# Could E-Commerce Accelerate Renewable Energy Use?: A Case of Indonesia

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# 1. Motivation

Understanding how growing e-commerce interacts with renewable energy adoption at household level is crucial for inclusive, low-carbon growth.

Indonesia = Southeast Asia's largest digital economy (USD 86.8 billion in 2023 -> USD 87 billion by 2025)

Net-zero by 2060; renewables 23% target by 2025 (RUEN)

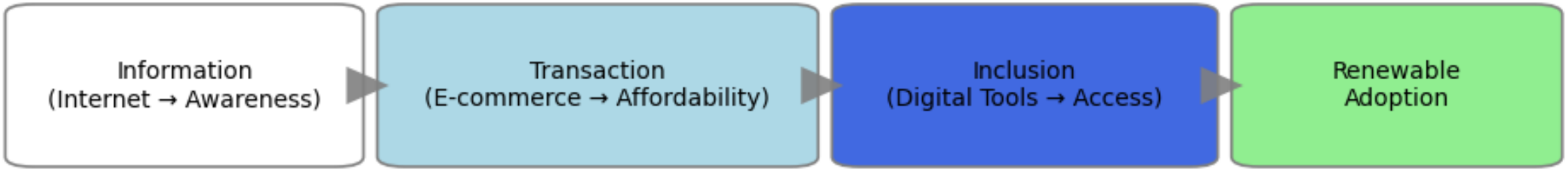
Yet digital and energy transitions progress separately

Key Question:

"Does household digital participation through e-commerce platforms facilitate or substitute for renewable energy adoption?"

# 2. Conceptual Framework

Digital participation through e-commerce platforms can enable renewable energy adoption through information, transaction, inclusion channels.




Three mechanisms

1. Information: Internet -> awareness of renewables
2. Transaction: Digital payments -> easier financing (PAYG solar)
3. Inclusion: E-commerce -> economic participation -> affordability

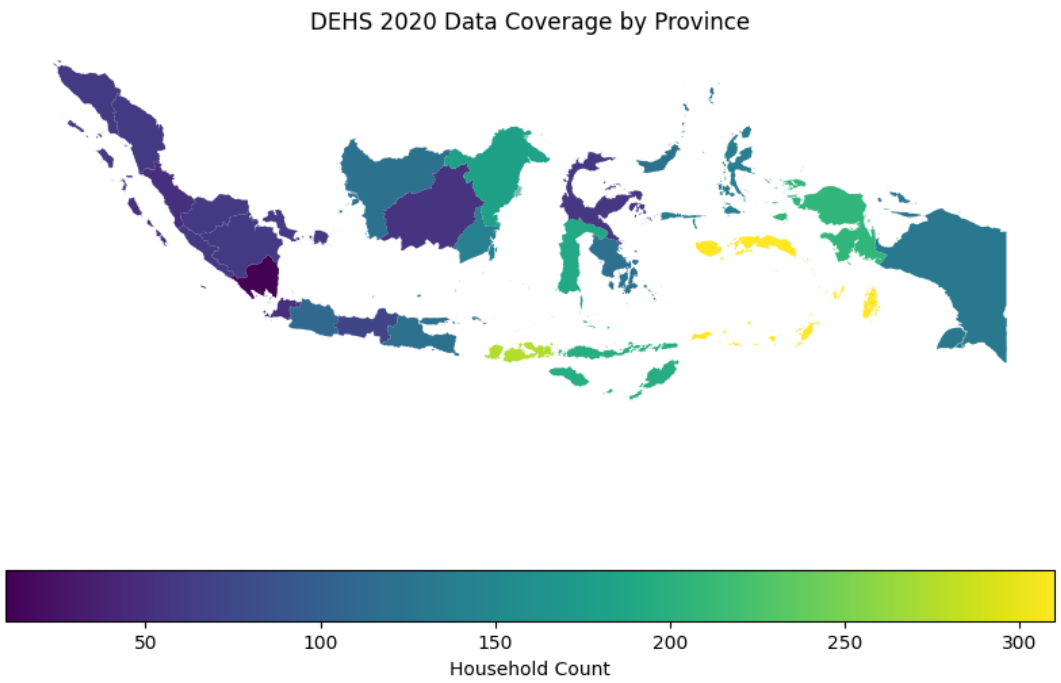
Hypothesis:

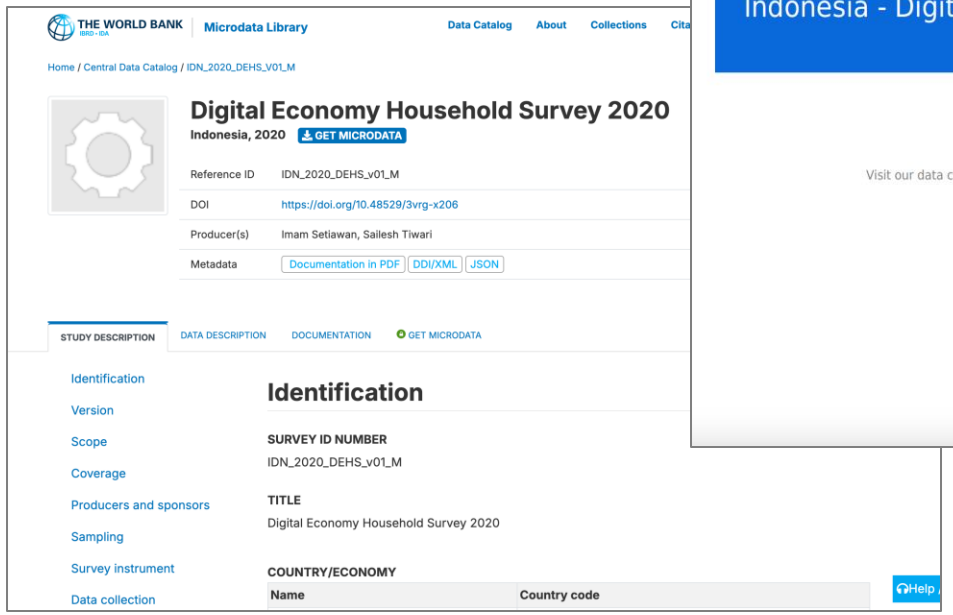
Digital participation (+) Renewable use => Complementary twin transition

# 3. Data and Variables

Dataset: Digital Economy Household Survey (DEHS 2020, World Bank)

- Nationally representative microdata
- 3,063 households (urban & rural)




# 4. Empirical Model

Linear probability Model (LPM):

$$Renewable\_use_i = \beta_0 + \beta_1 DigitalParticipation_i + \beta_2 X_i + \varepsilon_i$$

- Controls: income, education, urban/rural location, province FE
- Robust SE (HC1); Logit check for robustness

# 5. Key Findings

Digital participation is high but renewable adoption is very low. Regression results show a negative association that digitalized households are less likely to rely on renewables.

## Descriptive Statistics

| | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Dependent variable | | | | | |
| renewable_use | 3063.000 | 0.012 | 0.109 | 0.000 | 1.000 |
| Independent variables | | | | | |
| digital_payment | 191.000 | 0.115 | 0.320 | 0.000 | 1.000 |
| ecommerce_participation | 1542.000 | 0.124 | 0.330 | 0.000 | 1.000 |
| digital_participation | 1542.000 | 0.124 | 0.330 | 0.000 | 1.000 |
| Control variables | | | | | |
| log_income | 1542.000 | 0.024 | 0.222 | 0.000 | 2.079 |
| urban_dummy | 3063.000 | 0.667 | 0.471 | 0.000 | 1.000 |
| education_level | 3047.000 | 8.442 | 4.184 | 1.000 | 99.000 |
| province_code | 3063.000 | 58.304 | 24.337 | 11.000 | 94.000 |

## Regression Results

OLS Regression Results

| | | | |
|---|---|---|---|
| Dep. Variable: | renewable_use | R-squared: | 0.016 |
| Model: | OLS | Adj. R-squared: | 0.015 |
| Method: | Least Squares | F-statistic: | 8.859 |
| Date: | Sat, 18 Oct 2025 | Prob (F-statistic): | 4.14e-07 |
| Time: | 17:10:04 | Log-Likelihood: | 2460.8 |
| No. Observations: | 3063 | AIC: | -4912. |
| Df Residuals: | 3058 | BIC: | -4881. |
| Df Model: | 4 | | |
| Covariance Type: | HC1 | | |

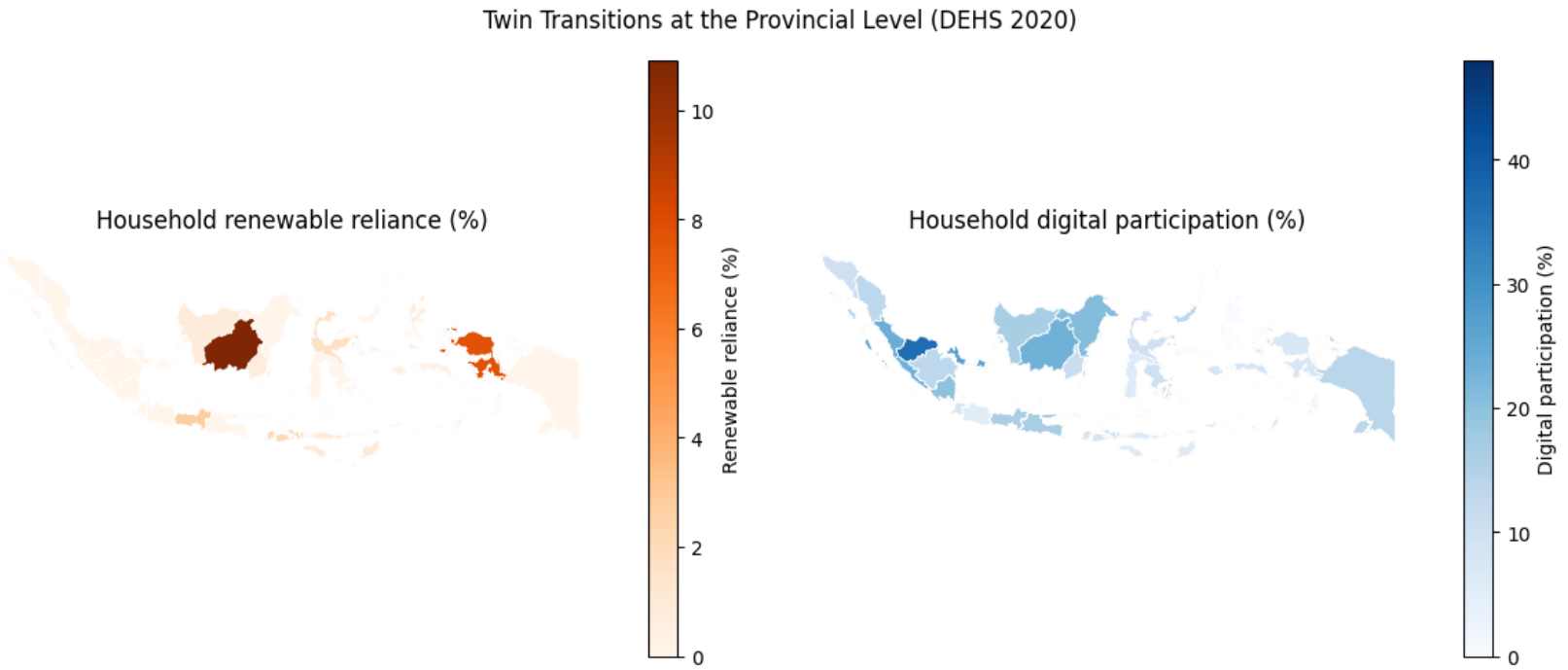
| | coef | std err | z | P>\|z\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| Intercept | 0.0353 | 0.007 | 5.037 | 0.000 | 0.022 | 0.049 |
| digital_participation | -0.0059 | 0.002 | -3.829 | 0.000 | -0.009 | -0.003 |
| log_income | -0.0022 | 0.001 | -2.164 | 0.030 | -0.004 | -0.000 |
| urban_dummy | -0.0280 | 0.006 | -5.036 | 0.000 | -0.039 | -0.017 |
| education_level | -0.0005 | 0.001 | -0.937 | 0.349 | -0.002 | 0.001 |

| | | | |
|---|---|---|---|
| Omnibus: | 4373.348 | Durbin-Watson: | 0.997 |
| Prob(Omnibus): | 0.000 | Jarque-Bera (JB): | 761594.737 |
| Skew: | 8.713 | Prob(JB): | 0.00 |
| Kurtosis: | 78.258 | Cond. No. | 60.2 |

Notes:
[1] Standard Errors are heteroscedasticity robust (HC1)

# 6. Interpretation

Urban households connected to grids are likely in digital markets but non-renewable; rural households are more on renewable energy but digitally excluded.




Parallel not integrated transitions

- Households with grid access -> digitally included but non-renewable
- Off-grid households -> renewable but digitally excluded
- Biomass fuels inflate “renewable” share? -> potential data bias

# 7. Policy Recommendations

To unlock synergies, Indonesia should integrate digital and energy policies in value chains, infrastructure, financing, and data.

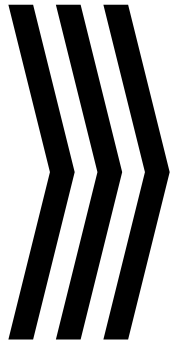
| | |
|---|---|
|  1. Integrate digitalization in energy access | -> Link e-commerce and e-wallets to PAYG off-grid solar equipment |
|  2. Co-locate digital and energy infrastructure | -> Bundle broadband and mini-grid equipments in rural areas |
|  3. Mobilize finance for digital energy startups | -> Utilize blended finance and impact investors led by DFIs |
|  4. Strengthen data coordination | -> Create cross-jurisdictional observatory for digital and energy data |

# 8. Implications

Aligning e-commerce and renewable energy can create mutually reinforcing pathways for inclusive, sustainable growth.

Integrate

Joint Impact



DIGITAL ECONOMY INCLUSION THROUGH E-COMMERCE PLATFORMS

GREEN ENERGY INCLUSION THROUGH OFF-GRID RENEWABLES

EFFICIENCY GAINS AND INCLUSIVE GROWTH (-> SDG7&9)

# 9. Conclusions and Future Work

Digital and renewable transitions in Indonesia remain parallel but can converge through integrated policy design and investment.

| Main Takeaways: | Next Steps: |
| --- | --- |
| • Digital and energy transitions move in parallel, not together<br>• Integration through co-located investment and data governance is key | • Add panel data or 4G-tower IV for causal inference<br>• Expand analysis to ASEAN comparative context |