MERCY FOR ANIMALS

Farmed Animal Opportunity Index (FAOI)

Methodology

Introduction

The Farmed Animal Opportunity Index (FAOI) is a composite index[1] that measures the potential for work related to farmed animal protection using relevant socioeconomic and scale-oriented indicators. The index serves as a preliminary, fundamental stage in a larger analysis to evaluate the scope of interventions to help farmed animals.

This document outlines the statistical methodology and framework adopted to create the index.

Dimensions and Indicators

The three pillars of effective altruism (EA) are importance, tractability, and neglectedness. Mercy For Animals adds global influence to this list because we believe that institutional and attitudinal change in highly influential countries is likely to promote a positive domino effect around the globe and therefore increase a country's potential for effective interventions. We use the scale of the problem, defined as how many animals are slaughtered, as a measure of importance. The FAOI score incorporates scale, tractability, and global influence. In all, 19 indicators were selected based on relevance and the availability of data for countries in the analysis and allocated to one of the three FAOI dimensions.

Neglectedness was incorporated separately as a high, medium, or low score reflecting relative levels of resources spent on farmed animal welfare according to data from Farmed Animal Funders,[2] where low resources correspond to high neglectedness. It would have been possible to create dummy variables for these three levels of neglectedness and include them in the FAOI as a fourth dimension; however, determining the value of these dummy variables on a scale of 0–100 would require information on the absolute level of neglectedness, which we do not have. Additionally, we expect different types of donors and nonprofits to be better suited for different levels of neglectedness. For example, a country with high economic tractability that is also highly neglected could be a good candidate for starting a new animal welfare nonprofit or plant-based business. On the other hand, some organizations are better suited to working with existing nonprofits in a country or region and would want to focus their efforts on countries with low neglectedness scores.

Following are definitions of each indicator included in the FAOI.

Scale

This dimension represents the importance of the problem. A higher value for any of the indicators suggests greater potential impact for farmed animals.

1. **Farmed land animals**
   Definition: Estimated number of animals slaughtered for domestic food supply, according to the following FAOSTAT items: eggs, hen, in shell; meat, buffalo; meat, cattle; meat, chicken; meat, duck; meat, goat; meat, goose and guinea fowl; meat, pig; meat, rabbit; meat, sheep; meat, turkey; milk, whole fresh, buffalo; milk, whole fresh, cow; milk, whole fresh, goat; milk, whole fresh, sheep.
   Year: 2021
   Source: FAOSTAT, Livestock Primary
2. **Farmed fish**
   Definition: Estimated tonnes of farmed fishes based on the FAO.
   Year: 2017
   Source: FishCount

Tractability

This dimension seeks to answer the question, If we intervene, how likely are we to succeed? Indicators for this dimension are broken down into three subdimensions: social, political, and economic. Social is further broken down into two categories: accessibility and charity.

- **Social**
  - **Accessibility**

3. **Food expenditure**
   Definition: Percentage of total consumer expenditures (goods and services) accounted for by food and nonalcoholic beverages. Consumption expenditure in the domestic

market is equal to consumer expenditure by resident households plus direct purchases in the domestic market by nonresident households and minus direct purchases abroad by resident households. We reversed this variable to ensure uniform directionality with the outcome variable.
Year: 2021
Source: USDA ERS

4. **Gross national income (GNI) per capita**
   Definition: Total domestic and foreign output claimed by residents of a country plus factor incomes earned by foreign residents minus income earned in the domestic economy by nonresidents. This indicator is measured in U.S. dollars using the World Bank Atlas method and divided by the midyear population. It is log normalized for use in the composite index.
   Year: 2021
   Source: World Bank and OECD
5. **Urban population**
   Definition: Percentage of the population residing in urban areas.
   Year: 2021
   Source: United Nations Population Division
6. **Schooling**
   Definition: Average number of years of schooling
   Year: 2021
   Source: UNDP
7. **Internet penetration**
   Definition: The internet penetration rate corresponds to the percentage of the total population of a given country or region that has the opportunity to use the internet.
   Year: 2020
   Source: Internet World Stats

- Charity

8. **Volunteering**
   Definition: Percentage of people who reported volunteering in the month before their interview for the 2022 Gallup World Poll.
   Year: 2022
   Source: CAF World Giving Index
9. **Giving**
   Definition: Percentage of people who reported donating in the month before their interview for the 2022 Gallup World Poll.
   Year: 2022
   Source: CAF World Giving Index

- Political

10. **Globalization**
    Definition: Economic, social, and political state and extent of globalization, according to the KOF Globalization Index on a scale of 1–100.
    Year: 2020 (from 2022 data set)
    Source: KOF Globalization Index
11. **Lack of corruption**
    Definition: Perceived degree of public-sector lack of corruption, according to the Corruption Perceptions Index on a scale of 0–100.
    Year: 2022
    Source: Corruption Perceptions Index
12. **Democracy**
    Definition: State of democracy in a country, determined using the EIU Democracy Index on a scale of 0–10, which assesses five categories for 165 independent states and two territories: electoral process and pluralism, civil liberties, the functioning of government, political participation, and political culture.
    Year: 2022
    Source: EIU Democracy Index
13. **Size of informal economy**
    Definition: Size of informal or shadow economy as a percentage of GDP. We reversed this variable to ensure uniform directionality with the outcome variable.
    Year: 2015
    Source: IMF, Shadow Economies Around the World
14. **Political stability**
    Definition: Perceptions of the likelihood of political instability or politically motivated violence, including terrorism. Estimate gives the country's score on the aggregate indicator in units of a standard normal distribution.
    Year: 2021
    Source: World Bank, World Governance Indicators

- Economic

15. **Ease of starting a business**
    Definition: Procedures, time, cost, and paid-in minimum capital required for a small- to medium-size limited liability company to start up and formally operate in each economy's largest business city, according to the World Bank on a scale of 0–100.
    Year: 2020
    Source: No longer available.
16. **Innovation**
    Definition: State of innovation in a country, according to WIPO's Global Innovation Index on a scale of 0–100.
    Year: 2022
    Source: Global Innovation Index

Global Influence

This dimension caters to our belief that policies and trends in highly influential countries are more likely than those in less influential ones to affect other countries—for better and for worse. A recent example is George Floyd's death in the United States, the world's most influential country, and the rapid

growth of the Black Lives Matter movement, which spread to dozens of countries in a matter of days and amplified the call for racial justice worldwide.

Global influence is calculated based on the degree of cultural influence a country exerts on the rest of the world, as well as its levels of international trade in meat and live animals.

17. **Soft presence**
    Definition: Extent of a country's soft presence outside its borders, as defined by the Elcano Global Presence Index, where each indicator was scaled by a global minimum and maximum over all countries and all periods.
    Year: 2022
    Source: Elcano Global Presence Index
18. **Meat trade**
    Definition: Sum of exported and imported meat in tonnes. Categories include bovine meat, mutton and goat meat, pig meat, and poultry meat.
    Year: 2020
    Source: FAOSTAT, New Food Balances
19. **Live animal trade**
    Definition: Sum of the number of exported individual animals and imported individual animals. Categories include buffaloes, cattle, chickens, ducks, rabbits and hares, turkeys, goats, sheep, and pigs.
    Year: 2021
    Source: FAOSTAT Trade Data

Missing Data

These 19 indicators were selected based on their relevance and the availability of data for countries in our analysis. While several additional indicators were shortlisted, those missing data for 25% or more of the countries were excluded. We also had to exclude from our analysis some countries we had initially included, such as Cyprus, Estonia, Luxembourg, and Malta, due to unavailability of data for multiple indicators.

Variables with missing countries that had reliable alternative sources or had data from recent previous years were imputed using a cold-deck imputation method.[3] The following is a list of alternate sources or years used for cold-deck imputations:

- **GNI per capita**
  - Country: Taiwan
    Alternate year: 2018
    Alternate source: CEIC Data
- **Schooling**
  - Country: Taiwan
    Year: 2021
    Alternate source: Ministry of Education, Republic of China (Taiwan)
- **Urban population**
  - Country: Taiwan
    Alternate year: 2020
    Alternate source: Statista
- **Volunteerism and giving**
  - Countries: Bangladesh, Belgium, Malaysia
    Alternate year: 2021
    Source: CAF World Giving Index
  - Country: Belarus
    Alternate year: 2019
    Source: CAF World Giving Index
- **Innovation**
  - Country: Bolivia
    Alternate year: 2021
    Source: Global Innovation Index
- **Meat trade**
  - Country: Singapore
    Alternate year: 2021
    Alternate source: Singapore Food Agency

We used more advanced multiple imputation techniques[4] where cold-deck imputations were not applicable for these variables: globalization, innovation, and soft presence.

For globalization and innovation, which were missing Taiwan, we employed truncated regression to impute the missing values, given the continuous and bounded nature of the variables. In both cases a lower limit of the truncation was zero and upper limit was 100. For globalization, the independent variables (and their correlations with globalization) chosen for regression were log(GNI per capita) (.90), schooling (.80), political stability (.79), and reversed food expenditures (.83). For innovation, the independent variables (and their correlations with innovation) chosen for regression were log(GNI per capita) (.87) and reversed informal economy (.77).

We used predictive mean matching to impute soft presence* values for Hong Kong and Taiwan. The independent variables (and their correlations with soft presence) chosen were farmed land animals* (.37), reversed food expenditures (.36), log(GNI per capita) (.41), internet penetration (.32), and meat trade* (.70).

*Farmed land animals, meat trade, and soft presence all had outliers that would have decreased the reliability of the imputation. Therefore, the top 10% of countries in each of the three indicators were removed, and the remaining 53 countries were used in the imputation. While imputing data for globalization and innovation, data from the 59 remaining countries were used.

At no point were previously hot-deck-imputed values used to impute other missing data. Note that in accounting for error from independent variable choice and the 95% confidence value of the imputation itself, the largest rank change for Taiwan was 2 and the largest rank change for Hong Kong was 1. This indicates that our results are not sensitive to the particulars of the imputation.

Transformation and Normalization

Gross national income was log transformed to reduce skewness. The directionality of percentage of food expenditures and size of informal economy was reversed to align with the outcome variable. Since the variables are not measured on the same scale or in the same unit, normalization is needed to allow for aggregation. Variables that were not on a bounded scale were transformed using a min-max normalization rule, which used the observed bounds (i.e., the minimum and maximum value of the observed spread of data in the sample) to convert the data to a 0–100 scale. Variables on a bounded scale were transformed using the min-max normalization rule using the scales' theoretical bounds to convert the data to a 0–100 scale.

Aggregation and Weighting

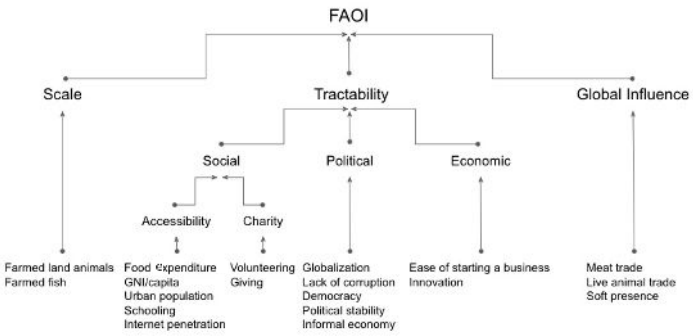

Figure 1. Tree chart illustrating the organization of indicators (listed along horizontal axis) within the FAOI framework.

Except for the top tier, scores for each element of each tier in the hierarchy are determined through equal weighting and arithmetic averaging of the elements immediately below it. At the top tier, geometric averaging with unequal weights determines the final FAOI score.

Scale and global influence scores are the arithmetic means of the normalized values of their constituent indicators. For tractability, we created a score for each subdimension by averaging only the indicators within that subdimension. Then we averaged the subdimension scores to form a tractability score. The FAOI is the geometric mean of the scale, tractability, and global influence dimensions, where each dimension is assigned a weight, and the sum of the weights is one.

Geometric aggregation avoids the issue of full compensability, which is observed in additive aggregations. Full compensability implies that low levels of performance on one indicator can be compensated equally by high levels of performance on another. Aggregating geometrically also incentivizes improvement in performance on dimensions for which a country is performing poorly by accounting for the differences in marginal utility (the resulting change in the index score from a one-unit increase in a dimensional score) at different levels of performance. For example, an increase in a dimensional score from 8 to 9 is rewarded more in a geometric aggregation than an increase from 88 to 89. In an additive aggregation, both would be treated equally. Additionally, (positive) data that is not comparable—and composed of variables measured on a ratio scale—can be meaningfully aggregated using only geometric functions.

Weighting is a key part of the analysis. The default weights, assigned based on extensive discussions between Mercy For Animals decision-makers and experts, are as follows:

Scale: 0.25
(or 25%)

Tractability: 0.55
(or 55%)

Regional Influence: 0.20
(or 20%)

Not all organizations will weight FAOI factors the same. While the EA sector of the animal rights movement has tended to pay more attention to the scale of the problem, we believe that evaluating our likelihood of success is critical if we are to intervene in a particular country, especially in regions with vastly different cultures and political contexts. Bearing this in mind, we assign tractability a considerably greater weight.

Other organizations may wish to adjust the weights differently to suit their unique perspectives. Therefore, the weights between dimensions may be adjusted to reflect users' own decision-making priorities. However, the weights *within* a dimension are not flexible. Allowing for opinion-based weights across a large number of indicators introduces reliability issues, as it could bear a high cognitive load on the user and induce circular thinking. For this reason, within dimensions we rely on an equal-weighting scheme. Several other landmark composite indices, including the UN's HDI, use this robust approach.[5]

The FAOI tool also allows for ranking regions instead of countries. Each indicator was recalculated for the region. Farmed land animals, farmed fish, meat trade, and live animal trade were summed among the countries in the region. Food expenditure, GNI per capita, urban population, schooling, internet penetration, volunteering, and giving underwent a weighted average based on a country's population and informal economy based on the country's GDP. The rest of the indicators were averaged with equal weights because they are themselves composite indices. The new regional indicators were transformed and normalized. Then new dimensional scores and a new FAOI score were created for each region using the same methodology above.

Changes from the 2019 FAOI

The most substantial change since the first iteration of the FAOI is updated data for all the indicators. Some small modifications to the indicator list include removing population from scale, making volunteerism and giving two separate indicators, and removing gender inequality from tractability. The tractability dimension now has three subdimensions—social, governmental, and economic—to limit double counting of variables that measure similar aspects of a country's

tractability. Finally, the aggregation technique for regions has changed from averaging the countries' FAOI scores to aggregating individual indicators and recalculating the scores.

Limitations

Notably, while the first three countries vary significantly in FAOI scores, starting at the fourth-ranked country the average score change between rankings is only 3.7%. Given that each indicator has a small margin of error, countries whose scores are within a couple of percentage points of each other should be considered of equal rank. Scores beyond a couple of percentage points should be considered meaningful. The public-facing FAOI tool enables users to reassign weights to the dimensions to reflect their own priorities. Changing the weights can produce major changes in scores and therefore ranking.

A concern with equal weighting of dimensions is that if any two indicators are highly correlated, double counting may occur. Creating subdimensions within tractability enabled us to group some indicators that we know measure similar features to ensure that those features are not double counted. However, double counting will still exist to a small extent in the FAOI. Additionally, some of the external indices incorporated in this index, such as the Global Innovation Index, capture some of the individual factors included in the FAOI. This contributes marginally to double counting.

FAOI rankings do not provide a complete picture of opportunity for advocacy in each country. Several important variables, particularly ones relating to movement-specific tractability, are not included in the FAOI because of the lack of available quantifiable data. Although the index seeks to reflect conditions in countries that have been understudied, for several key considerations, foundational data is needed but not available. In addition, the FAOI cannot capture the current social and political context in any country, which in some cases changes rapidly. Future versions of the index will attempt to capture some aspects of this context. Assuming data availability, restructuring to a panel dataset will enable users to discern trends in index, dimension, and indicator performance over time.

Key considerations better analyzed through other methods include the following: cultural norms; history of animal farming; role of religion; ease and efficiency of making social change; government attitudes toward activism, farmed animal welfare, meat reduction, etc.; prevalence of meat and dairy alternatives; impact of COVID-19; important legislative and judicial processes and precedents; and ease of finding and retaining quality staff. To assess these factors, we encourage users to conduct more in-depth research as part of scoping studies for countries of interest.

We suggest users refrain from critiquing countries on the basis of factors included in the index. For instance, in post-FAOI discussions, if lack of democracy or extent of corruption are diminishing a country's potential, this should be excluded from consideration since the index already assesses countries on those metrics.

Conclusion

This index provides a system for ranking countries according to their potential for effective interventions to help farmed animals. Rankings are based on available data. That said, we emphasize that using the index should be a preliminary step to guide or inform further research into the factors considered, as well as those not included here. Mercy For Animals, for instance, conducted detailed scoping studies of the six highest-ranked countries in our SE Asia iteration of the index before making decisions on whether to expand into that region and on the type of work with the greatest potential impact in each country (e.g., movement building, legislative advocacy, corporate engagement). Please read our use guide to better understand how the FAOI fits into your international work planning.

Our intention with the FAOI is to push the movement's focus beyond scale and inform organizational and philanthropic decision-making by incorporating and quantifying tractability to offer a more complete view of potential challenges and opportunities for impact. The FAOI is designed to be your first stop when deciding where to make the most impact for animals.

Notes

1. OECD and Joint Research Centre of the European Commission, *Handbook on Constructing Composite Indicators: Methodology and User Guide* (Paris: OECD Publishing, 2008), 13.
2. Farmed Animal Funders, *State of the Movement Report: 2021* (Chicago: Farmed Animal Funders, 2021), farmedanimalfunders.org/wp-content/uploads/2021/12/External-FAF-State-of-the-Movement-Report-2021.pdf.
3. OECD and JRC, *Handbook on Constructing Composite Indicators*, 55–57.
4. OECD and JRC, *Handbook on Constructing Composite Indicators*, 58–62.
5. Sudhanshu K. Mishra, "On Construction of Robust Composite Indices by Linear Aggregation," *SSRN* (2008): 3, https://doi.org/10.2139/ssrn.1147964.