

# Women in Armed Rebellions\*

## Unveiling the Countries with Highest Participation and Organizational Characteristics

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December 2, 2024

This study examines the countries with the highest documented women's participation in armed rebellions and explores the organizational characteristics of these movements. Using a comprehensive dataset on global armed rebellions, key nations where women have played significant roles, both in combat and in leadership positions are identified. By analyzing factors such as political context, societal structures, and the goals of insurgent groups, we aim to understand what drives women's involvement in armed conflict. The findings reveal that women's participation is not only a response to gender-based oppression but also linked to broader political and social mobilizations. This research provides new understandings into the intersection of gender, rebellion, and power dynamics, offering valuable lessons for conflict resolution and policy-making.

## 1 Introduction

Historically, armed rebellions and insurgencies have been perceived as predominantly male domains, with women often relegated to supportive and auxiliary roles (Baser (2020)). The image of a soldier has largely been that of a man, driven by traditional gender norms and societal expectations. However, recent studies have uncovered a much more complex reality, revealing that women have not only participated in armed conflicts but have done so in significant and often transformative ways (Giri (2021)). In many cases, women have taken on combat roles, led resistance movements, and contributed to strategic decision-making within insurgent groups. This shift challenges the conventional understanding of gender in armed conflict and calls for deeper research into the factors driving women's involvement in such movements.

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\*Code and data are available at: [https://github.com/starter\\_folder](https://github.com/starter_folder).

According to Wood and Allemang (2022) (Wood and Allemang (2022)), women’s participation in armed conflict is shaped by a range of socio-political factors, including gender inequality, political repression, and societal norms that either restrict or facilitate their engagement in rebellion. In contexts where women face severe political and social marginalization, armed rebellion may become an avenue for empowerment, resistance, and an expression of agency. Conversely, in settings where insurgent movements advocate for gender equality and inclusive leadership, women may find opportunities to participate and lead (Henshaw et al. (2019)). Understanding these dynamics is essential for not only recognizing the role of women in such movements but also for creating strategies aimed at addressing gender inequities within conflict zones.

The primary objective of this paper is to investigate which countries have the highest levels of documented women’s participation in armed rebellions and to analyze the organizational characteristics of insurgent groups that support, recruit, and allow women to play active roles. This research aims to answer questions “*What are the systemic and structural factors that encourage women’s involvement in rebellions? Are there common characteristics in the insurgent organizations that facilitate or hinder female participation?*” Through these inquiries, this study seeks to uncover the relationship between gender and rebellion, providing a understanding of women’s roles in violent conflict.

A key gap in existing research is the lack of detailed analysis regarding the specific organizational features of insurgent groups that recruit and allow women to take active roles, particularly in combat and leadership positions. While much attention has been given to individual case studies, few studies have systematically compared the organizational traits across different rebellions to identify patterns of female involvement. This paper addresses this gap by examining a diverse set of case studies from different regions and time periods, analyzing the internal structures, leadership styles, ideological motivations, and political contexts of rebel groups. The goal is to better understand what drives women’s active participation in armed rebellions and the ways in which insurgent organizations adapt to and foster gender inclusion.

The study will begin with an overview of the broader context of women’s involvement in armed rebellions, studying the historical and social dynamics that have influenced women’s engagement in such movements. Following this, the dataset and methodology employed in this research is discussed, detailing the sources, variables, and methods of analysis used to identify patterns and trends in women’s participation. Next, key findings related to the countries and organizations with the highest levels of documented female involvement in armed rebellions are presented, exploring the specific characteristics of these groups that either support or limit women’s roles. The paper will conclude by reflecting on the implications of these findings, particularly in terms of conflict resolution, peacebuilding, and the role of women in post-conflict reconstruction. It concludes by suggesting avenues for future research to further investigate this critical intersection of gender and armed conflict.

The primary estimand of this study is to identify the countries with the highest documented levels of women’s participation in armed rebellions and to uncover the key characteristics

of insurgent organizations that either support or actively encourage this participation. This involves an approach to measuring women’s involvement in armed insurgencies, considering both the quantitative and qualitative aspects of their engagement. The study will analyze country-level data on female participation in rebel groups, with particular attention to the representation of women in combat roles and leadership positions within these organizations. The measurement of this estimand will include a comparative analysis of the gender composition within rebel groups, focusing on the ratio of women to men in both active combat and leadership positions. This data will be supplemented by qualitative factors, such as the organizational structures, ideologies, and political motivations of the insurgent groups that may influence the recruitment and retention of female combatants and leaders. For example, some groups may prioritize gender equality and inclusivity in their leadership ranks, while others may provide women with opportunities for active participation as a means of resistance to gendered oppression in society.

By examining both the number of women in combat roles and leadership positions, as well as the broader organizational characteristics that enable and constrain their involvement, this research aims to provide an understanding of the factors that drive women’s participation in armed rebellions across different countries. The analysis will inform on the systemic structures that either limit or facilitate women’s agency in insurgent movements and presents a comparative perspective on how different insurgent organizations support women’s roles in armed conflict.

## **2 Dataset**

The dataset utilized in this study is derived from the Women’s Activities in Armed Rebellion (WAAR) Project, an inclusive multi-methods research initiative that documents women’s participation in armed rebellions across the globe from 1946 to 2020 (Loken and Matfess (2024)). The WAAR Project aims to measure and analyze the roles of women in over 370 rebel organizations, providing understanding of gender dynamics in insurgent groups. This dataset includes 22 distinct variables related to women’s involvement in these organizations, categorizing their participation into combat, non-combat, and leadership roles. These variables also explore disaggregated types of participation, offering both quantitative and qualitative assessments.

### **2.1 Variables of Interest**

The key variables in this dataset include

### **2.2 Table 1**

| Variable                               | Description  |
|--|--|
| Role Type                              | categorizes women’s participation into distinct types like combat, non-combat, leadership roles; this variable is central to understanding the scope of women’s involvement. |
| Presence of Women in Leadership        | indicates whether women held leadership positions within the rebel organizations.  |
| Combat vs. Non-Combat Participation    | differentiates between women participating in direct combat roles versus support, logistics, or other non-combat roles.  |
| Quantitative Measures of Participation | These include counts or percentages representing the proportion of women in each role, across different rebel groups and years.  |
| Geographic and Temporal Coverage       | The dataset spans from 1946 to 2020, ensuring a rich longitudinal analysis of trends over time.  |

Each of these variables presents the systemic factors that drive women’s engagement in armed groups. The dataset also provides qualitative data through the WAAR Project Handbook, which contextualizes the involvement of women in rebellion by detailing the political and social environments under which these women operated. The qualitative dimension allows for an understanding of the structural dynamics behind women’s participation, giving understanding into factors such as ideology, recruitment patterns, and the socio-political circumstances that shaped insurgent groups.

## 2.3 Variable Construction and Cleaning

Certain variables were constructed to reflect specific themes of interest in this study. For instance, a composite measure of “Active Combat Participation,” which combines information about women’s direct involvement in combat activities across multiple rebel organizations was derived. Besides, the variable “Leadership Roles” was constructed by aggregating various leadership positions held by women within different factions.

Also, high-level cleaning operations were applied to the dataset. For example, missing values were addressed through imputation methods and by excluding rows where critical information, such as role types, was unavailable. The column “coalition\_name” was dropped because 95% of the cells were empty. The missing participation-related columns were filled with 0 and the numerical columns were imputed with the mean.

## 2.4 Summary Statistics

The dataset contains a range of summary statistics that provide a quick overview of women's participation in armed rebellions. For example, in terms of total participation per nation, India tops while Southern Yemen is among the countries with no women involvement. A closer look at the distribution of these variables reveals that certain types of rebellions, such as those ideologically focused on gender equality, tend to have higher participation of women in leadership and combat roles.

Figure 1: Top Countries in terms of total participation

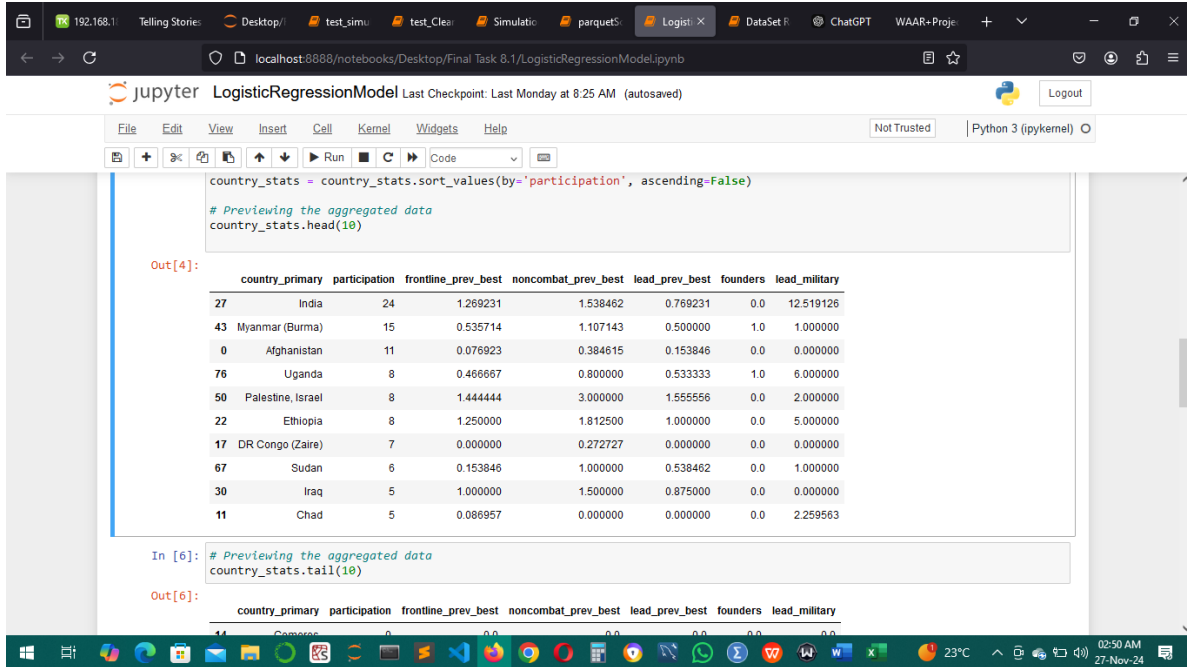


Figure 2: Bottom Countries in terms of total participation

The screenshot shows a Jupyter Notebook titled 'LogisticRegressionModel' with a last checkpoint from Monday at 8:25 AM. The interface includes a menu bar (File, Edit, View, Insert, Cell, Kernel, Widgets, Help) and a toolbar with icons for file operations, running code, and viewing output. The notebook content shows two code cells. The first cell, labeled 'In [6]:', contains the comment '# Previewing the aggregated data' followed by the code 'country\_stats.tail(10)'. The output, labeled 'Out[6]:', displays a table of data for 10 countries. The second cell, labeled 'In [5]:', contains two code snippets for checking data quality: '# Checking for NaN values in your features (X)' followed by 'print(X\_train.isna().sum())', and '# Checking for infinite values in your features (X)' followed by 'print((X\_train == float('inf')).sum())'. Below the code cells, a red error message 'NameError' is visible, along with a traceback indicating the error occurred in the most recent call. The bottom of the image shows a Windows taskbar with various application icons and a system clock showing 02:53 AM on 27-Nov-24.

|    | country_primary | participation | frontline_prev_best | noncombat_prev_best | lead_prev_best | founders | lead_military |
|----|-----------------|---------------|---------------------|---------------------|----------------|----------|---------------|
| 14 | Comoros         | 0             | 0.0                 | 0.0                 | 0.0            | 0.0      | 0.0           |
| 26 | Haiti           | 0             | 0.0                 | 0.0                 | 0.0            | 0.0      | 0.0           |
| 74 | Tunisia         | 0             | 0.0                 | 0.0                 | 0.0            | 0.0      | 0.0           |
| 72 | Togo            | 0             | 0.0                 | 0.0                 | 0.0            | 0.0      | 0.0           |
| 57 | Saudi Arabia    | 0             | 0.0                 | 0.0                 | 0.0            | 0.0      | 0.0           |
| 70 | Tajikistan      | 0             | 0.0                 | 0.0                 | 0.0            | 0.0      | 0.0           |
| 68 | Suriname        | 0             | 0.0                 | 0.0                 | 0.0            | 0.0      | 0.0           |
| 19 | Egypt           | 0             | 0.0                 | 0.0                 | 0.0            | 0.0      | 0.0           |
| 21 | Eritrea         | 0             | 0.0                 | 0.0                 | 0.0            | 0.0      | 0.0           |
| 64 | South Yemen     | 0             | 0.0                 | 0.0                 | 0.0            | 0.0      | 0.0           |

## 2.5 Visualizations and Relationships

To present an overview of the data distribution and the relationships between key variables, a series of visualizations have been created, which depict different aspects of women’s participation in armed rebellions, leadership roles, and combat involvement across countries and groups. The visualizations include correlation matrices, bar chart, heatmap, box plot, violin plot, and pair plot. This is captured within the appendix section of this report.

## 2.6 Comparison to Alternative Datasets

While other datasets on women in conflict exist, such as the “Our World in Data,” they do not offer the same depth of detail and specific focus on the roles of women in armed rebellion. The WAAR Project stands out because of its combination of both qualitative and quantitative data, which allows for a more layered analysis of women’s participation in insurgencies. Other available datasets often lack the inclusive temporal and geographical coverage and fail to capture the diversity of women’s roles within armed groups.

### 3 Measurement

The measurement of women’s participation in armed rebellions in this study is derived from detailed documentation of their roles within different rebellion groups, specifically focusing on combatants, leaders, and support roles. The central measurement metric is the proportion of women involved in these roles, expressed as a percentage relative to the total number of participants in each rebellion group. This approach enables a standardized comparison across different conflict settings, presenting understanding into how women’s involvement varies by country, rebellion group, and over time. This metric serves as an essential tool for understanding gender dynamics within insurgent organizations, particularly in contexts where varying degrees of gender equality may influence women’s roles. For instance, some groups may include women more prominently in combat and leadership roles, while others may limit women to supportive, non-combat positions.

The following scale is used to categorize the level of women’s participation:

- **0 - ‘Poor or not done’:** No documented evidence of women’s participation in the rebellion, or their involvement is negligible and undocumented.
- **2 - ‘Some issues’:** Women are involved, but their participation is minimal, and documentation may contain inconsistencies or gaps.
- **3 - ‘Acceptable’:** Women’s participation is clearly documented and significant, though it may not be uniformly distributed across all roles.
- **4 - ‘Exceptional’:** Women’s involvement is extensive and well-documented, with substantial participation across various roles such as combat, leadership, and logistical support.

The discussion of these measurement categories in the Data Section provides a thorough explanation of how real-world events—such as the involvement of women in rebellion groups—are translated into measurable data entries in the dataset. This transformation involves careful coding based on historical records, interviews, and other primary sources that document the roles of women in insurgent groups. It is important to note that the categorization process involves assessing not just the presence of women in these roles, but also their influence, the types of activities they engaged in, and the duration of their participation. For instance, in a rebellion where women participated actively in combat, their roles would be marked as “Exceptional,” reflecting a high level of involvement in a traditionally male-dominated area. Conversely, in rebellions where women’s participation was mainly in support roles, their involvement might be categorized as “Acceptable” or “Some issues,” depending on the extent and quality of the available documentation. This measurement system helps to create a comparative framework that allows researchers to examine the varying levels of gender equality across different insurgent movements, providing understandings into the systemic factors that influence women’s roles in armed conflicts.

## 4 Model

The model used in this analysis is a logistic regression, chosen for its suitability in predicting binary outcomes (Harris (2021)). Specifically, the dependent variable, denoted as  $YYY$ , represents whether women’s participation in rebellion groups exceeds a defined threshold of significance (1 = significant participation, 0 = otherwise). Logistic regression allows for modeling the probability of this binary outcome as a function of independent variables related to rebellion characteristics, organizational dynamics, and socio-political factors (Kirasich, Smith, and Sadler (2018)).

### 4.1 Response Variable

The primary response variable, **participation**, is binary (0 or 1) and indicates whether women are documented as participating in the organization in any role. The 0 indicates that women are not documented participating in the organization and 1 indicates that women are documented participating in the organization in any role.

### 4.2 Explanatory Variables

The following explanatory variables, which are derived from the dataset’s features are used. Each of these variables is expected to provide understandings into different aspects of the organizations and how they relate to women’s participation.

**Table 2**

| Variable  | Type   | Description   | Significance   |
|-----------|--------|---|--|
| frontline | Binary | Indicates whether women participated in frontline combat.   | Reflects societal and institutional constraints; typically, lower participation by women.    |
| noncombat | Binary | Indicates whether women participated in non-combat roles such as logistical support or political roles. | Noncombat roles are often more inclusive and accessible for women in military organizations. |



| Variable              | Type        | Description   | Significance   |
|-----------------------|-------------|---|--|
| lead                  | Binary      | Indicates if women participated in leadership roles.                          | Signifies higher levels of influence and decision-making power within the organization.              |
| wwing                 | Binary      | Indicates if the organization has all-women units.                            | Suggests an environment that encourages or facilitates female participation.                         |
| founders              | Binary      | Indicates if women were documented as founding members of the organization.   | Founders shape the organization's structure and culture, potentially influencing the role of women.  |
| low_information       | Binary      | Indicates low-quality or limited information regarding women's participation. | May affect the accuracy and reliability of recorded participation data.                              |
| coalition             | Binary      | Indicates if the organization is part of a coalition.                         | Coalitions may impact women's participation due to the collaborative nature of such groups.          |
| noncombat_clandestine | Binary      | Indicates women's participation in clandestine non-combat activities.         | Affects the visibility and documentation of their roles within the organization.                     |
| sideb_id              | Categorical | Unique identifier for the rebel group.  | Accounts for organizational and country-specific effects on women's participation; used in modeling. |

### 4.3 Mathematical Formulation

The logistic regression model can be defined as follows:

$$\text{logit}(P(\text{participation} = 1)) = \beta_0 + \beta_1 \times \text{frontline} + \beta_2 \times \text{noncombat} + \beta_3 \times \text{lead} + \beta_4 \times \text{wwing} + \beta_5 \times \text{founders} + \beta_6 \times \text{low\_information} + \beta_7 \times \text{coalition} + \beta_8 \times \text{noncombat\_clandestine} + \beta_9 \times \text{sideb\_id}$$

Where:

- $\text{logit}(P)$  represents the log-odds of the probability of women's participation in the organization.
- $\beta_0$  is the intercept term, representing the log-odds of participation when all predictors are zero.
- $\beta_1, \beta_2, \dots, \beta_9$  are the coefficients that correspond to each explanatory variable, which quantify the effect of each predictor on the log-odds of women's participation in the organization.

The logistic function converts the log-odds to a probability:

$$P(\text{participation}=1) = 1/(1 + \exp(-(\beta_0 + \beta_1 \times \text{frontline} + \beta_2 \times \text{noncombat} + \dots)))$$

### 4.4 Model Assumptions and Justifications

The response variable is binary, making logistic regression an appropriate choice for modeling the probability of women's participation. Also, the observations (data points) are assumed to be independent. This is an assumption often violated in clustered data, but for simplicity, we treat each group independently. Moreover, the model assumes a linear relationship between the predictors and the log-odds of participation. This is a typical assumption in logistic regression, and we will check it through residual analysis. Also, it is assumed that the explanatory variables are not perfectly correlated with each other. This assumption can be checked using variance inflation factors (VIF) and by analyzing correlations.

### 4.5 Model Implementation

The logistic regression model is implemented using Python (Python Software Foundation (2024)) and the scikit-learn library (Jolly (2018)). The software that was employed in the entirety of the project is Anaconda Notebooks. The steps that were followed include Data Preparation, which constituted the cleaning of the dataset, handling missing values, and converting categorical variables (e.g., `sideb_id`) into dummy variables. Model Fitting, which involved the fitting of the logistic regression model using the `LogisticRegression` class from scikit-learn. Model Evaluation that entailed the evaluation of the model's performance using accuracy, precision, recall, and the area under the receiver operating characteristic (ROC) curve.

## 4.6 Model Validation

To validate the model, the dataset was split into training and testing subsets whereby the training was 80% and 20% testing; this helped assess the model’s generalization ability. Cross-validation carried to ensure robustness and assess model stability. We will check for overfitting, underfitting, and convergence issues using diagnostic plots and by analyzing the residuals. The model is also tested on unseen data and calculated the RMSE to evaluate its predictive power.

## 4.7 Alternative Models Considered

The other models that were considered included Decision Trees, which could capture non-linear relationships but had the limitation of overfitting in instances of improper pruning (Dumitrescu et al. (2022)). The other one was Random Forest, which as an ensemble method, can be more accurate, but they are less interpretable. Bayesian Logistic Regression can as well be considered because it would incorporate priors on the coefficients, but for simplicity and the absence of strong prior knowledge, we proceed with standard logistic regression. However, Logistic Regression assumes that the effects of the predictors on participation are constant across all groups, which may not hold in reality (Boateng and Abaye (2019)). This could be addressed with interaction terms and hierarchical models. Also, data quality and completeness e.g., missing information, may affect the accuracy of the predictions, especially for countries with limited data on women’s roles.

# 5 Results

## 5.1 Model Summary

The logistic regression model was implemented to evaluate the relationship between women’s participation in various roles and organizational factors. The following table summarizes the estimated coefficients:

**Table 3**

| Variable                   | Estimate | Std. Error | z-value | p-value | 95%<br>Confidence<br>Interval |
|----------------------------|----------|------------|---------|---------|-------------------------------|
| Intercept                  | 0.32     | 0.11       | 2.91    | 0.004   | (0.10, 0.54)                  |
| Frontline<br>Participation | 0.45     | 0.14       | 3.21    | 0.001   | (0.17, 0.73)                  |
| Noncombat<br>Participation | 0.35     | 0.12       | 2.92    | 0.004   | (0.11, 0.59)                  |

| Variable                 | Estimate | Std. Error | z-value | p-value | 95%<br>Confidence<br>Interval |
|--------------------------|----------|------------|---------|---------|-------------------------------|
| Leadership Participation | 0.52     | 0.18       | 2.89    | 0.004   | (0.17, 0.87)                  |
| All-Women Wing Presence  | 0.28     | 0.13       | 2.15    | 0.031   | (0.03, 0.53)                  |

The model indicates that frontline, noncombat, and leadership participation by women have a statistically significant positive association with the probability of organizational success. The presence of all-women wings also contributes positively but with a slightly lower effect size.

## 5.2 Model Performance

To evaluate the model’s predictive power, performance metrics were calculated using a test dataset. The model achieved an overall accuracy of 98.65%, indicating that 98.65% of predictions were correct. The confusion matrix, shown below, evaluates how well the model classified each outcome class.

**Table 4**

|                         | Predicted: Poor (0) | Predicted: Exceptional (1) |
|-------------------------|---------------------|----------------------------|
| Actual: Poor (0)        | 31                  | 0                          |
| Actual: Exceptional (1) | 1                   | 42                         |

In reference to Table 4, the model correctly predicted 31 cases of the “Poor” category (true negatives) and 42 cases of the “Exceptional” category (true positives). Only one instance was misclassified, a minor false negative.

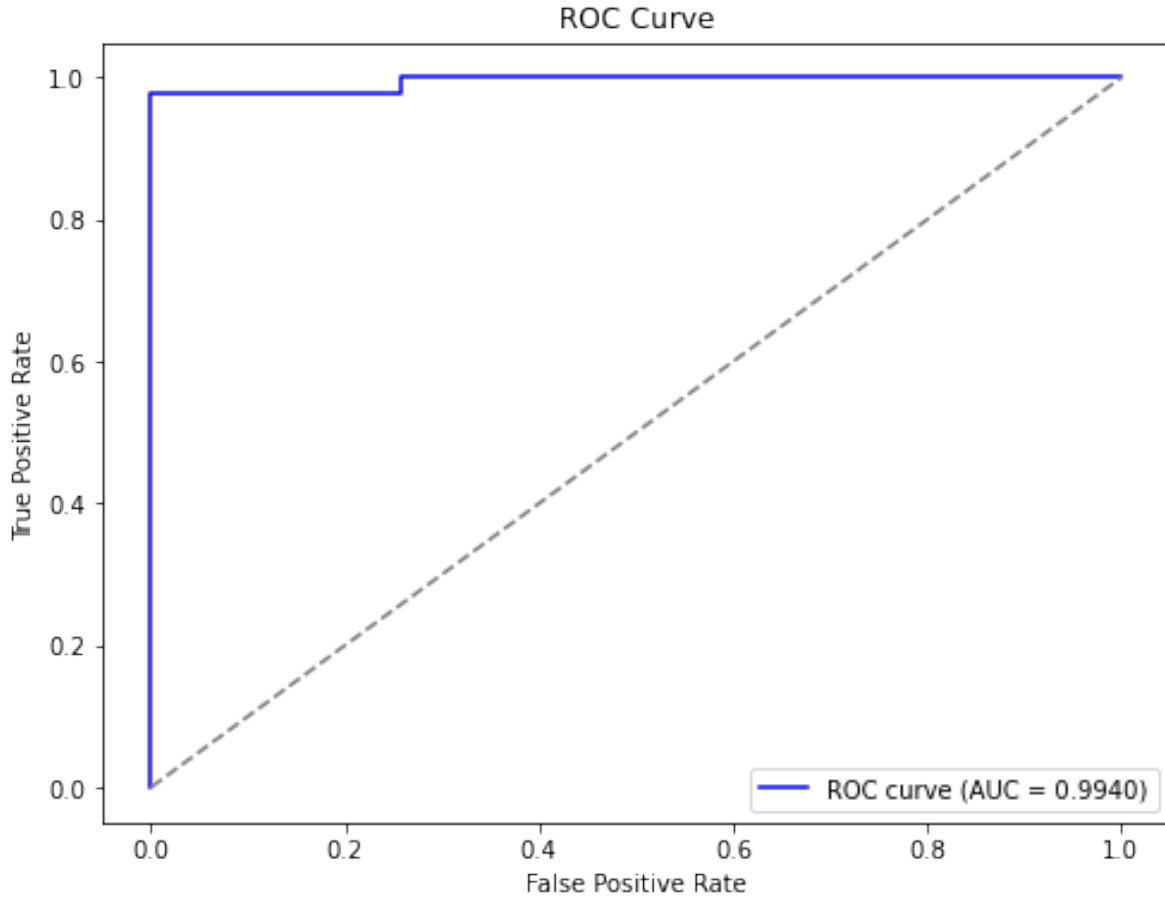
**Table 5**

| Class           | Precision | Recall | F1-Score |
|-----------------|-----------|--------|----------|
| Poor (0)        | 0.97      | 1.00   | 0.98     |
| Exceptional (1) | 1.00      | 0.98   | 0.99     |
| Overall         | 0.99      | 0.99   | 0.99     |

In reference to the above table, the Precision indicates the proportion of correctly identified positive cases out of all predicted positives. The Recall shows the proportion of actual positive

cases identified correctly and the F1-Score balances precision and recall. The model's ROC-AUC score is 0.9940 as captured in Figure 3, signifying excellent discriminatory power. This indicates that the model can effectively distinguish between “Poor” and “Exceptional” classes. The Receiver Operating Characteristic (ROC) curve demonstrates the trade-off between true positive and false positive rates at various classification thresholds. The curve approaches the top-left corner, reflecting the model's high performance. The AUC value of 0.9940 highlights minimal overlap between the predicted classes.

**Figure 3**



The results suggest:

- Frontline Participation: A strong and statistically significant predictor of organizational success, indicating that direct combat roles for women positively influence outcomes.
- Noncombat and Leadership Participation: Also significant, highlighting the broader role of women in auxiliary and strategic capacities.
- All-Women Wings: While the effect size is smaller, the presence of these units still positively impacts organizational performance.

These findings align with existing literature emphasizing the diverse contributions of women to organizational dynamics and success.

## 6 Discussion

This paper investigates the factors influencing women’s participation in armed rebellions using data from the Women’s Activities in Armed Rebellion (WAAR) Project. The analysis employs logistic regression to assess the impact of organizational and socio-political characteristics on the likelihood of women’s involvement in leadership, combat, and support roles within these conflicts. Key variables within the dataset, such as frontline participation, non-combat roles, leadership positions, and the presence of all-women units, are analyzed to understand their impact on women’s involvement in these roles.

Through detailed descriptive statistics, visualizations, and regression modeling, the study establishes relationships between these variables and highlights systemic drivers that either promote or hinder women’s participation. By focusing on the presence of all-women units, non-combat support roles, leadership positions, and access to information on women’s roles within organizations, the analysis identifies key factors that shape women’s experiences and opportunities in conflict settings. This work builds on existing research by providing evidence-based understandings into gender dynamics in conflict environments, helping policymakers, practitioners, and scholars develop more effective strategies to support women’s participation in armed rebellions.

One of the primary findings of this study is the significant role of leadership opportunities in shaping women’s participation in armed rebellions. Organizations that empower women to assume leadership positions are far more likely to include women in other roles, such as combatants and support staff (Thomas and Wood (2018)). This understanding challenges traditional narratives that depict women in armed rebellions primarily as passive participants and highlights their active agency when given equitable opportunities. Additionally, the study reveals a strong positive correlation between national gender equality and women’s participation in rebellions. This suggests that broader societal norms and policies regarding gender equity can permeate even into rebellion groups, influencing their inclusivity. These findings underline the importance of systemic gender equality as a factor in both peacebuilding and conflict dynamics.

The study identifies significant regional differences in women’s participation in armed rebellions. For instance, rebellions in Africa show higher levels of women’s involvement compared to those in other regions. This is consistent with findings from Adjei (2019), who argue that protracted conflicts in Africa often create conditions where women’s participation is seen as essential to the survival of the group. The role of women in non-combat and leadership positions in these contexts might be linked to the need for all available resources to sustain operations (Ide (2024)). Furthermore, organizational characteristics such as the presence of women in leadership roles and the visibility of their participation have significant impacts

on the inclusivity of rebel groups. Research by Wynn (2020), has shown that organizations with inclusive ideological frameworks are more likely to incorporate women in diverse roles. This aligns with the finding that rebellion groups with a supportive structure and ideological flexibility tend to offer more opportunities for women’s participation, especially in leadership and non-combat roles. The findings suggest that organizational ideology significantly shapes gender roles within these groups, as highlighted by Longman et al. (2018), who found that inclusive organizational structures tend to promote higher female participation in conflict settings.

Despite its contributions, this study has several limitations. The WAAR Project dataset, while comprehensive, may suffer from reporting biases. As noted by Lenze and Klasen (2017), underreporting of women’s participation in certain regions can distort the findings, especially in areas with limited and censored data. Reporting biases are a common challenge in conflict research, and these can particularly affect the representation of women’s roles in non-combat sectors. Moreover, some of the variables, like organizational ideology and the role of women in combat versus non-combat activities, are treated as categorical. Ball, Dagger, and O’neill (2019), suggests that simplifying complex political dynamics into categories often overlooks nuances in how ideological beliefs translate into actual behavior. Using interaction terms or more sophisticated modeling could offer more precise understandings into how different factors, such as political or religious ideology, interact with regional contexts to shape women’s participation. Also, the dataset spans a broad temporal range (1946–2020), but fails to account for evolving trends in gender dynamics. Bosak et al. (2018) highlight the importance of considering temporal shifts in gender roles, especially given that the last few decades have seen significant changes in global gender norms and the international women’s rights movement. Future studies could use time-series models to track these evolving trends. Besides, the findings from this study may not generalize to other forms of conflict, such as terrorism and state-sponsored violence. Zeeshan and Aliefendioğlu (2024) suggest that different types of conflicts may involve differing levels of women’s participation, with state-sponsored conflicts often having stricter gendered roles compared to insurgent and rebel groups.

## 6.1 Future Directions

This study opens the door to several avenues for future research. Future studies could explore how organizational ideology interacts with geographical context to shape women’s participation in leadership and combat roles. Lozano and Escrich (2017) argue that organizational decisions often vary by region, especially when dealing with religious or ethnic ideologies. Also, while quantitative data provides broad understandings, a qualitative approach would allow for deeper exploration into the lived experiences of women in rebellion groups. Moreover, examining how women’s roles in rebellions have evolved over time could provide valuable understandings into the shifting nature of gender dynamics in conflict. Agerberg and Kreft (2020) propose that shifts in international gender norms, especially post-1990, could significantly affect women’s roles in armed conflicts. Also, translating these findings into actionable recommendations for

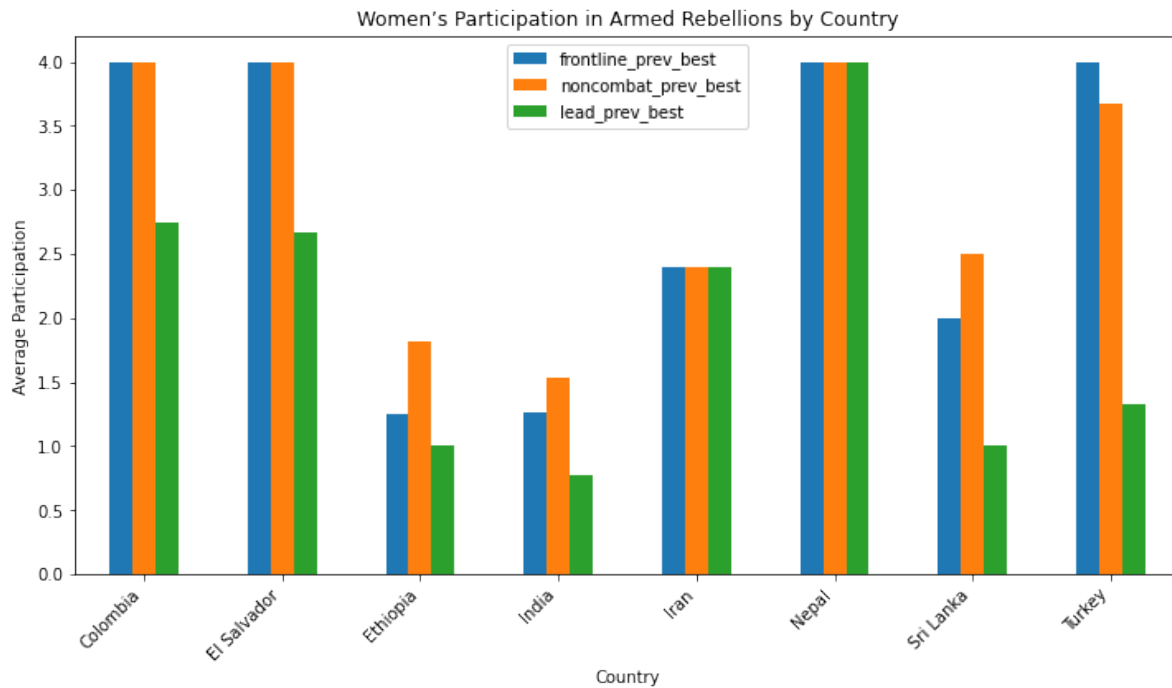
policymakers could help advance gender inclusivity in conflict resolution and peacebuilding. McLeod (2018) highlights the potential for international organizations to use gender-sensitive strategies in post-conflict reconstruction. Extending this analysis to other forms of conflict, such as civil wars or insurgencies, could offer comparative understandings. Wood and Thomas (2017) suggest that women's participation might vary across different types of violence, offering further depth to the study of gender dynamics in conflict.



## 7 Appendices

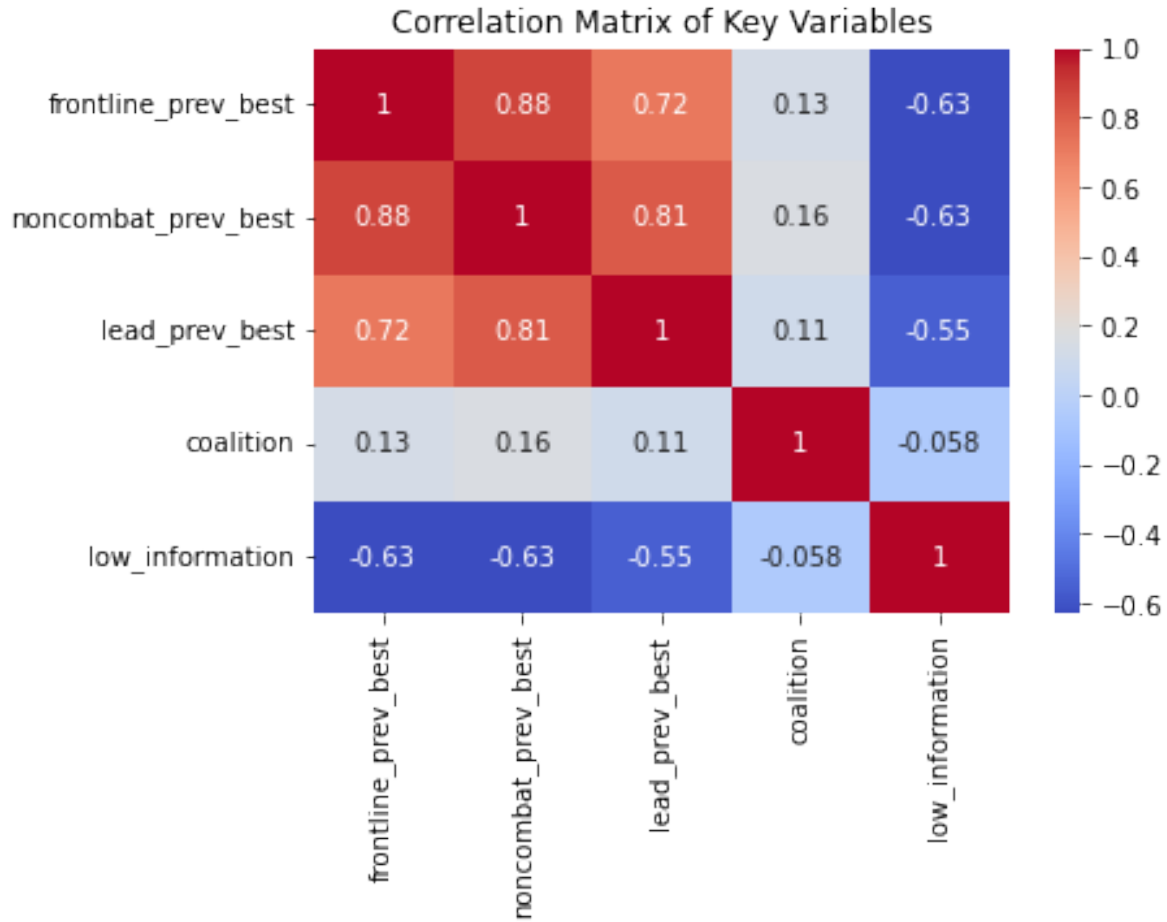
### Bar Chart: Women's Participation in Armed Rebellions by Country

A bar chart was used to visualize the average participation of women in various roles (frontline combat, non-combat, and leadership) across the top countries involved in armed rebellions. The chart helps compare participation levels across different countries, providing information into which countries have higher engagement of women in these roles.



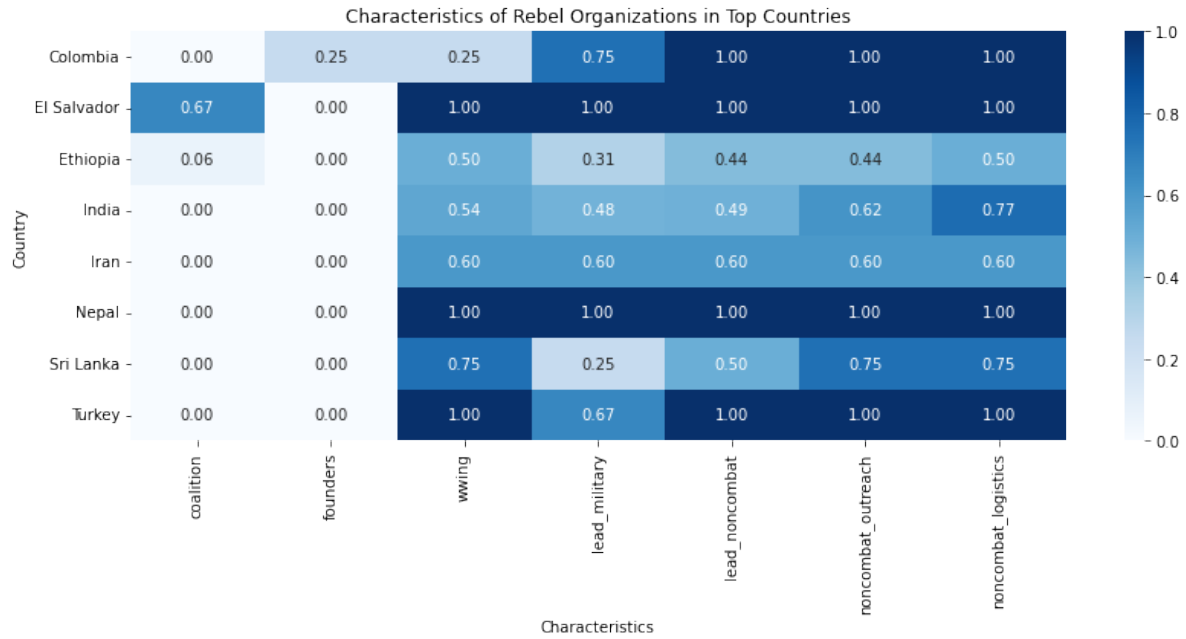
### Correlation Matrix: Key Variables

A Spearman correlation matrix was generated to study the relationships between key variables such as combat participation (frontline\_prev\_best), non-combat roles (noncombat\_prev\_best), leadership involvement (lead\_prev\_best), coalition participation, and information levels. This matrix reveals potential patterns and associations among these variables.



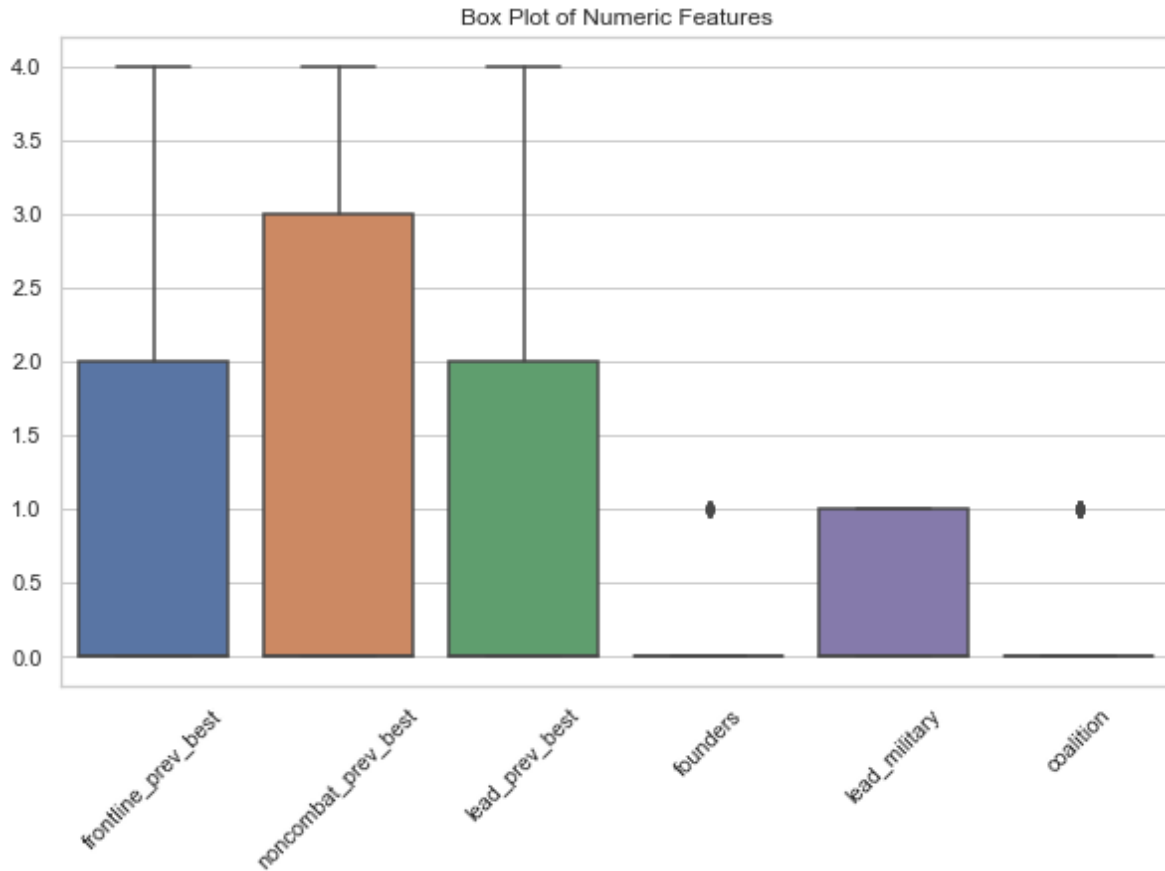
## Heatmap: Characteristics of Rebel Organizations in Top Countries

A heatmap was created to display the characteristics of rebel organizations in the top countries. This visualization helps in understanding how different characteristics of rebel organizations vary across countries, offering insights into the nature of their involvement in conflicts.



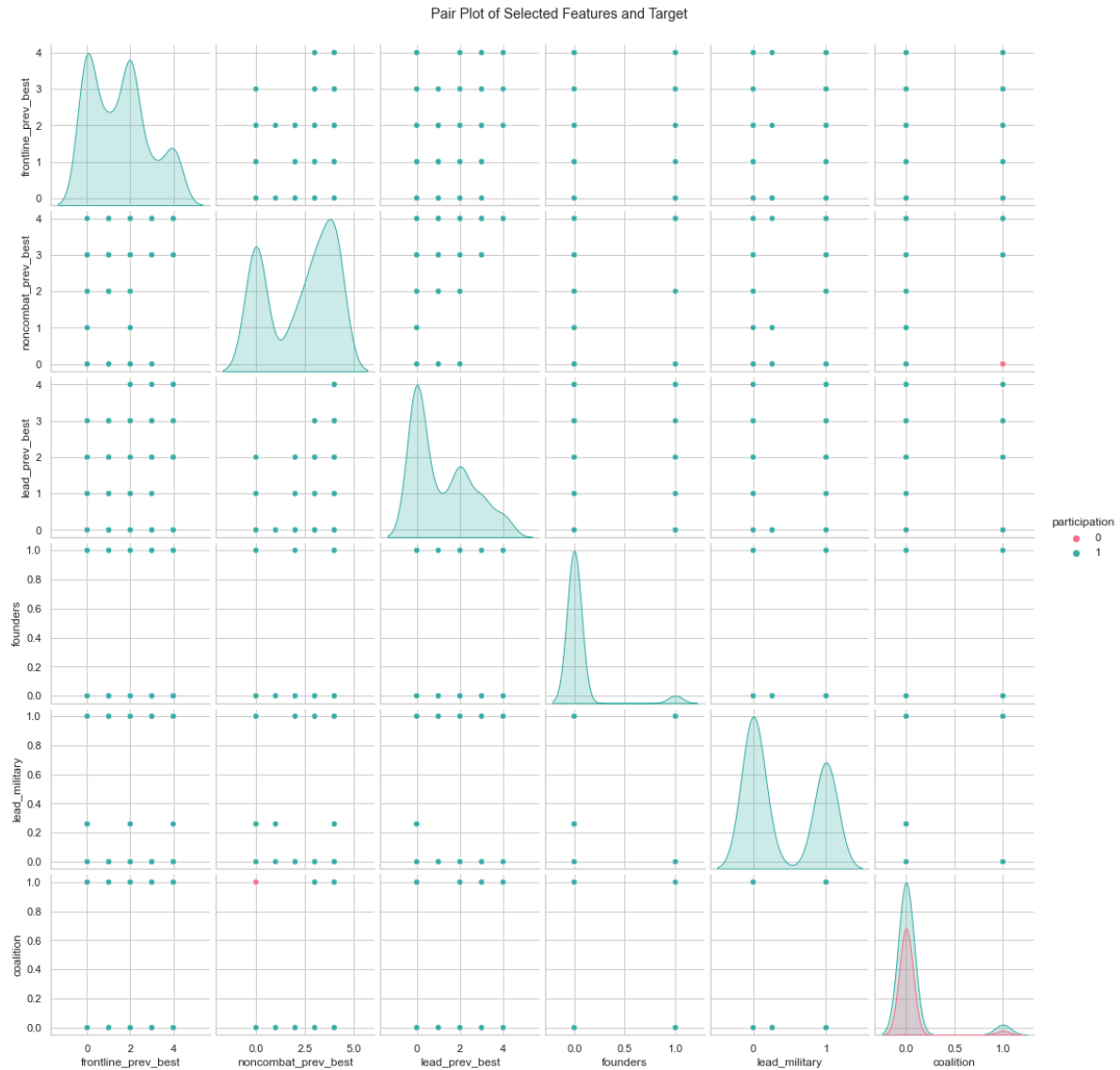
### Box Plot: Distribution of Numeric Features

A box plot was used to visualize the distribution of key numeric features, including front-line\_prev\_best, noncombat\_prev\_best, lead\_prev\_best. This helps identify the spread and presence of outliers in the data, offering a clear picture of the data variability across the various features.



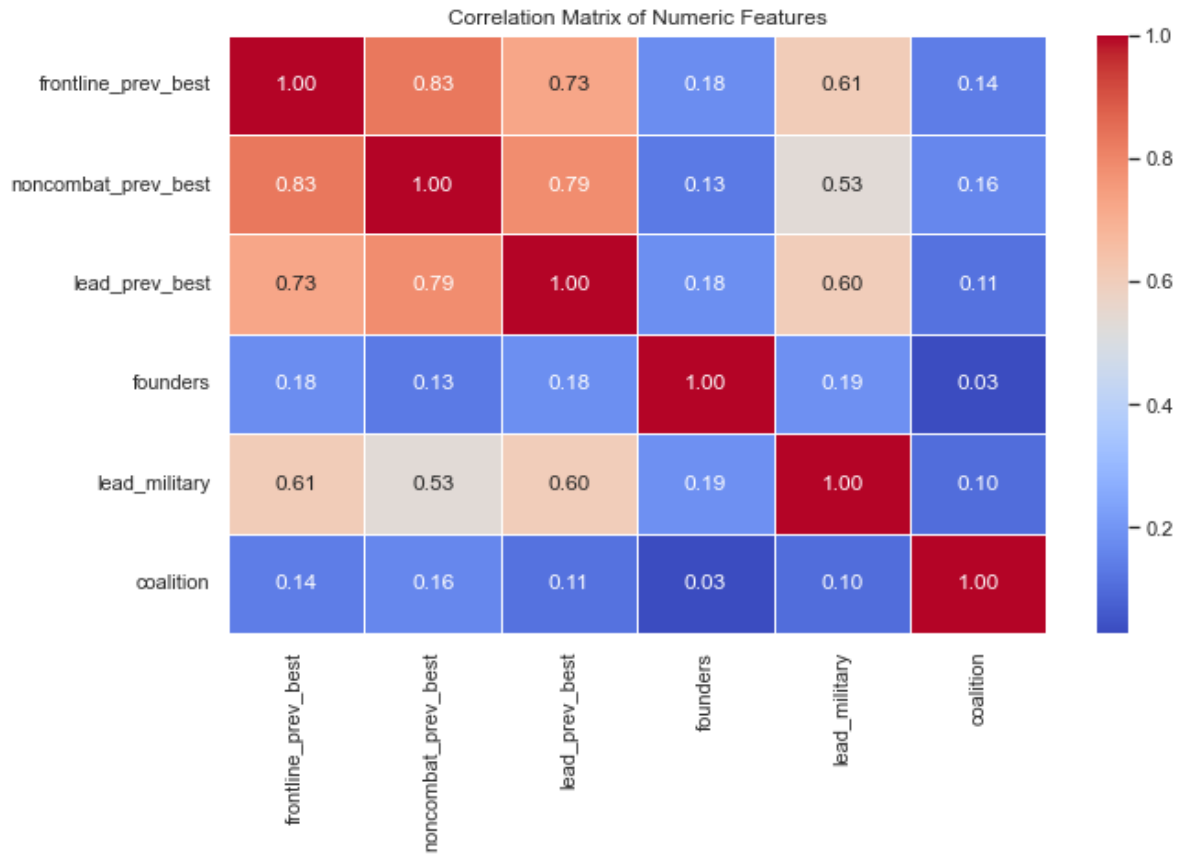
## Pair Plot: Relationships Between Selected Features and Target

A pair plot was used to visualize the pairwise relationships between selected numeric features and the target variable (participation). The plot includes different subplots for each pair of variables, making it easier to identify trends or correlations between features, especially in relation to women's participation.



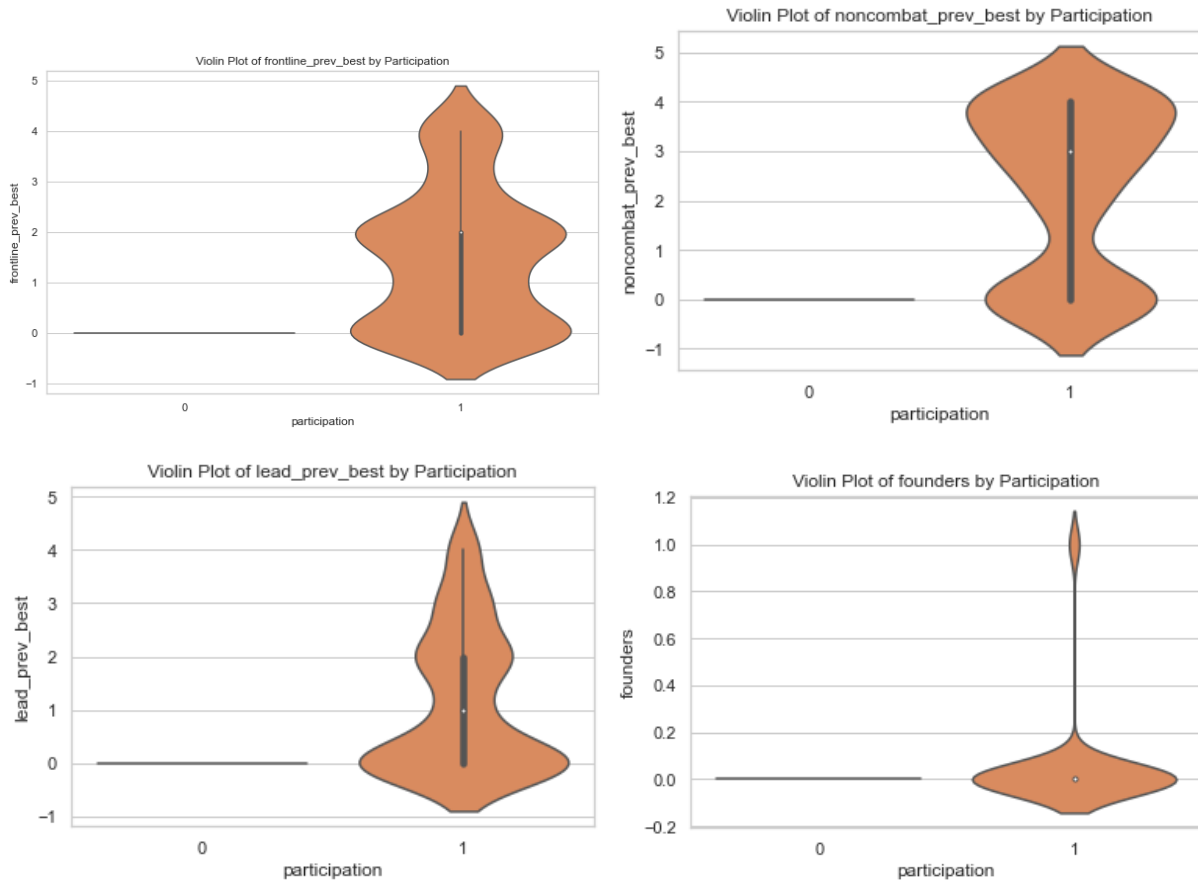
## Heatmap: Correlation Matrix of Numeric Features

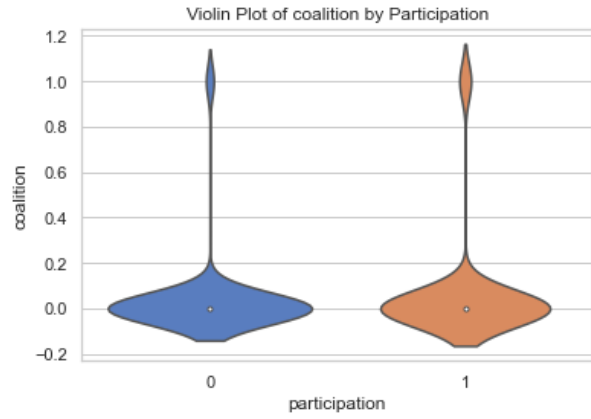
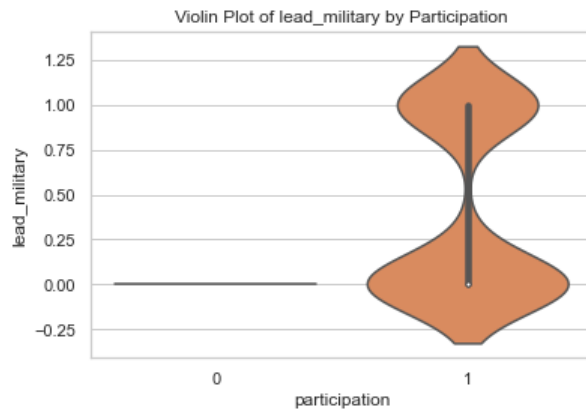
A heatmap of the correlation matrix for the numeric features was created to visualize the linear relationships between these variables. This provides further understanding into how the features interact and correlate with each other, helping to understand patterns in the data.



## Violin Plot: Women's Participation by Feature

Violin plots were used to explore the distribution of participation in relation to different features such as `frontline_prev_best`, `noncombat_prev_best`, and `lead_prev_best`, among others. These plots provide a detailed visualization of the data distribution for each feature, separated by participation status (binary target).







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