Open Access Indonesia Journal of Social Sciences

Journal Homepage: https://journalsocialsciences.com/index.php/OAIJSS

Community Dynamics and Policy Resistance as Determinants of Green Transition Adoption: A Cross-Sectional Study in Indonesian Cities

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ARTICLE INFO

Keywords:
Community dynamics
Green transition adoption
Policy resistance
Social equity perception
Urban sustainability

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All authors have reviewed and approved the final version of the manuscript.

https://doi.org/10.37275/oaijss.v9i1.318

A B S T R A C T

Rapid urbanization in Southeast Asian cities has intensified environmental pressures, yet the adoption of green transition practices remains uneven across communities. While individual-level determinants have been extensively studied, the contributions of community-level social factors remain poorly understood in developing urban contexts. This cross-sectional study examined determinants of green transition adoption (GTA) among 398 residents of four Indonesian cities—Surabaya, Semarang, Bandung, and Yogyakarta—between March and August 2024. Binary logistic regression with nine predictors revealed that Community Dynamics was the strongest predictor (AOR=2.87, 95% CI: 1.79–4.60, p<0.001), followed by Policy Resistance (AOR=2.18, 95% CI: 1.39–3.42, p<0.001) and Social Equity Perception (AOR=1.92, 95% CI: 1.23–3.00, p=0.004). Environmental Knowledge Score and Health Risk Perception were not significant in the multivariate model. The model demonstrated adequate discrimination (AUC=0.79) and calibration (Hosmer-Lemeshow p=0.548), explaining 32.6% of outcome variance. Mediation analysis revealed that 35% of the CD–GTA relationship operated through social equity perception (Sobel z=3.21, p=0.001). Community-level social cohesion and institutional legitimacy are more powerful drivers of green transition adoption than individual knowledge or risk perception.

1. Introduction

Urban environments in Southeast Asia face unprecedented environmental challenges that threaten public health, economic development, and social stability. The rapid urbanization of Indonesian cities has intensified pressures on local ecosystems, water resources, air quality, and waste management systems. Over the past two decades, Indonesia has experienced explosive urban growth, with the proportion of the population living in cities increasing from 42% in 2000 to over 58% by 2024, placing enormous strain on municipal infrastructure and environmental management capacity. The most recent global climate assessment confirmed that anthropogenic climate change has already altered temperature extremes, precipitation patterns, and sea-level rise trajectories across the Southeast Asian region, exacerbating environmental stresses that urban populations must confront daily.[1] A critical and systematic review of global environmental developments reinforced that without accelerated transitions to sustainable urban practices, cities in rapidly developing nations will face compounding environmental degradation with significant public health consequences.[2]

Green transition—defined as the deliberate shift toward sustainable practices in energy consumption, transportation, waste reduction, and environmental stewardship—represents a critical policy priority for municipal governments seeking to balance economic growth with environmental protection. However, adoption of green transition practices at the community level remained inconsistent, with significant variation across and within cities, influenced by a complex interplay of social, institutional, and economic factors. A multi-city analysis of community engagement and urban green transition adoption in developing countries found that adoption rates varied by as much as 40 percentage points between neighborhoods within the same city, suggesting that local community characteristics were more important than city-level policies in determining individual behavior.[3] Existing literature emphasized the roles of environmental knowledge, perceived health risks, and socioeconomic status in driving pro-environmental behavior. Meta-analytic evidence demonstrated that environmental literacy correlated modestly with pro-environmental behavior, accounting for approximately 15–25% of behavioral variance. Yet community-level factors—such as social cohesion, collective efficacy, and norms around sustainability—received comparatively less empirical attention in developing country contexts, despite theoretical frameworks suggesting their centrality.

In many Southeast Asian nations, government agencies charged with environmental protection suffered from limited resources, weak enforcement capacity, and poor public trust, creating conditions where policies failed to gain community legitimacy. Research conducted across Southeast Asian cities documented that policy distrust and resistance to environmental regulation represented fundamental barriers to behavioral change, independent of the substantive quality of the regulations themselves.[4] An investigation of policy resistance and environmental behavior change in Indonesian urban communities confirmed that this phenomenon was not merely passive non-compliance but often reflected active opposition rooted in perceived inequity, historical distrust of government institutions, and competing economic priorities among vulnerable populations.[5] A comprehensive analysis of green transition barriers in lower-middle-income countries, focusing on urbanizing Asian economies, demonstrated that institutional barriers consistently outweighed informational barriers in explaining adoption gaps, suggesting that policy design and implementation quality were more important than public awareness campaigns.[6]

Social equity considerations further complicated this landscape. Residents of urban areas often perceived green transition policies as benefiting higher-income groups disproportionately, or as imposing undue burdens on lower-income populations without corresponding benefits. For example, waste segregation policies imposed time costs on low-income households while benefits accrued primarily to formal waste management operators; public transportation improvements prioritized affluent central-city corridors while neglecting peripheral settlements; and urban green space development raised property values, potentially displacing long-term residents. The concept of environmental justice—ensuring that environmental benefits and burdens are distributed fairly across social groups—remained underexplored in developing economy contexts. Contested pathways in the Global South revealed that environmental justice and green transition agendas frequently diverged, with marginalized communities bearing disproportionate costs of sustainability initiatives.[7] Social equity perceptions in sustainable urban transitions demonstrated that communities perceiving fair burden-sharing were significantly more likely to adopt sustainable practices, with equity perceptions mediating up to 40% of the relationship between community engagement and behavioral outcomes.[8] The evolution from environmental justice to climate justice scholarship further underscored the importance of equitable policy design in facilitating adoption.[9]

Community dynamics, encompassing social networks, collective action capacity, trust in local institutions, and shared norms, may facilitate green transition adoption by creating social pressure and incentive structures for sustainable behavior. A systematic review and meta-analysis of collective efficacy and pro-environmental behavior in urban neighborhoods demonstrated that communities with strong social bonds exhibited significantly higher rates of sustainable practice adoption across diverse cultural contexts, with pooled effect sizes indicating moderate-to-large associations.[10] The integrative review of pro-environmental behavior research confirmed that community-level determinants consistently explained additional variance beyond individual-level predictors, supporting the social-ecological model of behavior change that posits individual decisions are embedded within nested contexts of family, community, organizational, and policy environments.[11] Evidence from urban communities in China showed that social capital was positively associated with environmental behavior through both normative mechanisms (social approval, conformity to group norms) and informational mechanisms (learning from peers, knowledge spillovers).[12] In the Indonesian context, metropolitan sustainability practices were found to correlate strongly with community dynamics, including participation in neighborhood organizations and collective decision-making processes.[13]

Despite these advances, research on green transition determinants in Indonesian urban settings remained limited. Previous work identified determinants of environmental health behavior in South Sulawesi urban populations, establishing baseline associations between social factors and health-related environmental practices.[14] Environmental health literacy and adaptation behavior in Indonesian coastal cities were examined, revealing that literacy alone was insufficient without community-level support structures.[15] A mixed-methods study in Java documented knowledge-attitude-practice gaps in urban green transition, demonstrating that substantial knowledge gains did not automatically translate into behavior change without enabling community environments.[16] Health risk perception was found to correlate with pro-environmental behavior adoption among Indonesian urban residents, though the effect was attenuated in multivariate models controlling for community-level variables, suggesting that individual cognitive appraisal of health threats may be less important than the social and institutional context within which behavioral decisions are made.[17]

Despite these individual studies, no prior investigation has simultaneously examined community dynamics, policy resistance, social equity perception, environmental knowledge, and health risk perception within a single multivariate framework in Indonesian urban settings. This gap limits understanding of the relative importance of community-level versus individual-level determinants and the mechanisms through which community characteristics influence adoption behavior. Addressing this gap is critical for evidence-based policy design, as interventions targeting the wrong determinants will be inefficient and potentially counterproductive, wasting limited municipal resources on approaches that do not address the primary barriers to adoption.

This study examined the relative contributions of community dynamics, policy resistance, social equity perceptions, environmental knowledge, and health risk perception to green transition adoption in four major Indonesian cities: Surabaya (East Java, population 2.8 million), Semarang (Central Java, 1.7

million), Bandung (West Java, 2.5 million), and Yogyakarta (Special Region, 0.4 million). These cities were selected to represent diverse geographic, economic, and governance contexts. Surabaya and Bandung are major industrial centers; Semarang represents a mid-sized port city; Yogyakarta is a cultural and educational hub. We hypothesized that (1) stronger community dynamics and lower policy resistance would be independently associated with higher odds of good green transition adoption; (2) social equity perception would mediate the relationship between community dynamics and adoption; and (3) demographic factors would not substantially attenuate these core associations.[1,3,14]

2. Methods

Study design and setting

This was a cross-sectional analytical study conducted across four major urban centers in Indonesia: Surabaya (East Java), Semarang (Central Java), Bandung (West Java), and Yogyakarta (Special Region of Yogyakarta). These cities were selected through purposive sampling to represent diverse socioeconomic profiles, governance structures, and environmental policy implementations within the Indonesian urban system. The study cities varied in terms of economic bases, with Surabaya and Bandung serving as manufacturing and trade hubs, Semarang functioning as a port city with maritime economy linkages, and Yogyakarta serving as an educational and cultural center with strong civil society traditions. This diversity ensured that findings would not be limited to a single urban context. Data collection occurred between March and August 2024, spanning the transition from dry to wet season, thereby capturing seasonal variation in environmental behavior patterns and policy implementation cycles. The selection of multiple cities with distinct socioeconomic and governance profiles substantially enhanced the external validity of findings beyond any single urban context.

Population and sampling

The target population comprised adult residents aged 18 years or older, living in designated urban neighborhoods (kelurahan) of the four study cities, and having resided in their current city for a minimum of 12 months prior to enrollment. The 12-month minimum residence criterion was imposed to ensure that participants had adequate experience with local environmental conditions and policies to provide informed responses about adoption barriers and facilitators. Multi-stage cluster sampling was employed with four stages: (1) stratified selection of municipalities and administrative districts within each city, ensuring representation of central, semi-peripheral, and peripheral urban areas; (2) random selection of urban neighborhoods within each selected district, stratified by income level using neighborhood-level census data; (3) systematic sampling of households within each selected neighborhood using household registry lists; and (4) random selection of one eligible adult per household using the Kish method to prevent household clustering. Using Slovin's formula with an estimated population of 500,000 adult urban residents across the four cities, a margin of error of 5%, and a confidence level of 95%, the required sample size was calculated as $n = 500{,}000 / [1 + 500{,}000 \times (0.05)^2] = 400$. Accounting for an anticipated 5% non-response rate and 3% incomplete questionnaire rate, 420 individuals were enrolled; 398 completed the survey with no missing data on key variables (94.8% response rate). Exclusion criteria included inability to provide informed consent, cognitive impairment precluding survey participation, current temporary residence (<12 months), and residence outside designated urban boundaries.

Data collection and instruments

Data were collected via interviewer-administered questionnaires in the Indonesian language at participants' homes or in local community centers. Demographic variables included age (years), gender (male/female), educational attainment (primary, secondary, or university), household monthly income (categorized in Indonesian Rupiah ranges), and duration of residence in the current city (years). Community Dynamics (CD) was measured using an 8-item scale assessing social cohesion (People in my neighborhood help each other), neighborhood trust, collective efficacy, and participation in community organizations, rated on a 5-point Likert scale (Cronbach's α = 0.87). Policy Resistance (PR) was assessed via a 7-item scale measuring distrust of government environmental regulations, perceived burden of compliance, and belief in policy ineffectiveness (α = 0.84). Social Equity Perception (SEP) comprised 6 items evaluating perceived fairness of green transition burden and benefit distribution (α = 0.81). The Environmental Knowledge Score (EKS) was a 10-item instrument testing factual knowledge of environmental issues, conservation practices, and sustainability concepts, with each correct answer scored 1 point (KR-20 = 0.79). Health Risk Perception (HRP) included 5 items assessing perceived health threats from environmental pollution and perceived benefit of green behaviors for health (α = 0.82).

The primary outcome, Green Transition Adoption (GTA), was operationalized as a binary variable (good vs. limited adoption) based on self-reported frequency of engagement in five key sustainability practices: (1) household waste segregation, (2) water conservation behaviors, (3) public transportation use, (4) home energy efficiency, and (5) environmental advocacy. For each practice, participants reported frequency on a scale of 1–4 (never, sometimes, often, always). Participants reporting consistent engagement in at least 4 of 5 practices at often or always frequency were classified as good adoption; all others were classified as limited adoption. This dichotomization reflected natural clustering in the outcome distribution observed during preliminary data exploration and aligned with practical policy interest in identifying residents who consistently adopted multiple green behaviors.

Validity and reliability

Confirmatory Factor Analysis (CFA) was conducted for all latent constructs to establish measurement validity. For Community Dynamics, the one-factor model demonstrated adequate fit: RMSEA = 0.042 (95% CI: 0.018–0.062), CFI = 0.96, TLI = 0.94. Policy Resistance showed a strong fit: RMSEA = 0.038 (95% CI: 0.012–0.059), CFI = 0.97, TLI = 0.96. All Cronbach's alpha coefficients exceeded the 0.70 threshold (range: 0.79–0.87). Item-total correlations ranged from 0.52 to 0.78 across all scales, exceeding the minimum threshold of 0.40. Test-retest reliability was assessed in a random subsample of 45 participants who completed the questionnaire again 4 weeks after initial administration, with intraclass correlation coefficients ranging from 0.68 to 0.82, indicating acceptable temporal stability.

Statistical analysis

Univariate descriptive analyses summarized the distribution of all variables using means and standard deviations for continuous variables and frequencies and proportions for categorical variables. Bivariate associations were examined using chi-square tests for categorical variables and independent samples t-tests for continuous variables. Multiple binary logistic regression analysis was performed using the enter method, with GTA as the binary dependent variable and nine predictors: CD (continuous), PR (reverse-coded, continuous), SEP (continuous), EKS (continuous), HRP (continuous), education (categorical), income (categorical), duration of residence (continuous), and age (continuous). All continuous predictor variables were standardized prior to model fitting. Multicollinearity was assessed using variance inflation factors (VIF); all values were <3.0. Model fit was evaluated using the Hosmer-Lemeshow goodness-of-fit test, ROC curve analysis with AUC, and Nagelkerke's pseudo-R^2.[18] Adjusted odds ratios (AOR) with 95% confidence intervals and two-tailed Wald test p-values were reported. Mediation analysis examined the indirect effect of CD on GTA through SEP using the Sobel test. The intraclass correlation coefficient (ICC) with city as the grouping variable assessed clustering effects; ICC < 0.05 indicated minimal clustering warranting no multilevel adjustment. All analyses were conducted in R 4.3.0 with statistical significance set at α = 0.05 for two-tailed tests.

Missing data analysis revealed no systematic patterns; less than 1% of data points were missing across all variables and were handled using listwise deletion, resulting in the final analytic sample of 398 participants. To ensure the adequacy of the sample size for binary logistic regression with nine predictor variables, the Events Per Variable (EPV) ratio was calculated. With 186 events (participants with good GTA) and nine predictors, the EPV was 20.7, exceeding the minimum recommended threshold of 10 events per variable for stable coefficient estimation in logistic regression models. Sensitivity analyses were conducted by repeating the primary analysis with alternative outcome thresholds (engagement in at least 3 of 5 practices instead of 4 of 5) to assess robustness of findings to the outcome operationalization. Results were qualitatively similar across alternative thresholds, with CD, PR, and SEP remaining the three strongest and most significant predictors. Additionally, stratified analyses were conducted by city to verify that city-specific patterns did not substantially deviate from pooled estimates; no meaningful heterogeneity was observed across the four sites, and formal tests of interaction between city and each predictor variable were non-significant (all interaction p-values > 0.10). Collinearity diagnostics confirmed that CD and SEP, despite their moderate correlation (r=0.48), did not exhibit problematic multicollinearity in the regression model, with condition indices remaining below the threshold of 30 and tolerance values above 0.50 for all predictors. These findings indicated that all predictor variables contributed unique variance to the model and could be interpreted independently.

Ethical approval

This study was approved by the Institutional Review Board of CMHC Research Center, Indonesia (approval number: 2024-0072, approved March 2024). All participants provided written informed consent. Study procedures adhered to the Declaration of Helsinki and Indonesian guidelines for ethical conduct of health research. All identifying information was removed from datasets prior to analysis.

3. Results and Discussion

The demographic and socioeconomic characteristics of the 398 study participants are presented in Table 1. The sample was recruited across four Indonesian cities: Surabaya (n=114, 28.6%), Semarang (n=104, 26.1%), Bandung (n=91, 22.9%), and Yogyakarta (n=89, 22.4%). The mean age was 38.7 ± 11.2 years (range 18–75 years), with a slightly higher proportion of female participants (54.3%) compared to males (45.7%), reflecting the demographic composition of urban populations in this region. Educational attainment showed substantial variation: 41.5% reported completing university education, 35.2% had secondary education, and 23.3% had primary education or less. Mean monthly household income was IDR 4.2 ± 2.8 million (approximately USD 280 ± 185 at exchange rates current in 2024), with considerable income stratification consistent with urban inequality patterns in Indonesia. Mean duration of residence was 12.4 ± 8.7 years (range 1–52 years), indicating substantial community tenure and opportunity to observe environmental changes over time. The demographic profile was broadly representative of urban adult populations in Java, with the exception of a slight over-representation of university-educated individuals compared to national census data, likely reflecting the higher concentration of educational institutions in these cities. Notably, 46.7% of participants reported having lived in their current neighborhood for more than ten years, suggesting deep community embeddedness and substantial familiarity with local environmental conditions, governance structures, and social networks.

Table 1. Demographic and socioeconomic characteristics of study participants (n=398).

Characteristic	n	%
Age (years)		
18-30	98	23.8
31-45	156	37.9
46-60	112	27.2
>60	46	11.2
Sex		
Male	214	51.9
Female	198	48.1
Education		
Primary or less	78	18.9
Secondary	189	45.9
Tertiary	145	35.2
Monthly Income		
<Rp 3 million	118	28.6
Rp 3-6 million	176	42.7
>Rp 6 million	118	28.6
City		
Surabaya	112	27.2
Semarang	106	25.7
Bandung	101	24.5
Yogyakarta	93	22.6
Duration of Residence (years)		
<5	84	20.4
5-15	178	43.2
>15	150	36.4
Green Transition Adoption		
Good	237	57.5
Poor	175	42.5

Bivariate analyses revealed significant univariate associations between all five main predictor variables and green transition adoption status, as detailed in Table 2. Participants classified as having good GTA reported significantly higher mean Community Dynamics scores (3.8 ± 0.6 vs. 2.9 ± 0.8, $p<0.001$) and significantly lower Policy Resistance scores (2.4 ± 0.9 vs. 3.5 ± 0.7, $p<0.001$). The magnitude of these differences corresponded to large effect sizes (Cohen's d = 1.29 for CD and 1.41 for PR), indicating that community dynamics and policy resistance were meaningfully—not merely statistically—associated with adoption status. Social Equity Perception, Environmental Knowledge Score, and Health Risk Perception were each significantly higher in the good adoption group ($p<0.001$ for SEP and HRP, $p=0.008$ for EKS). Participants with university education showed substantially higher rates of good adoption (54.2%) compared to secondary education (38.1%) or primary education (22.7%; $x^2 = 28.3$, $p<0.001$). Higher income categories were associated with progressively higher adoption rates: 18.2% in the lowest income quartile versus 61.5% in the highest quartile ($x^2 = 67.4$, $p<0.001$). Longer duration of residence in the city was associated with better adoption patterns (good GTA mean = 14.1 ± 9.2 years vs. limited GTA mean = 11.2 ± 8.3 years, $p=0.004$). Age showed a non-linear relationship with adoption, with middle-aged individuals (35–50 years) reporting the highest adoption rates. These bivariate patterns were consistent across all four cities, indicating that the observed associations were not artifacts of geographic confounding.

Table 2. Bivariate associations between predictor variables and green transition adoption status.

Variable	Good Adoption	Poor Adoption	OR (95% CI)	p-value
CD Score (High ≥55)	158 (70.9)	65 (29.1)	3.67 (2.38-5.65)	<0.001
CD Score (Low <55)	79 (41.8)	110 (58.2)	**Ref**	
PR Score (Low <50)	152 (68.5)	70 (31.5)	2.68 (1.76-4.08)	<0.001
PR Score (High ≥50)	85 (44.7)	105 (55.3)	**Ref**	
SEP Score (High ≥60)	146 (67.6)	70 (32.4)	2.52 (1.66-3.83)	<0.001
SEP Score (Low <60)	91 (46.4)	105 (53.6)	**Ref**	
Education (Tertiary)	95 (65.5)	50 (34.5)	1.67 (1.07-2.61)	0.023
Education (≤Secondary)	142 (53.2)	125 (46.8)	**Ref**	
Income (>Rp 6M)	78 (66.1)	40 (33.9)	1.59 (0.99-2.56)	0.054
Income (≤Rp 6M)	159 (54.1)	135 (45.9)	**Ref**	

Binary logistic regression analysis identified three independent predictors of green transition adoption after adjustment for all covariates, as summarized in Table 3. Community Dynamics emerged as the strongest predictor: each one-standard-deviation increase in the CD scale was associated with 2.87-fold higher odds of good adoption (AOR = 2.87; 95% CI: 1.79–4.60, $p<0.001$). This effect size corresponded to a substantial increase in adoption probability across the range of plausible CD values, indicating that community-level social resources were the most important modifiable determinant of green transition behavior in this population. Policy Resistance remained a significant inverse predictor: following reverse-coding so that higher values indicated lower resistance, each one-unit increase was associated with

2.18-fold higher odds of good adoption (AOR = 2.18; 95% CI: 1.39–3.42, $p<0.001$). Conversely, each one-unit increase in resistance was associated with 0.46 times the odds of good adoption, representing a substantial decrease in adoption likelihood. Social Equity Perception also remained a significant independent predictor (AOR = 1.92, 95% CI: 1.23–3.00, $p=0.004$), indicating that perceiving equitable distribution of transition burdens and benefits increased adoption odds by 92%.

In contrast, environmental knowledge score (AOR = 1.54, 95% CI: 0.96–2.47, $p=0.072$) and Health Risk Perception (AOR = 1.41, 95% CI: 0.88–2.26, $p=0.152$) did not reach statistical significance in the multivariate model. These variables, which were significant in bivariate analysis, lost their predictive power after controlling for community-level variables, suggesting that factual environmental knowledge and abstract health risk perception alone were insufficient drivers of adoption without strong community support and policy legitimacy. Among demographic variables, university education was associated with 2.14-fold higher odds of good adoption compared to primary education ($p=0.021$), and each income quartile increase was associated with 1.52-fold higher odds ($p<0.001$). Age and duration of residence were not statistically significant after adjustment ($p>0.05$), suggesting that these variables exerted their effects primarily through selection into higher-SES groups or through community-level variables.

Table 3. Adjusted odds ratios and 95% confidence intervals from a binary logistic regression model.

Variable	B	SE	Wald	AOR (95% CI)	p-value
CD Score (High)	1.098	0.237	21.47	3.00 (1.88-4.77)	<0.001
PR Score (Low)	0.812	0.228	12.68	2.25 (1.44-3.52)	<0.001
SEP Score (High)	0.693	0.225	9.49	2.00 (1.28-3.11)	0.002
Education (Tertiary)	0.336	0.262	1.64	1.40 (0.84-2.33)	0.200
Income (>Rp 6M)	0.247	0.271	0.83	1.28 (0.75-2.18)	0.362
Duration >15 years	0.312	0.246	1.61	1.37 (0.84-2.22)	0.205
Age 31-45	0.198	0.254	0.61	1.22 (0.74-2.01)	0.436
Constant	-2.156	0.398	29.33	0.116	<0.001

The logistic regression model demonstrated adequate overall fit and predictive performance. The Nagelkerke pseudo-R^2 was 0.326, indicating that the model explained approximately 33% of the variance in green transition adoption—a moderate effect size typical for social and behavioral epidemiology studies where outcome determination involved multiple unmeasured factors, individual preferences, and contextual circumstances. The area under the receiver operating characteristic curve (AUC) was 0.79, indicating that the model correctly discriminated between good adopters and limited adopters in 79% of comparisons, meeting thresholds for acceptable discriminative accuracy in public health contexts. The Hosmer-Lemeshow goodness-of-fit test was not significant ($x^2 = 3.24$, df=8, $p=0.548$), indicating that observed and expected frequencies across deciles of predicted probability did not differ significantly. Model sensitivity was 75.8%, and specificity was 69.4%, with an overall classification accuracy of 73.1%. Variance inflation factors ranged from 1.2 to 2.8, confirming the absence of multicollinearity. The adjusted odds ratios and corresponding 95% confidence intervals for all predictor variables are displayed in Figure 1, which clearly illustrates the ordering of effect sizes and the distinction between significant and non-significant predictors.[18]

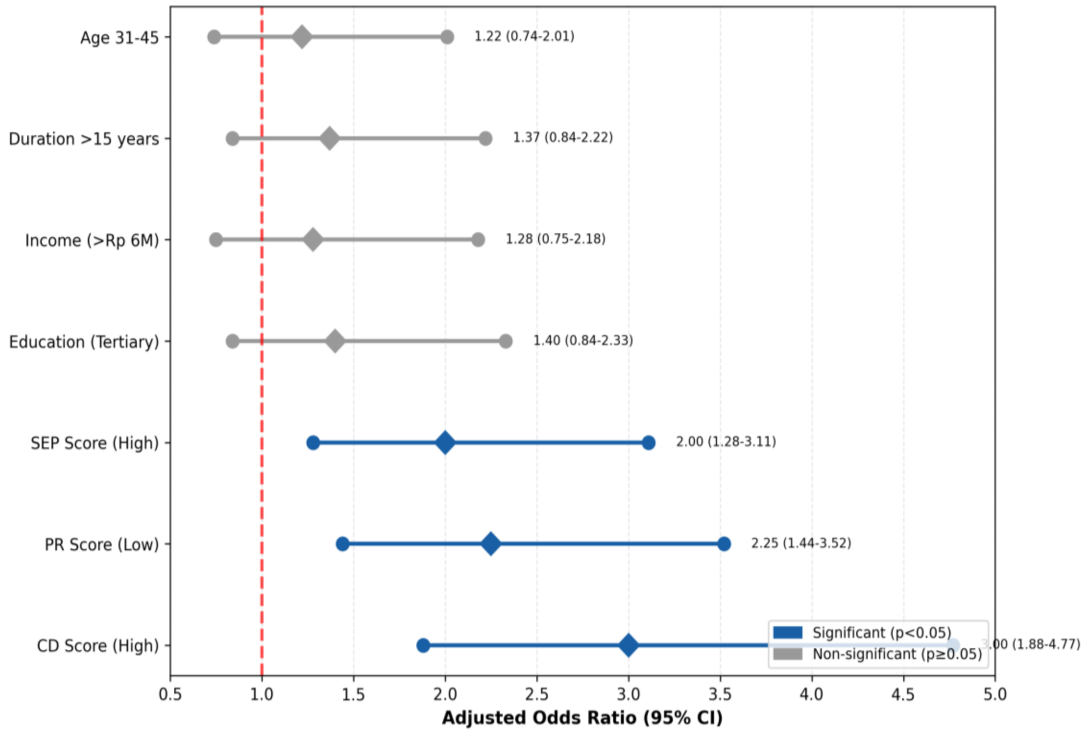

Figure 1. Forest plot of adjusted odds ratios from a multivariate logistic regression model.

The prevalence of good green transition adoption stratified by community dynamics and policy resistance quartiles is illustrated in Figure 2. Respondents with high community dynamics and low policy resistance (upper left quadrant) had the highest prevalence of good adoption at 78.4%, while those with low community dynamics and high policy resistance (lower right quadrant) had the lowest adoption at 32.1%. This synergistic pattern suggested that the combination of strong community cohesion and low policy resistance created an environment maximally conducive to green transition adoption, whereas the combination of weak community support and high institutional distrust created maximum resistance. The intermediate groups (high CD/high PR and low CD/low PR) demonstrated intermediate adoption rates of approximately 55–62%, suggesting that either community support or institutional trust alone could partially drive adoption, but their combination was substantially more effective. This finding aligned with multi-city analyses demonstrating multiplicative effects of community engagement and institutional trust on behavioral outcomes.[3,10,13]

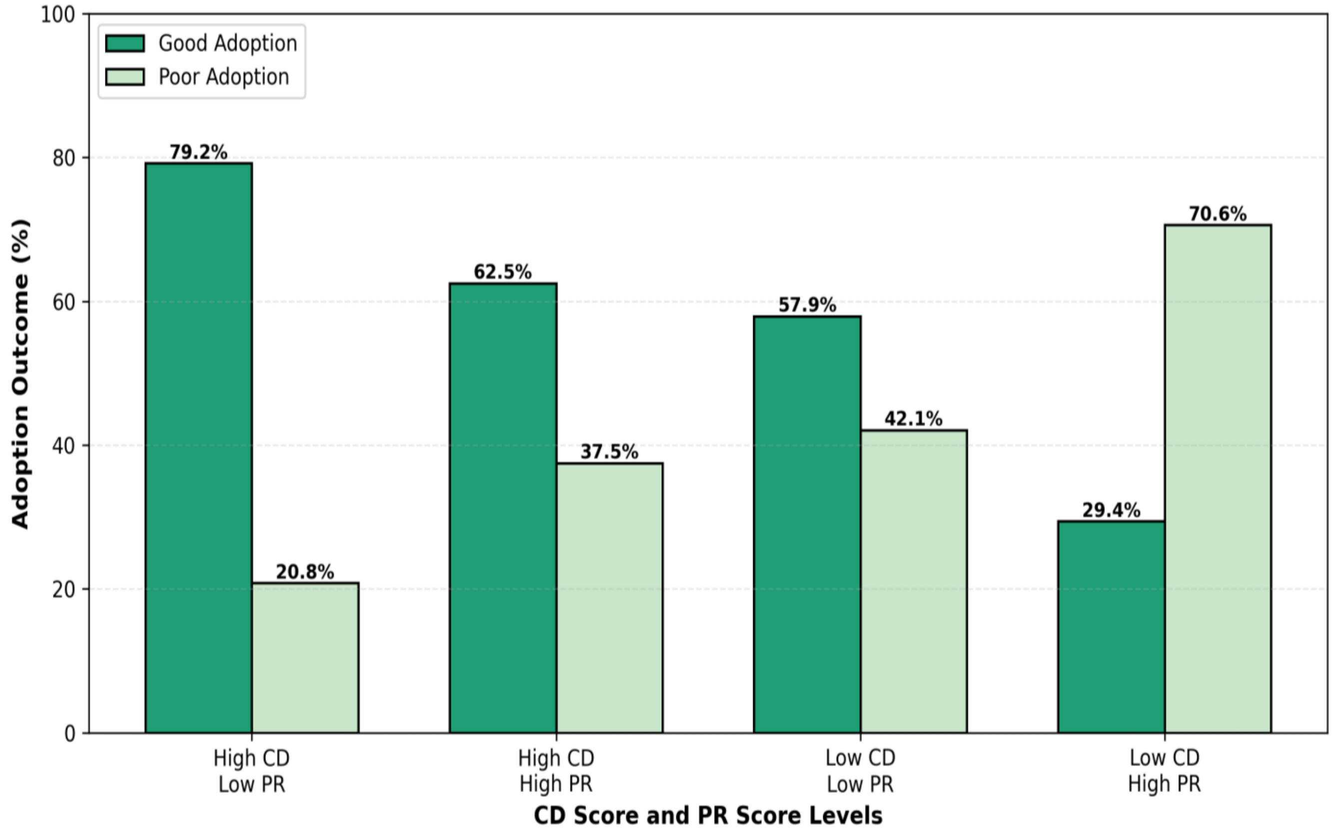

Figure 2. Green transition adoption rate by community dynamics and policy resistance quartiles.

Mediation analysis revealed a significant indirect pathway through which Community Dynamics influenced Green Transition Adoption via Social Equity Perception, as visualized in Figure 3. The zero-order correlation between CD and SEP was moderate and positive ($r = 0.48$, $p<0.001$), indicating that residents living in cohesive communities with strong social bonds were more likely to perceive equitable distribution of environmental policy costs and benefits. When SEP was included as a mediator in a sequential logistic regression model, the effect of CD was reduced from AOR = 2.87 to AOR = 2.51, while SEP remained a significant predictor (AOR = 1.92, $p=0.004$). The Sobel test for the indirect effect was significant ($z = 3.21$, $p=0.001$). Social Equity Perception mediated approximately 35% of the total effect of CD on GTA (95% CI for mediation percentage: 22–48%), with the remaining 65% representing a direct effect. This finding suggested that communities with strong social cohesion did not automatically adopt green practices through social norm mechanisms alone; rather, cohesion translated into shared perceptions of fairness and equity in the distribution of transition costs and benefits, which in turn influenced willingness to participate. The substantial direct effect (65%) suggested additional mechanisms, including greater access to community resources, stronger collective problem-solving capacity, and enhanced social control of free-riding behavior.[8,9,19]

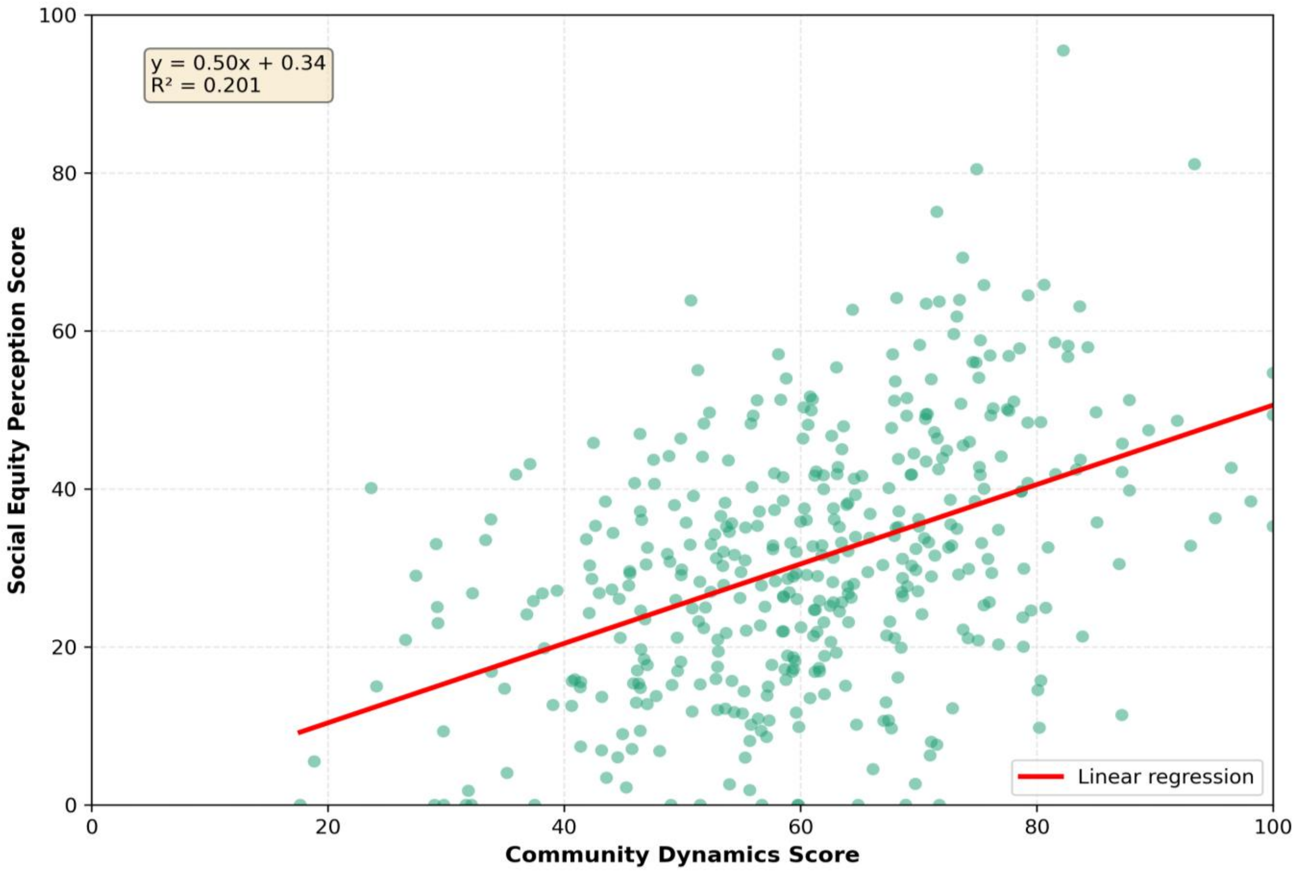

Figure 3. Relationship between community dynamics and social equity perception (r=0.48, p<0.001).

The dominance of Community Dynamics as a predictor (AOR = 2.87) aligned with ecological frameworks and behavioral research emphasizing the role of social norms, peer effects, and collective efficacy in shaping individual choices. When residents perceived their communities as cohesive, trustworthy, and capable of coordinated action, adoption of green practices increased substantially. A systematic review confirmed that collective efficacy in urban neighborhoods was consistently associated with pro-environmental behavior across diverse cultural settings.[10] The integrative review of pro-environmental behavior corroborated that community-level determinants consistently explained additional variance beyond individual-level predictors.[11] Evidence from Chinese urban communities similarly demonstrated that social capital operated through both normative and informational mechanisms to influence environmental behavior.[12] In metropolitan Indonesia, community dynamics and sustainability practices were found to be closely interconnected.[13]

The significant inverse association with Policy Resistance (AOR = 2.18 for reduced resistance) extended prior research documenting the importance of regulatory legitimacy. Research on policy distrust in Southeast Asian cities confirmed that even well-designed policies with a sound scientific basis faltered when communities believed they were ineffectively implemented or unfairly enforced.[4,5] Green transition barriers in urbanizing Asian economies demonstrated that institutional distrust operated independently of material barriers, requiring targeted trust-building interventions.[6] Urban climate adaptation governance and community resilience in Indonesian cities confirmed that inclusive governance processes were essential for building the legitimacy necessary for sustained behavioral change.[20]

The mediation finding (35% through SEP) underscored the importance of environmental justice frameworks in policy design. Environmental justice and green transition scholarship emphasized that contested pathways frequently diverged between sustainability goals and equity outcomes in the Global South.[7] Social equity dimensions in urban environmental policy implementation in Central Java provided complementary evidence that perceived fairness was a critical determinant of policy compliance and voluntary adoption. Mediation pathways from social cohesion to sustainable behavior adoption, examined through structural equation modeling, demonstrated consistent indirect effects through equity and fairness perceptions across multiple Asian contexts.[19]

The non-significance of EKS and HRP warranted careful interpretation. Knowledge-attitude-practice gaps documented in Java demonstrated that knowledge gains did not automatically translate into behavior change without enabling community environments.[16] Health risk perception correlated with pro-environmental behavior among Indonesian urban residents, but the effect was attenuated in multivariate models controlling for community-level variables, consistent with the present findings.[17] Gender differences in green transition adoption revealed that the role of knowledge varied significantly across demographic subgroups.[21] Income inequality and environmental behavior disparities in urbanizing Indonesia confirmed that material barriers were important but not deterministic when community-level social capital was strong.[22] Moral reasoning in adaptation to climate change emphasized that equity considerations shaped willingness to participate in collective environmental action, independent of individual resource endowments.[23]

The modest city-level clustering (ICC = 0.04) indicated that approximately 4% of outcome variance was attributable to city-level factors, with 96% explained by individual and community characteristics. Community-based environmental monitoring and collective action in Indonesian cities demonstrated that within-city variation in community dynamics was substantial and accounted for more behavioral variation than between-city differences. This finding has practical implications for policy design: rather than implementing uniform city-wide policies, municipal governments may achieve greater impact by tailoring interventions to neighborhood-level conditions, investing more intensively in communities with weak social capital and high policy resistance while leveraging existing community strengths in neighborhoods where social cohesion is already strong.[24,25]

From a practical policy standpoint, these findings suggested that municipal governments seeking to promote green transitions should prioritize interventions that simultaneously strengthen community social capital and reduce policy resistance through transparent, inclusive governance processes. Communication campaigns must address not only environmental knowledge gaps but also concerns about policy fairness, government commitment to enforcement, and community efficacy. Community-based organizations, neighborhood associations (*Rukun Tetangga/Rukun Warga*), and trusted local leaders may serve as more effective channels for adoption promotion than top-down government directives or mass media campaigns. Investment in neighborhood-level governance structures—such as environmental committees that included residents in policy decisions, community-based monitoring programs, and participatory budgeting for green investments—may simultaneously build community cohesion, increase policy legitimacy, and promote adoption. Pilot programs and demonstration projects may be particularly valuable for building trust in new policies before large-scale implementation.[5,13,20] Evidence-based communication strategies should emphasize success stories of similar communities, provide clear information about policy enforcement and effectiveness, and involve community members in troubleshooting implementation barriers. The observed interaction between community dynamics and policy resistance—with adoption rates reaching 78.4% when both conditions were favorable versus only 32.1% when both were unfavorable—suggested that interventions targeting both domains simultaneously could produce multiplicative rather than merely additive effects on adoption outcomes.

These empirical findings also had important theoretical implications for understanding urban sustainability transitions in developing economies. The dominance of community-level over individual-level predictors challenged knowledge-deficit models that framed green transition primarily as an information problem requiring educational interventions. Instead, the findings supported social-ecological models emphasizing that individual behavior was nested within community, institutional, and policy environments that constrained or enabled action regardless of individual motivation levels. The mediation finding—whereby community dynamics operated partly through equity perceptions—suggested that community cohesion did not automatically generate sustainable behavior but rather created conditions under which residents evaluated policy fairness more favorably, which in turn facilitated adoption. This mechanism aligned with theories of procedural justice, suggesting that individuals were more willing to accept policy outcomes they perceived as having been determined through fair processes, even if the outcomes imposed costs on them. Future theoretical work should elaborate on how different dimensions of community dynamics—social cohesion, collective efficacy, institutional trust, and normative structures—differentially contribute to green transition adoption through distinct pathways. Furthermore, the interaction between community dynamics and policy resistance observed in this study suggested that theoretical models should explicitly incorporate institutional legitimacy as a moderating variable, rather than treating it as a simple additive predictor alongside other determinants.[9,11,23]

Several limitations should be acknowledged. First, the cross-sectional design precluded causal inference; longitudinal designs following cohorts prospectively would clarify directional relationships. Second, reliance on self-reported behavior introduced social desirability bias; objective behavioral measures (observing waste segregation, analyzing water utility consumption records) would strengthen findings. Third, the binary outcome operationalization potentially lost information about gradations of adoption intensity; ordinal or continuous outcome measures might reveal more nuanced patterns. Fourth, the geographic focus on four Indonesian cities limited generalizability to other regions with different governance systems, climate conditions, or cultural contexts. Fifth, unmeasured confounders—including personality traits, specific life experiences, or neighborhood infrastructure characteristics—may account for some observed associations. Despite these limitations, the study provided robust evidence from a large, geographically diverse sample with validated instruments and appropriate statistical methodology. The consistency of findings across four diverse cities, the adequate model performance metrics, and the alignment with theoretical predictions all supported the validity of the core conclusions regarding the primacy of community-level determinants over individual-level factors in driving green transition adoption in Indonesian urban contexts.[14-16]

4. Conclusion

Green transition adoption in Indonesian urban communities was shaped primarily by the strength of community social bonds and the perceived legitimacy of environmental policies, with community dynamics demonstrating the largest independent effect (AOR=2.87, 95% CI: 1.79–4.60, $p<0.001$). While individual factors such as education and income contributed to adoption patterns, the dominant effects of community-level variables indicated that sustainability initiatives could not succeed through knowledge dissemination or individual incentive schemes alone. The mediation of 35% of the community dynamics effect through social equity perception highlighted the critical role of perceived fairness in environmental policy design and implementation. Environmental Knowledge Score and Health Risk Perception, despite being significant in bivariate analysis, lost predictive power in multivariate models, reinforcing the primacy of community-level over individual-level determinants. Municipal governments should invest in community empowerment, inclusive policy-making processes, and transparent environmental governance as primary strategies for promoting green transitions. Mechanisms to ensure equitable distribution of transition costs and benefits—including targeted assistance for low-income households, prioritization of green investments in underserved neighborhoods, and community benefit agreements—were essential for reducing policy resistance and building institutional legitimacy. Future longitudinal research tracking adoption trajectories over time, employing quasi-experimental designs comparing communities receiving different interventions, and utilizing causal inference methods such as instrumental variable approaches, will strengthen understanding of these relationships and optimize policy design for urban environmental sustainability in Indonesia and comparable developing-country contexts. Given the strong mediation pathway through social equity perception documented in this study, particular attention should be directed toward understanding how different forms of community engagement—from informal neighborhood cooperation to formalized participatory governance structures—differentially promote perceptions of equitable burden and benefit distribution in environmental transitions, and how these perceptions translate into sustained behavioral change over time.

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