acquisition strategies, particularly in timing and prioritizing modernization efforts.

Methodology Summary

- **Data Cleaning:**
  - Removed duplicate entries based on unique identifiers (ID) to ensure accurate counting.
  - Standardized vendor names to reduce inconsistencies in reporting.
- **Data Categorization:**
  - Applied a keyword-based approach to classify vehicle types (Abrams Tank, Bradley Fighting Vehicle, and Stryker Armored Personnel Carrier).
  - Used substring matching and lowercase normalization to ensure uniform categorization.
- **Spending Analysis:**
  - Extracted relevant fiscal year data (2016-2020) to focus on recent procurement and modernization trends.
  - Used aggregation functions (`group by` and `sum()`) to compute yearly and total awarded amounts.
  - Ensured accuracy through SUMIFS calculations in Excel before validating with Python.
- **Cross-Referencing & Validation:**
  - Compared extracted values with Congressional Research Service (CRS) reports to verify spending trends.
  - Created summary statistics, visualizations, and category breakdowns to ensure the dataset aligns with historical procurement patterns.

- **Visualization & Insights Generation:**
    - Developed time-series graphs to depict yearly spending variations across different vehicle types.
    - Generated pie charts to showcase the distribution of total spending across the Abrams, Bradley, and Stryker platforms.
    - Highlighted vendor concentration risks by identifying the dominant contractors in the dataset.

References

- Congressional Research Service, *The Army's M-1 Abrams, M-2/M-3 Bradley, and M-1126 Stryker: Background and Issues for Congress*, April 5, 2016.
- Federal Procurement Data System (FPDS).