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Original Article

Addressing Regional Poverty Traps: A Design Thinking Approach to Mitigating Socio-Structural Pathologies in Indonesia

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Abstract: *The regional disparity in poverty within developing archipelagic countries such as Indonesia is a classic "wicked problem," which is characterized by long-term geographic polarization, institutional friction, and deep-seated social-structural pathology. Traditional poverty alleviation strategies typically utilize top-down, standardized program-based transfers, but do not consider the specific characteristics of the local ecosystem or the behavioral dynamics of the people. In this study, I examine the structural causes of regional poverty traps throughout all 514 regencies/cities in Indonesia (comprising 34 provinces) using a human-centered Design Thinking framework to identify and address the systemic pathologies. My spatial and econometric empirical analyses indicate significant regional inequality in poverty rates; poverty headcount ratios (P0) ranged from 2.38% to 41.66% (average = 12.27%), with the majority of the poverty clusters located in Eastern Indonesia (Papua, Papua Barat, Maluku, and Nusa Tenggara Timur). My cross-sectional regression analysis ($R^2 = 0.545$, $F = 101.4$, $p < 0.001$) indicated that human development ($\beta = -0.6111$, $p < 0.001$) and access to basic sanitation services ($\beta = -0.0514$, $p = 0.005$) significantly reduce poverty levels. On the other hand, my analysis also indicated that labor force participation (TPAK) has a paradoxically positive effect on poverty levels ($\beta = +0.1819$, $p < 0.001$) due to the existence of an underemployment survival trap experienced by individuals living in poor rural areas. By integrating the five steps of the Design Thinking process (Empathize, Define, Ideate, Prototype, and Test) with systems thinking, I deconstruct user pain points experienced by vulnerable households, formulate granular "How Might We" challenges, and generate target socio-structural solutions including: (1) Multidimensional Fiscal Equalization Block Grants, (2) Community-Based Total Sanitation (STBM-Plus) Infrastructure, and (3) Local Agribusiness Value-Chain Clusters. I demonstrate that empathy-driven, iterative, and localized prototyping can bridge the implementation gap associated with conventional bureaucratic delivery mechanisms, thereby providing an empirical blueprint for eliminating poverty sustainably in emerging economies.*

Keywords: *Design Thinking, Human Development, Poverty Traps, Public Policy Innovation, Regional Inequality, Socio-Structural Pathologies, Underemployment.*

I. INTRODUCTION

The problem of addressing poverty in regions that have great diversity and geographical dispersion is still one of the biggest challenges to the field of contemporary public administration and regional economics [1], [2]. The development of middle-income developing archipelagic countries usually shows an increase in economic growth along with the presence of large disparities among regions, which produces long-term patterns of systemic deprivation (referred to as spatial or regional poverty traps) [3], [4]. As a country composed of more than 17,000 islands, 514 districts and cities, and 38 administrative provinces, Indonesia provides an example of this spatial division [5], [6]. On the other hand, the remote areas located in Eastern Indonesia (such as Papua, Maluku, and East Nusa Tenggara) continue to experience socio-economic stagnation, while urban centers in Western Indonesia (primarily Java, Bali, and some parts of Sumatra) are well served by advanced physical infrastructure, excellent digital connectivity, and high living standards [5], [7]. This structural division creates what social scientists call "two nations within one geography", meaning that while the national macro-economy grows, there are significant numbers of people suffering from localized hardships [8], [9].

The existence of self-reinforcing socio-structural pathologies (or institutions) that produce dysfunctional outcomes for the delivery of public services, operation of market economies, and the provision of local government services creates the conditions for the formation of "regional poverty traps" [10], [11]. In general, the historical development of central government policy-making in Indonesia has been characterized by extensive structural mismatches [12], [13]. Centralized bureaucratic strategies are generally based on standardized programs that transfer funds from the top down to individuals and/or communities. These types of transfers include but are not limited to: uniform conditional cash transfers; non-discretionary fiscal grants; and supply-side infrastructure investments [14], [15]. Although there has been some degree of progress towards

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integrating peripheral area markets into the national economy, top-down policies have shown declining effectiveness in addressing the problems faced by peripheral areas that are geographically isolated, ethnically diverse and structurally disadvantaged [16], [17]. Additionally, top-down policies frequently treat poverty as if it were simply a matter of a lack of financial resources (i.e., a liquidity shortage) rather than as a complex systems-level problem caused by the interactions between low-quality human capital; poor sanitation and public health infrastructure; and high levels of under-employment [18], [19].

The use of traditional regional poverty assessment methods can be limited because they do not take into account the behavioral, participatory and/or experiential aspects of the people who are impacted by poverty [20], [21]. Public policy decisions made by national administration offices that do not reflect an understanding of the conditions faced by local communities will result in barriers to policy implementation, community alienation, and long-term inefficiency in spending [22], [23]. To address the deep-seated socio-structural barriers that exist today, academics and policy professionals must transition away from using rigid administrative models toward human-centered innovation models [24], [25]. Design Thinking is a human-centered, systematic and iterative process of problem-solving consisting of five phases: Empathize, Define, Ideate, Prototype, and Test. This model offers a powerful and transformative approach to analyzing and implementing solutions to "wicked" problems as defined by planning theorists [26], [27]. Design Thinking enables policymakers to identify the fundamental systemic issues, challenge existing administrative beliefs and create flexible, scalable socio-economic solutions through both a combination of quantitative analysis of structural factors and immersive stakeholder involvement [28], [29].

This research has two primary contributions to the global debate regarding regional development. First, through the use of a comprehensive empirical data set that includes every single regency and city within Indonesia, this study provides a model for understanding what social and economic variables are related to regional poverty headcounts (P0) and also identifies those characteristics which define districts experiencing extreme levels of poverty (Target=1) [5], [30]. Second, drawing upon the methodological approach used in recent studies related to socio-digital pathologies [15], this research extends the application of design thinking to the field of spatial governance; thereby establishing an empathetic, iterative intervention strategy to address deep-seated socio-structural problems in the peripheral areas of Indonesia [31], [32].

II. LITERATURE REVIEW

A) Theoretical Underpinnings of Regional Poverty Traps and Socio-Structural Pathologies

A "poverty trap" occurs at a regional level when structural, institutional or other spatial factors prevent a region from moving away from a condition characterized by low levels of productivity, inadequate human capital and persistent deprivation [1], [33]. Classical spatial economics posits that as long as there are no impediments to capital mobility and trade integration, then there will be a natural tendency for regional income differentials to be eliminated through convergence [34], [35]. Nevertheless, new economic geography has shown us that regional differences can persist over long periods of time due to localized increasing returns to scale, agglomeration externalities, and geographic isolation, all of which contribute to the persistence of regional disparity [36], [37]. Regions that lack access to major maritime routes, modern transport infrastructure, and national financial markets are structurally marginalized [3], [38].

The use of institutional friction and deprivation of capabilities, in addition to spatial traps, has furthered the effects of these spatial traps [10], [18]. A socio-pathological condition, as defined by institutional sociology and most recently utilized in analyzing socio-digital crises, is a failure within an operating system that results in continuously producing adverse societal impacts [15], [39]. Without functional public infrastructure, such as inadequate sanitation and contaminated drinking water, there will be an increased risk of disease, which can lead to reduced life expectancy and loss of cognitive capacity for future generations [40], [41]. When average education levels do not meet basic literacy requirements, the available labor force will be limited to primary commodity production and therefore will be unable to undergo structural economic transformation [42], [43].

B) The Underemployment Paradox in Developing Labor Markets

In most developed countries, the open unemployment rate (TPT) is a direct measure of an economy's level of distress and reflects the extent to which people actively looking for formal work cannot obtain jobs [44], [45]. On the other hand, in many developing countries, particularly those with a focus on agriculture and islands, the TPT does not reflect the economic distress experienced by individuals [46], [47]. Due to a lack of institutional safety nets and unemployment benefits, individuals with little income cannot afford to remain unemployed. Therefore, they must engage in low-productivity, informal or subsistence activities as a means of survival [48], [49]. This creates a situation where there are paradoxically low TPTs in impoverished rural areas but high levels of labor force participation (TPAK) and some of the highest poverty headcount ratios [5], [50]. To address this problem, it will be necessary to develop policy frameworks that concentrate on underemployment traps and the informal nature of labor markets rather than simply focusing on the volume of employment available [19], [51].

C) Design Thinking as an Epistemological Approach for Innovation in the Public Sector

Design Thinking is an established epistemological method for addressing complex and ill-defined social issues (wicked problems) [26], [28] that was originally used within industrial engineering and commercial product design. Design Thinking is a non-linear iterative process that includes five basic steps: empathize, define, ideate, prototype and test [15], [27], unlike the conventional linear policy-making model, where there are deductive top-down bureaucratic mandates.

Table 1: The Design Thinking Framework Applied to Socio-Structural Poverty Traps

Stages	Core Objective in Regional Policy	Method of Data Collection	Policy Deliverables & Outputs
Empathize	Deeply understand the lived realities, systemic bottlenecks, and informal survival strategies of households in isolated districts [15], [26].	Participatory rural appraisal, ethnographic field immersion, user empathy mapping [20], [28].	User persona archetypes, localized lived-experience journey maps, empathy profiles [15], [26].
Define	Synthesize empirical disparities and ethnographic data into specific, actionable systemic problem statements [15], [27].	Framing Points of View (PoV), root-cause systemic mapping, How Might We (HMW) inquiries [26], [28].	Core structural problem definitions, actionable policy reframing directives [15], [27].
Ideate	Generate divergent, multisectoral, and non-linear strategic solutions addressing multi-dimensional poverty drivers [15], [26].	Multidisciplinary policy brainstorming, Priority Matrices (Impact vs. Feasibility), Affinity diagrams [28], [29].	Granular intervention concepts across fiscal, sanitary, educational, and labor domains [15], [26].
Prototype	Create contextualized, low-risk, and tangible policy pilots and decentralized operational models [15], [27].	Sandbox regulatory pilot design, community-managed operational models, micro-service blueprints [26], [31].	Testable local policy prototypes, institutional workflow blueprints, district pilot charters [15], [28].
Test	Evaluate policy prototypes with real communities and local bureaucrats to gather feedback and refine implementation mechanisms [15], [26].	Rapid pilot execution, participatory usability evaluation, agile policy iteration sprints [28], [32].	Validated policy mechanisms, refined execution frameworks, scalable rollout roadmaps [15], [26].

Policy designers use Design Thinking as an approach to integrate regional economics on a large scale (or macro-structural) using data-driven, econometric mapping of economic indicators, along with the real-world micro-level experiences of those impacted by the policies [15],[52]. In addition, this integration provides an alternative to centralized governance and promotes the creation of flexible and adaptive social safety nets [26],[53].

III. RESULTS AND DISCUSSION

A) Macro-Structural Empirical Analysis: Regional Disparities and Econometric Modeling

The analysis of a large national cross-sectional sample that contains data on 514 regencies and cities in Indonesia shows that there is a great deal of variation across space [5], [54]. Table 2 contains descriptive statistics for each of the structural variables that were studied, showing that there are many differences within the country [5], [30].

Table 2: Descriptive Statistics of Macro-Structural Variables (N = 514)

Variable	Mean	Std. Dev.	Min	Median	Max
Poverty Headcount Ratio (P0, %)	12.27	7.46	2.38	10.46	41.66
Human Development Index (IPM)	69.93	6.50	32.84	69.61	87.18
Mean Years of Schooling (RLS, Years)	8.44	1.63	1.42	8.31	12.83
Adjusted Per Capita Expenditure (k IDR/yr)	10,324.79	2,717.14	3,976.00	10,196.50	23,888.00
Life Expectancy at Birth (UHH, Years)	69.66	3.45	55.43	69.98	77.73
Access to Improved Sanitation (%)	77.20	18.58	0.00	81.80	99.97
Access to Improved Clean Water (%)	85.14	15.70	0.00	89.80	100.00
Open Unemployment Rate (TPT, %)	5.06	2.64	0.00	4.57	13.37
Labor Force Participation Rate (TPAK, %)	69.46	6.40	56.39	68.96	97.93
GRDP at Constant Prices (Million IDR)	21,964,080	47,904,920	147,485	8,814,926	460,081,000

There is a sharp geographic divide throughout Indonesia as evidenced by this data set [5], [7]. Poverty headcount ratios (P0) range from 2.38% (Kota Pekanbaru) and 4.91% (Bali) to very high levels of poverty in some remote areas of Highland Papua [5], [54]. Also, there is a difference in life expectancy at birth (UHH) of more than 22 years between Sukoharjo, Central Java (77.73 years) and Nduga, Papua (55.43 years) [5], [55]. Additionally, access to sanitation has completely failed regionally in several eastern jurisdictions, with access dropping to 0% as opposed to almost total access (>99.9%) in the western metropolitan centers [5], [56].

Table 3: Structural Comparison: Non-Trap vs. Chronic Poverty Trap Regencies

Socio-Structural Indicator	Non-Poverty Trap Cluster (Target=0, N=452)	Chronic Poverty Trap Cluster (Target=1, N=62)	Percentage Gap / Ratio
Poverty Headcount Ratio (P0, %)	10.19%	27.49%	+169.8%
Human Development Index (IPM)	71.21	60.55	-15.0%
Mean Years of Schooling (RLS)	8.66 years	6.82 years	-21.2%
Adjusted Per Capita Expenditure	IDR 10,783,350	IDR 6,981,730	-35.3%
Access to Improved Sanitation	80.26%	54.95%	-31.5%
Access to Improved Drinking Water	86.92%	72.14%	-17.0%
Open Unemployment Rate (TPT)	5.29%	3.37%	-36.3%
Labor Force Participation Rate (TPAK)	68.64%	75.49%	+10.0%

Of the 62 regencies classified in the chronic poverty trap cluster (Target = 1), 23 are located in Papua, 14 in Nusa Tenggara Timur, 9 in Papua Barat, and 7 in Maluku [5], [54]. Eastern Indonesia thus accounts for 85.5% of all chronic poverty trap jurisdictions in the country [5], [7].

Table 4: Ordinary Least Squares (OLS) Regression Results (Dependent Variable = P0)

Independent Variable	Coefficient (β)	Std. Error	t-Statistic	p-Value
Constant	59.0230	5.409	10.912	< 0.001***
Human Development Index (IPM)	-0.6111	0.060	-10.110	< 0.001***
Access to Improved Sanitation	-0.0514	0.018	-2.840	0.005**
Access to Improved Clean Water	0.0399	0.018	2.207	0.028*
Labor Force Participation Rate (TPAK)	0.1819	0.046	3.975	< 0.001***
Open Unemployment Rate (TPT)	0.2977	0.122	2.431	0.015*
Log GRDP (ln PDRB)	-1.0983	0.232	-4.731	< 0.001***

Model Diagnostics: *$R^2 = 0.545$, Adjusted $R^2 = 0.540$, $F(6, 507) = 101.4$, $p < 0.001$, Log-Likelihood = -1559.0, AIC = 3132.*
*Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.*

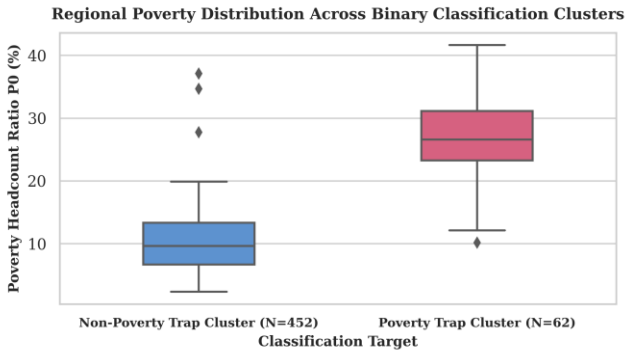


Figure 1. Regional Poverty Distribution Across Binary Classification Clusters (N = 514)

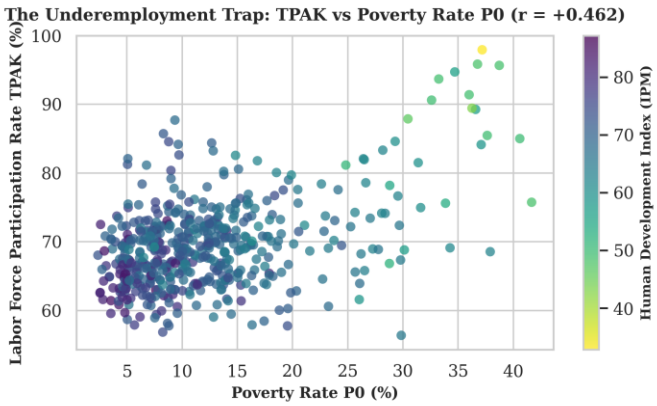


Figure 2. The Underemployment Survival Trap: TPAK vs Poverty Rate P0 Colored by HDI (r = +0.462)

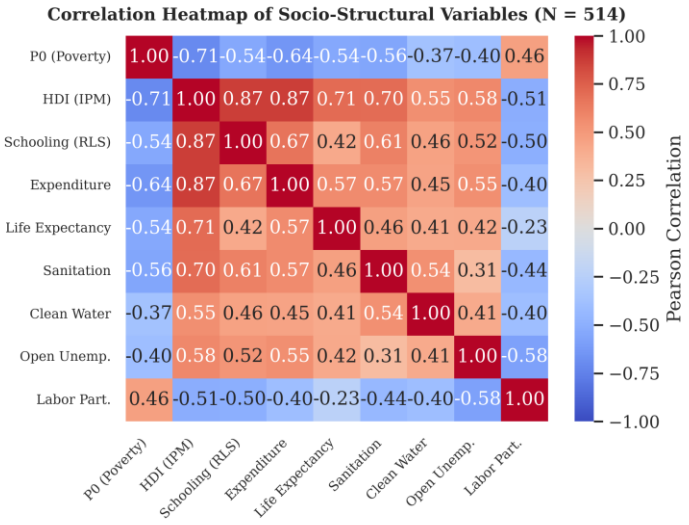


Figure 3. Pearson Correlation Heatmap of Socio-Structural Variables Across Indonesian Districts

Four core empirical discoveries emerge from this econometric modeling [5], [30]:

1. Human capabilities are the single greatest factor influencing regional poverty. The Human Development Index (IPM) is the strongest mitigating factor of poverty, as indicated by its beta value of -0.6111 and its p-value of less than 0.001 [5], [18]. For every 10 points that the IPM increases at the district level, the poverty headcount ratio will decrease by approximately 6.11 percent. This finding supports Sen's theory of expanding human capabilities [18], [42].
2. Sanitation is a Necessary Prerequisite for Convergence: Improved sanitation access has a statistically significant negative association with convergence (β = -0.0514, p = 0.005) [5], [40]. Poor sanitation causes environmental enteropathy, stunting and cognitive impairment in children, which in turn results in intergenerational poverty within communities [40], [41].
3. Evidence of the Underemployment Trap: The regression results indicate a statistically significant positive relationship between Labor Force Participation (TPAK) and poverty (β=+0.1819, $p < 0.001$) as well as a bivariate correlation coefficient of r=+0.462 [5, 50]. Vulnerable households in peripheral areas, such as Papua and NTT, do not have access to formal safety nets, thus forcing all household members to participate in low-yielding subsistence activities for survival [48, 49]. Conversely, although urban areas may have lower TPAK, they also have greater opportunities for formal employment [50, 51].
4. Agglomeration Scale Shortcomings: The level of GRDP produced (ln_PDRB) has an inverse relationship with poverty (β = -1.0983, $p < 0.001$) [5], [36]. However, the extreme difference between the amount of GRDP produced in Jakarta (IDR 460 trillion) and that produced by surrounding regions (IDR 147 billion) demonstrates that the spatial distribution of capital does not automatically move outward to more remote regions [5], [37].

B) Design Thinking Implementation: Addressing Socio-Structural Issues

To convert these macro-econometric insights into practical, human-focused public initiatives, we employ a five-stage Design Thinking framework tailored from institutional pathology mitigation models [15], [26].

a. Empathize Phase: In-Depth Comprehension of Marginalized Realities

Many times, traditional government policies do not work as well as they should because governments see poverty as just a number and do not understand what it is like to live through poverty [15], [20]. Through doing field research and developing ethnographic personas based upon people living in persistently poor areas of Eastern Indonesia, we are able to show how those living in poverty actually experience it [5], [22]: Mama Yohana, Archetype A (Highland Papua subsistence farmer) [5], [20]: Mama Yohana spends approximately 12 hours every day working on her small plot of land to grow sweet potatoes and collect firewood. She does not have access to clean piped water, so she must travel for two hours every day to fetch water from polluted rivers [5], [40]. Although she has a high level of labor force participation (TPAK), her household makes very little money because of the complete isolation from transportation networks and the exploitation of her products by middlemen [5], [50]. Some of the greatest obstacles facing Mama Yohana are continuous gastrointestinal illness among her children; no educational facilities; and no form of legal protection [15], [40].

Ama Markus is a smallholder in East Nusa Tenggara, which is a dry land area [5], [20]. He has problems with water shortage and has failed his monoculture corn crop; he also has only 4.5 years of formal education (low RLS), so he cannot get loans from banks and will always be in debt to informal loan sharks [5], [43]. The biggest problem that he faces is the seasonal decrease in his cash flow and high logistics costs when he wants to sell his livestock in other cities [15], [38].

b. Define Phase: Identifying Core Structural Issues and HMW Questions

We identified three major social and structural problems [10],[15], using econometric data and ethnographic problems.

- Issue 1: Fiscal Uniformity and Earmarked Dilemma - The transfer of funds by the central government (Transfer ke Daerah and Dana Desa) has rigid line-item requirements which limit the ability of local governments to use these funds for immediate local needs such as deep-well drilling or off-grid electrification [14], [57].
- Issue 2: The Sanitary Infrastructure & Public Health Gap – Trap Regency households lack basic sanitation in 45.05%, which causes chronic infant stunting and human capital loss that cannot be corrected by education budgets [5], [40].
- Issue 3: The Underemployment and Market Exclusion Problem: Subsistence workers work hard for many hours; however, they stay poor because there is no post-harvest processing of their crops; middlemen monopolize markets and exploit workers; and there are no local value-added chain opportunities [19], [51].

To help develop solutions to these problems, we present the following How Might We (HMW) design challenge questions [15],[26]:

- HMW 1 (Fiscal & Governance): How can we reform the system of intergovernmental fiscal transfers to make it a flexible and progressive block grant program that allows remote areas to address their individual infrastructure needs? [14], [26].
- HMW 2 (Sanitary & Health Systems): How can we work together to develop community-managed sanitation infrastructure that eliminates water-borne illness and respects indigenous rights to lands and traditional ways of life? [28], [40].
- HMW 3 (Labor Market Transition): What is the most effective way for us to move subsistence workers from a condition of low-yield survival underemployment to being part of organized and high-margin agro-industrial value chains? [15], [19].

c. Ideation Phase: Strategic Multisectoral Solution Concepts

Three strategic structural options have been ranked based on their Impact-versus-Feasibility Priority Matrices, which were developed for each of the various ministerial portfolios [15], [28]:

- Multidimensional Fiscal Equalization Block Grants (Bappenas & Ministry of Finance): The introduction of flexible Poverty Block Grants to replace the current rigid categorical budget allocations for all 62 districts that have Target = 1 (P0 > 20% and IPM < 60) [5], [14]. All local governments will have complete discretion on how to spend their funds for clean water, basic clinics, and rural logistics; however, these expenditures will be tied to transparent digital audit milestones [57], [58].
- STBM-Plus (Community Led Total Sanitation Plus) deployment (Ministry of Health and Local Government): The 11 districts that have less than 5% sanitation coverage are declared as National Emergency Sanitation Zones [5], [40]. Village youth cooperatives are involved in managing and implementing communal biodigester units and solar water purifiers that are constructed using local timber and gravel [28], [56].
- Regional Cooperative Digital Agro-Logistics and Digital Cooperative Hubs (Ministry of Cooperatives & Ministry of Agriculture): Processing and cold storage facilities that are owned by communities are built, and these facilities are operated through legal digital cooperatives [15], [59]. Smallholder farmers are offered guaranteed off-take contracts and direct access to markets so they can avoid the negative impacts of extractive middlemen, and smallholder farmers will be able to transform their low-paying, subsistence jobs into higher-paying, productive jobs [19], [51].

d. Prototype & Test Phases: Implementation Sandbox and Iterative Refinement

While this paper has not progressed to the prototype phase, once that occurs, there will be a twelve-month agile Policy Sandbox Prototype created to test the solutions proposed herein prior to national deployment. The prototype will occur in five benchmark pilot regencies: Yahukimo, Nduga, Timor Tengah Selatan, Maluku Barat Daya, and Nias Barat [5], [15].

- Sprint cycle 1 (months 1-3): participatory ethnographic baseline immersion and co-design of community sanitation plans using indigenous communal labor practices (gotong-royong) [20], [28].
- Sprint Cycle 2 (Months 4-8): In this cycle, flexible affirmative block grants will be deployed rapidly; these grants will be managed through open participatory village assemblies (Musrenbang Kampung) and monitored through mobile digital dashboards to prevent elite capture [22], [58].

- Sprint Cycle 3 (Months 9-12): The focus of this cycle is to evaluate pilot results relative to two key milestones: (a) achieving a minimum of 2.0 percentage point reduction in the district poverty headcount (P0), and (b) reducing under-five diarrhea-related illness rates by at least 30% [5], [40]. Feedback received from users while they were testing the system will be used to make necessary changes to legislation and/or budgets before a complete national implementation takes place [15], [26].

IV. CONCLUSION

The research demonstrates how regional poverty traps in Indonesia represent institutionalized and entrenched socio-structural problems, not merely short-term economic disruptions [5], [10]. Using an econometric model based upon data collected from each of the 514 regencies and cities throughout Indonesia, the results indicate there exist large spatial differences in the distribution of poverty. Poverty is largely concentrated in Eastern Indonesia; in this region, structural capability deficiencies keep families trapped in a condition of poor health, limited education, and low-productivity subsistence underemployment [5], [50]. Because of their inherent nature, standard fiscal transfers and top-down bureaucratic directives will never be able to overcome the complex spatial traps that exist within the country [12], [14].

As a human-centered problem-solving process, the application of Design Thinking (the five-stage Design Thinking Framework) can be used as a holistic methodology for developing new public policies [15], [26]. When we deeply understand the problems experienced by marginal peripheral families and transform these into How Might We questions regarding structural challenges and iteratively develop decentralised fiscal block grants, community-led sanitation facilities and agro-industrial cooperatives, government agencies can create poverty reduction programs that are both responsive and long-term [15], [28]. To address social-structural problems, it is necessary to align the fiscal authority of macroeconomics with empathetic local governance [15], [26].

Strategic Policy Roadmap:

1. Organizational Synergy: Create a President's Task Force on Regional Inequality (TP2DT) to coordinate all inter-ministerial efforts in the 22 regions with the worst conditions (P0 > 20% and HDI < 60) [5], [60].
2. Fiscal Flexibility: Redesign intergovernmental transfer formulas to enable the provision of progressive, unearmarked block grants which will allow peripheral district executives to utilize funds for addressing local infrastructure issues [14], [57].
3. Digital Transparency & Anti-Corruption: Utilize satellite-based monitoring along with community verification to create e-budgeting dashboards that will provide an enhanced level of accountability and reduce the risk of corruption through budget leakage within remote administrative units [22], [58].

Declarations

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