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--- title: "Green Coffee ESG Intelligence" subtitle: "ESG Benchmarking for Green Coffee Origins (FAOSTAT + World Bank)" author: "Juan Paulo Pinto Sandoval" format:   html:     toc: true     toc-depth: 3     theme: cosmo     code-fold: true     code-summary: "Show code"     df-print: paged   pdf:     toc: true     number-sections: true execute:   warning: false   message: false ---  # 1. Executive Summary  This report benchmarks the ESG-relevant performance of four key green coffee origins (**Brazil, Colombia, Peru, Honduras**) to support sourcing decisions for a fictitious European green coffee importer:  **Andean Green Coffee Europe S.L. (Spain).**  The analysis combines:  - **FAOSTAT production data** (supply concentration & volume risk)   - **World Bank rural/social indicators** (social exposure & vulnerability)    The objective is **not** to “rank countries morally”, but to provide a structured decision framework to support ESG-aware sourcing.  **Business question:**   *How can a European green coffee importer compare coffee origins using a transparent ESG-oriented framework?*  **Core origins analyzed:** Brazil, Colombia, Peru, Honduras.  **What this report delivers:** - Production trends and concentration risks   - Social and rural exposure indicators   - A simple ESG proxy score to compare origins   - Strategic implications and recommendations for sourcing policy    ---  # 2. Context & Strategic Use Case  Brazil dominates supply, creating **portfolio concentration risk**.  Higher rural/agricultural dependence can signal **higher social exposure**.  ESG trade-offs appear clearly:   **high-volume origins ≠ lowest social vulnerability.**  European green coffee buyers face a dual pressure:  - **Cost and reliability** (volume, production stability, diversification)   - **ESG and compliance** (social risk, rural vulnerability, long-term sustainability)  This project simulates a sourcing intelligence tool for:  **Andean Green Coffee Europe S.L. (fictional company).**  ---  # 3. Data Sources  | Dataset | Provider | Proxy Dimension | Notes | |---|---|---|---| | Coffee production | FAOSTAT | Supply / concentration risk | Tonnes per year | | Employment in agriculture (%) | World Bank | Social vulnerability | Higher = more dependence | | Rural population growth (%) | World Bank | Demographic pressure | Proxy for rural stress | | Gross domestic investment (%) | World Bank | Economic capacity | Proxy for resilience |  ---  # 4. Assumptions & Limitations  This is not a real ESG rating model.  It is a training-grade decision framework designed to: - be transparent   - be reproducible   - produce interpretable insights    Limitations: - World Bank indicators are not coffee-specific   - No Scope 1–3 emissions included yet (planned for Project 02)   - No governance indicators included (future upgrade)  ---  # 5. Load Processed Data  ```{r} library(readr) library(dplyr) library(tidyr) library(ggplot2) library(scales) library(knitr) library(kableExtra)  BASE <- "C:/Users/juanp/Documents/Meh" PROCESSED <- file.path(BASE, "data", "processed")  coffee <- read_csv(file.path(PROCESSED, "coffee_clean.csv")) full_data <- read_csv(file.path(PROCESSED, "full_data.csv")) esg_score <- read_csv(file.path(PROCESSED, "esg_score.csv"))
```

6. Production Benchmarking (FAOSTAT)

6.1 Production trends over time

```
p1 <- coffee %>%   ggplot(aes(x = year, y = production_tonnes, color = country)) +   geom_line(linewidth =
1.2) +   scale_y_continuous(labels = label_number(scale = 1e-6, suffix = "M t")) +   labs(     title =
"Coffee production trends (FAOSTAT)",     subtitle = "Brazil dominates total supply among the selected
origins",     x = "Year",     y = "Production (tonnes)",     color = "Origin"   ) +
theme_minimal(base_size = 13) +   theme(legend.position = "bottom")  p1
```

6.2 Average production (last 5 years)

```
ranking <- coffee %>%   filter(year >= max(year, na.rm = TRUE) - 4) %>%   group_by(country) %>%
summarise(avg_prod = mean(production_tonnes, na.rm = TRUE), .groups = "drop") %>%
arrange(desc(avg_prod))  p2 <- ranking %>%   ggplot(aes(x = reorder(country, avg_prod), y = avg_prod)) +
geom_col() +   coord_flip() +   scale_y_continuous(labels = label_number(scale = 1e-6, suffix = "M t")) +
labs(     title = "Average coffee production (last 5 years)",     subtitle = "A sourcing portfolio must
account for supply concentration risk",     x = "Origin",     y = "Average production (tonnes)"   ) +
theme_minimal(base_size = 13)  p2
```

7. Social & Rural Indicators (World Bank)

7.1 Employment in agriculture (proxy: rural dependence)

```
p3 <- full_data %>%   ggplot(aes(x = year, y = poverty_rate, color = country)) +   geom_line(linewidth =
1.1) +   labs(     title = "Employment in agriculture (%)",     subtitle = "Higher values suggest higher
dependence on rural/agricultural livelihoods",     x = "Year",     y = "% of total employment",     color
= "Origin"   ) +   theme_minimal(base_size = 13) +   theme(legend.position = "bottom")  p3
```

7.2 Rural population growth (proxy: rural pressure)

```
p4 <- full_data %>%   ggplot(aes(x = year, y = rural_growth, color = country)) +   geom_line(linewidth =
1.1) +   labs(     title = "Rural population growth (%)",     subtitle = "A proxy for demographic pressure
```

```
and rural transformation",     x = "Year",     y = "Annual growth (%)",     color = "Origin"   ) +
theme_minimal(base_size = 13) +   theme(legend.position = "bottom")  p4
```

8. Proxy ESG Score (Transparent model)

8.1 ESG score table

```
esg_score %>%   arrange(desc(esg_score)) %>%   mutate(esg_score = round(esg_score, 3)) %>%   kable(
col.names = c("Origin", "Production avg", "Employment agri avg", "Rural growth avg", "Investment avg",
"ESG proxy score")   ) %>%   kable_styling(full_width = FALSE)
```

8.2 Visual comparison

```
p5 <- esg_score %>%   ggplot(aes(x = reorder(country, esg_score), y = esg_score)) +   geom_col() +
coord_flip() +   scale_y_continuous(labels = label_percent(accuracy = 1)) +   labs(     title = "ESG proxy
score (illustrative)",     subtitle = "A transparent scoring method to support strategic discussions",
x = "Origin",     y = "Score (0–1)"   ) +   theme_minimal(base_size = 13)  p5
```

9. Strategic Interpretation (What the data suggests)

Based on the proxies used:

- Brazil dominates supply, increasing concentration risk.
- Colombia tends to balance production scale with relatively stronger socio-economic conditions.
- Peru and Honduras show higher rural dependence, suggesting higher exposure to social vulnerability.
- ESG trade-offs are structural: the lowest-risk supply origin is not always the lowest-risk social origin.

10. Recommendations (Consulting-grade)

Recommendation 1 — Build a balanced sourcing portfolio (reduce concentration risk)

Problem: Over-dependence on Brazil creates supply concentration risk.

Action:
Adopt a sourcing policy that sets a maximum share threshold for any single origin (e.g. 40–50%).

Deliverable:
A portfolio mix policy aligned with procurement risk management.

Recommendation 2 — Prioritize social safeguards for high-vulnerability origins

Problem: Higher employment in agriculture implies higher dependence on rural livelihoods, increasing social exposure.

Action:
For Peru and Honduras, include:

- Living income monitoring
- Supplier social audits
- Cooperative strengthening requirements

Deliverable:
A supplier ESG minimum requirements checklist.

Recommendation 3 — Invest in resilience signals (economic capacity proxy)

Problem: Origins with lower investment capacity may have weaker long-term adaptation potential.

Action:
Use economic resilience proxies to prioritize long-term supplier partnerships, including:

- climate adaptation projects
- productivity and quality improvement programs
- co-financing mechanisms

Deliverable:
A long-term resilience partnership strategy.

11. Next steps (Upgrade roadmap)

To convert this into a CSRD-ready tool:

- Add Scope 3 carbon intensity estimates (Project 02)
- Add climate risk mapping by origin (Project 03)
- Add a governance proxy and traceability layer (Project 07)

12. Appendix — Reproducibility

This report was generated from cleaned datasets located in:

`C:/Users/juanp/Documents/Meh/data/processed`

All transformations were executed in R using reproducible scripts.

```
 ---  # ✅ Cómo lo ejecutas (para que te genere el reporte bonito)  ### Opción 1 (la mejor): desde RStudio 1. Abre el `.qmd` 2. Click en **Render** 3. Te genera HTML o PDF según el YAML de arriba.  ---  ### Opción 2: por consola En R:  ```r quarto::quarto_render("reports/01_green_coffee_esg_report_v2.qmd")
```