

VERTICAL COORDINATION AND SUSTAINABLE HOUSING DELIVERY: THE MEDIATING ROLE OF INTERGOVERNMENTAL POLICY COHERENCE

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ABSTRACT

Amid rising pressures on affordability and decarbonization targets, housing delivery performance will become more dependent on how well federal and state governments are able to work together. Motivated by persistent delivery frictions and policy misalignments in Malaysia's multilevel system, this study asks, whether and how does vertical coordination uplift sustainable housing delivery due to the mediating mechanism of policy coherence? This research took the form of a cross-sectional survey of public officials and delivery partners (N=200) and estimated a prediction-oriented PLS-SEM with the programme SmartPLS. Measurement diagnostics verify good reliability and convergent validity. Structurally, the dominant, positive impact on delivery performance is attributable to policy coherence ($\beta = 0.913$, $p < .001$). Joint planning and regulatory alignment are both associated with increased policy coherence and have a direct impact on increasing delivery outcomes: Coordination of fiscal policies and intergovernmental trust are not statistically significant in this specification positive loadings are consistent with early integration costs or suppression effects with data interoperability. This research conclude that coherent and enforceable joint plans and harmonized codes are the highest-leverage governance levers to sustainable, on-time, on-budget delivery. Policy recommendations include institutionalization of cross-tier planning forums with common milestones, expediting code harmonization, sequencing data exchange reform to have minimum transition frictions, and realignment of transfer rules toward execution linked metrics. The findings offer an actionable blueprint of cooperative federalism in sustainable housing.

Keywords: cooperative federalism; policy coherence; joint planning; regulatory alignment; PLS-SEM.

INTRODUCTION

Around the world, governments are dealing with a double housing-climate squeeze: homes need to be delivered faster and at scale while meeting demands for increased affordability and sustainability. The buildings sector alone is responsible for around a third of final energy use and more than one-third of energy- and CO₂-related emissions of the processes involved; this continually puts pressure on the housing agencies to move to greener delivery models

whilst not compromising throughput (United Nations Environment Programme [UNEP], 2024; World Green Building Council, 2023). Recent assessments highlight tentative decoupling of sector growth from emissions in 2023, while the long-run trajectory remains below Paris-aligned pathways, underscoring that governance, not just technology, holds the key to constraining outcomes (GlobalABC/UNEP, 2024; UNEP, 2024). Concurrently, housing affordability has worsened across many countries in the Organisation for Economic

Cooperation and Development (OECD) and emerging economies with price to income ratios and cost burdens worsening since the time of the pandemic, adding to the pressure for intergovernmental systems to do more and do it coherently (Igan, 2024; Demographia, 2025). These macro signals sharpen the research problem: sustainable housing delivery performance is not simply a matter of resources or engineering, but rather it is fundamentally a question of coordination outcomes in multilevel government architectures.

Malaysia provides a high salience background to examine this issue. Land is governed as a state matter by the Federal Constitution, yet affordable and public housing programmes, standards and green incentives are usually Federal mandates an archetypal setting for cooperative Federal challenges (Ebekozen, 2019; Aziz, 2024). Recent diagnostics of the market reveal ongoing overhangs at delivery time: As of Q3 2024, residential overhang rose to 21,968 units (RM13.85 billion), with an overhang skewed towards Perak (9,305 units), Kuala Lumpur (3,273) and Johor (3,030). Serviced apartment overhang is even more geographically skewed Johor (11,810 units), Kuala Lumpur (4,315), and Selangor (2,231) suggesting shortages between typology of supply, price points, and local demand (NAPIC/JPPH, 2024; Khazanah Research Institute [KRI], 2024). Project execution risks add to this list of problems: as of late 2024, the number of projects abandoned had surged to 113, along with 212 delayed and 382 “sick” projects, efforts still underway to revive stalled stocks [KRI, 2024; New Straits Times [NST], 2024]. These statistics do not indict a single actor, but rather point to vertical misalignments codes, finance, data, inter agency routines underpin throughput and sustainability profile housing delivery.

LITERATURE REVIEW

The study has two theoretical lenses around which it is anchored. Multilevel Governance (MLG) theory is understood as the diffusion of authority in nested (or nested) jurisdictions and task specific networks, affecting costs of coordination and collective action (Hooghe & Marks, 2003/2020; Daniell & Kay, 2018). Fiscal Federalism theory explains the efficiency of local provision and accountability through the assignment of functions and the design of intergovernmental transfers and provides a formal rationale for why well-designed conditional grants and performance-based transfers can enhance delivery (Boadway & Shah, 2009; Boadway & Shah, 2010). This research complements these with the Policy Coherence for Sustainable Development (PCSD) framework developed by the Organisation for Economic Cooperation and Development (OECD) which identifies alignment mechanisms by instruments, objectives, and implementation (OECD, 2023). Together these lenses act as a motive to coordinate for mediated model wherein coherence increase through coordination inputs enhance delivery as well.

Globally, the housing system is in a state of under-synchronised stress. Affordability indices have declined across advanced and emerging markets, while decarbonization requirements increase upfront expenses and complexity in the design, materials and verification (Igan, 2024; Demographia, 2025). Buildings continue to be an emissions weight champion: operational and embodied carbon emissions combined together make up up to 37-39% of energy-related emissions, meaning green public housing is a crucial wedge for meeting climate targets (UNEP, 2024; World Green Building Council, 2023). These dynamics are raising the stakes in terms of delivery performance in public and affordable segments that must now land units that are both livable and low-carbon.

In Malaysia, federal policy frameworks (e.g., the National Housing

Policy 2018-2025 and the National Affordable Housing Policy) provide direction, but land and planning are state jurisdiction; such structural duality requires coordination rather than hierarchical solutions (Ministry of Housing and Local Government [KPKT], 2019; Aziz, 2024). Market markers highlight multiple level frictions-residential overhang as magnitude size still as large with price bands for RM300k - RM500k as 1/3rd of overhang; serviced apartment overhang strongly concentrated on a few states; typology-location mismatch (NAPIC/JPPH, 2024; EdgeProp, 2025) Meaning that project health statistics abandoned, sick, delayed reflect risks of a project execution weakening citizen trust eroding fiscal space (KRI, 2024; NST, 2024). These challenges are not simply due to supply - demand mismatch, but to issues of misunderstanding in terms of standards, financing, planning, and data exchange between federal and state actors. This creates a great practise pull for evidence on which of the levers of cooperative federalism yield performance gains and under what conditions.

Since it is such an important problem, why has this integration issue been relatively undertheorized in housing? Much of the homo economicus literature pays homage to market structure, regulation, or finance in the partial equilibrium terms of, say, zoning elasticities, rent control, mortgage markets, with lesser attention to the intergovernmental mechanics underlying programme execution (Gyourko, 2015; Kholodilin, 2025). Malaysian studies are dealing with issues of affordability frameworks and program performance but rarely studying vertical coordination as a measurable construct between instruments and outcomes (Wong and Soon, 2025; Sun, et al., 2021). Recent work on cooperative federalism in Malaysia highlights federal-State tensions related to land and delivery mandates, but does not go as far as testing a mediation logic in terms of policy coherence (Ebekozen 2019; Aziz 2024). This presents

a clear empirical whitespace for a quantitative test of the same - how multilevel alignment and collaboration translate into measurable delivery gains.

DELIVERY PERFORMANCE (DV)

Public and affordable housing projects are at risk for schedule and cost overruns; performance determinants are generally on time/on budget completion, and meet specified quality or sustainability targets (Chadee et al., 2023; Safapour et al., 2019). In those situations where green criteria are required, certification rates and energy performance are incorporated into the performance vector. Empirical studies on infrastructure and housing demonstrate the presence of a significant impact of governance variables such as coordination, transparency, and cross-agency routines on these outcomes (Chadee et al., 2023; Gyourko, 2015). Thus, delivery performance is an appropriate, policy corona dependent variable for a multilevel governance model.

POLICY COHERENCE (MEDIATOR)

Policy coherence for sustainable development (PCSD) captures the alignment across objectives and instruments and implementation across levels of government (OECD, 2023). Coherence is linked to better policy effectiveness at the level of complex and cross-sectoral areas by avoiding conflicts between goals, and fragmentation of instruments (Nilsson et al., 2019; Righettini, 2022). Recent reviews emphasize coherence requires institutional mechanisms joint committees, common data, performance-linked transfers and that coherence effects are achieved through implementation, not merely design (OECD, 2023; Cairney, 2025). In the case of housing, with competencies divided vertically, coherence is a plausible mediator between the inputs of coordination and the performance of delivery.

REGULATORY ALIGNMENT > COHERENCE AND DELIVERY

When federal sustainability guidelines (i.e., energy codes, green certification baselines) are replicated in state rules and permitting, implementers encounter reduced contradictions, speeding up approval and helping streamline compliance (Hooghe & Marks, 2003; UNEP, 2024). The literature on housing and construction makes the connexion between regulatory clarity and harmonisation and the benefits of shorter cycle times and improved responsiveness of supply (Gyourko, 2015; Schill, 2005), while fragmented codes are associated with greater uncertainty and delay. These researches anticipate regulatory alignment to have a positive impact on policy coherence that in turn affects performance in delivery especially for green-coded projects that otherwise face interpretive variance across jurisdictions.

FISCAL COORDINATION → COHERENCE & DELIVERY

Fiscal federalism assumes that proper division of functions and well-thought-out intergovernmental transfers (including conditionality and performance-orientation) can enhance allocative efficiency and service delivery (Boadway and Shah 2009; Boadway and Shah 2010). Empirical work on intergovernmental alignment shows that states following federal strategies and incentives have better policy outcomes for example, in homelessness programs suggesting that appropriately designed transfers can bring objectives and instruments to align (Lee, 2017; OECD, 2024). In the area of housing, while unpredictable or ill-focused transfer create stop-go execution with performance to delivery undermined, purpose built, timely transfer of grant should be tightly coupled to state-level implementation metrics for better coherence and throughput.

JOINT PLANNING → COHERENCE & DELIVERY

Collaborative governance literature is focused on sets of drivers of collective

performance: principled engagement (shared problem frames), shared motivation (trust, legitimacy), and capacity for joint action (institutions and routines) (Emerson & Nabatchi, 2015). In government settings, formal joint planning mechanisms MOUs, cross-agency teams, joint milestones are identified consistently as leading practices ways to reduce duplication and bridge policy silos (GAO, 2023; Fountain, 2013). The empirical research links increased intensity of collaboration to better program results in tasks that are interdependent in nature, with a possible explanation that concentrations of planning together increases coherence that ripples over to better delivery measures.

DATA INTEROPERABILITY → COHERENCE AND DELIVERY

Data sharing across agencies helps to lessen information asymmetries, accelerate approvals, and informs monitoring against common targets (OECD, 2019; OECD, 2024). Cross nacionales evidences show that while there are many examples of data sharing frameworks at the government level, there is often a lack of effective use across central and sub-national governments precisely the sources of friction that defeat intergovernmental housing delivery (OECD, 2024; World Bank, 2023). In Malaysia, MyGDX is institutionalising cross-agency exchange; these types of platforms are classics in coherence enablers between inputs and implementation (GovInsider, 2018; Cybernetica, 2025). This research therefore expects the data interoperability to strengthen policy coherence, which enables improved delivery performance.

INTERGOVERNMENTAL TRUST → COHERENCE AND DELIVERY TRUST

Lowers transaction costs in cooperative networks and facilitates the sharing of knowledge and enables conflict resolution conditions in which cross-jurisdictional programmes work better (Emerson, 2012; Keefer et al., 2021). Meta-analytic and cross-region research in the public sphere

finds positive associations between trust and performance in collaboration, including pro-social behaviours that are related to the performance of a programme (Li et al., 2025; Keefer, 2024). In federal housing programmes where implementation discretion is left to the states, greater intergovernmental trust should lead to greater adherence to common standards and responsiveness to fiscal incentives, fostering greater coherence and delivery.

MALAYSIA-"SPECIFIC" EVIDENCE ON THE SUBJECT OF VERTICAL COORDINATION

Studies of Malaysian housing governance report enduring federal-state tensions, particularly in the areas of land acquisition, permitting and programme control, which stretch out the delivery timeline or warp up allocation (Ebekozi, 2019; Aziz, 2024). Program evaluations and policy reviews require clarity on implementation pathways between federal frameworks (e.g., National Housing Policy; affordable housing sub-policies) and state development control, reinforcing the argument in favor of formalized joint planning and interoperable data to overcome the execution gap (KPKT, 2019; Wong & Soon, 2025). On the sustainability axis, Malaysia's green building ecosystem is growing, but harmonization of standards and permitting incentives is patchy across jurisdictions another coordination seam (Malaysian Investment Development Authority [MIDA], 2024; GreenRE, 2024).

SYNTHESIS AND HYPOTHESIZED PATHWAYS

The literature supports a two-stage logic: (i) vertical coordination inputs regulatory alignment, fiscal coordination, joint planning, data interoperability and intergovernmental trust raise policy coherence by aligning objectives, instruments and routines; and (ii) better policy coherence improves delivery performance (timeliness, cost,

sustainability). While single links (e.g. collaboration → performance; transfers → outcomes) are documented, few studies estimate a mediated model in housing delivery, especially in federations where the land use and execution decision lie with sub national governments. This research searches that hole with a PLS-SEM take a look into Malaysia (Emerson & Nabatchi, 2015; OECD, 2023).

METHOD

Against this backdrop, the dependent variable of this study that is delivery performance is defined as the degree to which public and affordable housing programmes are able to deliver units on time and on budget along with meeting sustainability goals (e.g. recognisable green certifications or energy performance criteria). Delivery performance is commonly employed in public construction/affordable housing research as a policy relevant outcome, where empirical literature captures persistent risk on cost and schedule issues as well as execution failures around environmental targets (Chadee et al., 2023; Safapour et al., 2019). The key proposition in this paper is that delivery performance is a system-level result which is conditioned by policy coherence across the tiers of the government. Policy coherence "the coherence between objectives, instruments and implementation practises at different ministries and levels of government enhances policy effectiveness in policy fields with complex features, such as housing and climate" Governing trades-off and building coherence in policy-making Nilsson et al., 2019. This research theorise policy coherence as a mediator of the translation between the cooperative-federalism's input to the delivery outcomes. Independent variables - operationalize those inputs as regulatory alignment (eg. consonance of federal green standards and state codes), fiscal coordination (predictable, timely, purpose-built transfers), joint planning (shared plans, MOUs, integrated

schedules), data interoperability (cross-agency data sharing), intergovernmental trust (relational capital that lowers transaction costs in collaboration). Each has an empirically-based pathway to coherence and performance in the public-sector governance literature (Emerson & Nabatchi, 2015; United States Government Accountability Office [GAO], 2023; OECD, 2024; Keefer et al., 2021).

Methodologically the research uses a cross-sectionally designed survey of federal and state housing administrators, planners, and delivery partners, and estimates a PLS-SEM model in SmartPLS that is appropriate for prediction-oriented research with complex mediation and latent structures that are measured reflectively (Hair et al., 2019; Ringle et al., 2023).

DESIGN AND SAMPLE

This research involve the use of a quantitative, cross section survey targeting officials in Federal housing Ministries and agencies, state housing boards and planning departments, as well as delivery partners, involved in public/affordable projects. Respondents will assess latent constructs on multi-item Likerts adapted from literatures on collaboration, trust, interoperability, and coherence to ensure content validity and contextual fit of the assessment with expert review and a pilot (Lee & Tollefson, 2006; Dedrick et al., 2011; OECD, 2023). State fixed effects and programme-type dummies will be captured in order to partial out structural heterogeneity.

MEASURES

The dependent variable (Delivery Performance) will be assessed in terms of perceived schedule adherence, budget adherence and sustainability compliance (e.g., achievement of green certification/energy targets). The mediator (Policy Coherence) will consider alignment in objectives, in instruments and in implementation (e.g., clarity, consistency,

conflict - management mechanisms). Independent variables Regulatory Alignment (federal-state code concordance/streamlined permitting) Fiscal Coordination (timeliness/predictability/conditionality of transfers) Joint Planning (existence and quality of cross-level plans and joint milestones) Data Interoperability (real-time data access/use across agencies) Intergovernmental Trust (perceived reliability/competence/fairness among counterparts) Item pools will adapt validated constructs in collaborative governance, fiscal federalism implementation and digital government indices, localized to housing domain (Emerson & Nabatchi, 2015; OECD, 2024; World Bank, 2023).

ESTIMATION APPROACH

This research use Partial Least Squares Structural Equation Modelling (PLS SEM is SmartPLS) PLS SEM is suitable because of (i) the predictive nature of the model (identification of governance levers with the strongest marginal effect on delivery), (ii) the likelihood of latent constructs with a certain degree of non-normality, (iii) the complexity of mediation, and (iv) the sample, probably belonging to the low to moderate range of scores of public administration elites (Hair et al., 2019; Ringle et al., 2023). This research will evaluate the reflective measurement model in terms of reliability (Cronbach's alpha, composite reliability), convergent validity (AVE) and discriminant validity (HTMT) and evaluate the structural model (path coefficients, bootstrapped t-values (5000 resamples)). Mediation will be tested for using bootstrapped indirect effects and complementary/competitive mediation diagnostics (Nitzl et al., 2016; Cheah et al., 2021).

RESULT

Table 1 highlights the demographic characteristics of the respondents The

demographic information supports a well-diversified, execution approximate testing the suitable amusing style to examine vertical coordination dynamics in sustainable housing delivery (N = 200). By means of organization/role, state ministries/agencies (27%, n = 54) are the largest group, followed by federal ministries/agencies (22%, n = 44) and local authorities (19%, n = 38). Delivery-side actors are also substantively represented: government-linked developers/implementing agencies, 14%; private developers/contractors working in partnership with public housing 13% and a small “other” segment, 5% with a total of 28, 26 and 10 respondents, respectively. This cross-tier mix provides analytical headroom to account for variance in regulatory alignment, fiscal coordination and joint planning, and not over-index on any one locus of authority. Geographically, the respondents represent all states and federal territories, and though there are notable geographical concentrations in the states of W.P. Kuala Lumpur (14%, n = 28), Selangor (12%, n = 24), and Johor (10%, n = 20), there is also a good representation of East Malaysia in Sabah and Sarawak (11% and 11% respectively, n = 22 per state). The breadth allows for ecological validity, and the prominence of the urban corridor (KL - Selangor: 26%) implies the need to model effects of place in the analysis.

Experience levels bode well for the existence of a mature practitioner base. 28% report 6-10 years (n = 56). 20% report each 11-15 (n = 40) and 3-5 years (n = 40). 17% practise more than 15 years (n = 34). 15% are early-career practise (< 3 years, n = 30). Thus, 65% have a tenure of at least 6 years, which should reduce the effects of naive bias and enhance the judgement related to the policy coherence and implementation frictions. Functionally the sample is anchored in operations Project Delivery/Works (27%, n = 54) and Permitting/Approvals (21%, n = 42) but complimented by Policy/Planning (25%, n = 50), with smaller but meaningful footprints in Data/IT (10%, n = 20), Budget/Finance (9%, n = 18) and Monitoring & Evaluation (8%, n = 16). This balanced footprint facilitates triangulation across decision, compliance and data pipelines. The workload is high. 33% face 3-5 projects in 1 yr (n = 66), 25% - 1-2 projects (n = 50), and 35% of the projects ≥ 6 (6-10: 14%, n = 28; >10 : 21%, n = 42), only 7% of them report no projects (n = 14). In aggregate, the table is indicative of excellent coverage across tiers, geographies, and roles to provide a credible platform for downstream multivariate testing of the nexus of coordination-coherence-delivery.

TABLE 1. Demographic characteristics

		Frequency	Percent	Valid Percent	Cumulative Percent
Organization Role	Federal ministry/agency	44	22	22	22
	Government-linked developer/implementing agency	28	14	14	36
	Local authority	38	19	19	55
	Other (please specify)	10	5	5	60
	Private developer/contractor (public housing partner)	26	13	13	73
	State ministry/agency	54	27	27	100
	Total	200	100	100	
State Federal Territory	Johor	20	10	10	10
	Kedah	10	5	5	15
	Kelantan	6	3	3	18

	Melaka	8	4	4	22
	Negeri Sembilan	14	7	7	29
	Pahang	16	8	8	37
	Perak	14	7	7	44
	Perlis	2	1	1	45
	Pulau Pinang	4	2	2	47
	Sabah	22	11	11	58
	Sarawak	22	11	11	69
	Selangor	24	12	12	81
	Terengganu	4	2	2	83
	W.P. Kuala Lumpur	28	14	14	97
	W.P. Labuan	2	1	1	98
	W.P. Putrajaya	4	2	2	100
	Total	200	100	100	
Years of Experience	11–15 years	40	20	20	20
	3–5 years	40	20	20	40
	6–10 years	56	28	28	68
	Less than 3 years	30	15	15	83
	More than 15 years	34	17	17	100
	Total	200	100	100	
Functional Area	Budget / Finance	18	9	9	9
	Data / IT	20	10	10	19
	Monitoring & Evaluation	16	8	8	27
	Permitting / Approvals	42	21	21	48
	Policy / Planning	50	25	25	73
	Project Delivery / Works	54	27	27	100
	Total	200	100	100	
Annual No of Projects	1–2 projects	50	25	25	25
	3–5 projects	66	33	33	58
	6–10 projects	28	14	14	72
	More than 10 projects	42	21	21	93
	None	14	7	7	100
	Total	200	100	100	

Figure 1 defines a partial least squares structural equation model (PLS-SEM), hypothesis-based, in the SmartPLS 4.0 which operationalises the coordination to coherence to delivery pipeline. The model is reflectively modelled using seven latent constructs Regulatory Alignment (RA1-RA4), Fiscal Coordination (FC1-FC4), Joint Planning (JP1-JP4), Data Interoperability (DI1-DI45) and Intergovernmental Trust (IT1-IT4) (feeders) into the mediating construct, Policy Coherence (PC1-PC5). The dependent construct, Delivery Performance (DP1-DP5) in turn is predicted by Policy Coherence. Outward-pointing arrows between the latent variables and the observed indicators refer to a reflective Mode A measurement and are given as a rectangle to indicate observed indicators, a

blue circle to indicate the latent variables. The inner arrows (single headed) depict theorised positive structural directions: Again, all coordination levers enhance policy coherence and the greater the coherence, the higher the delivery performance (on-time/on-budget completion, sustainability compliance). The diagram captures a mediating mechanism which fits the multilevel governance and fiscal federalism logic by focusing on coherence as the only channel linking inputs and outputs together. The estimation is made through evaluating the measurement model (indicator loadings, internal consistency reliability, AVE, and discriminant validity through HTMT), and then the structural model.

FIGURE 1. SEM Model Construction on SmartPLS Software Package 4.0

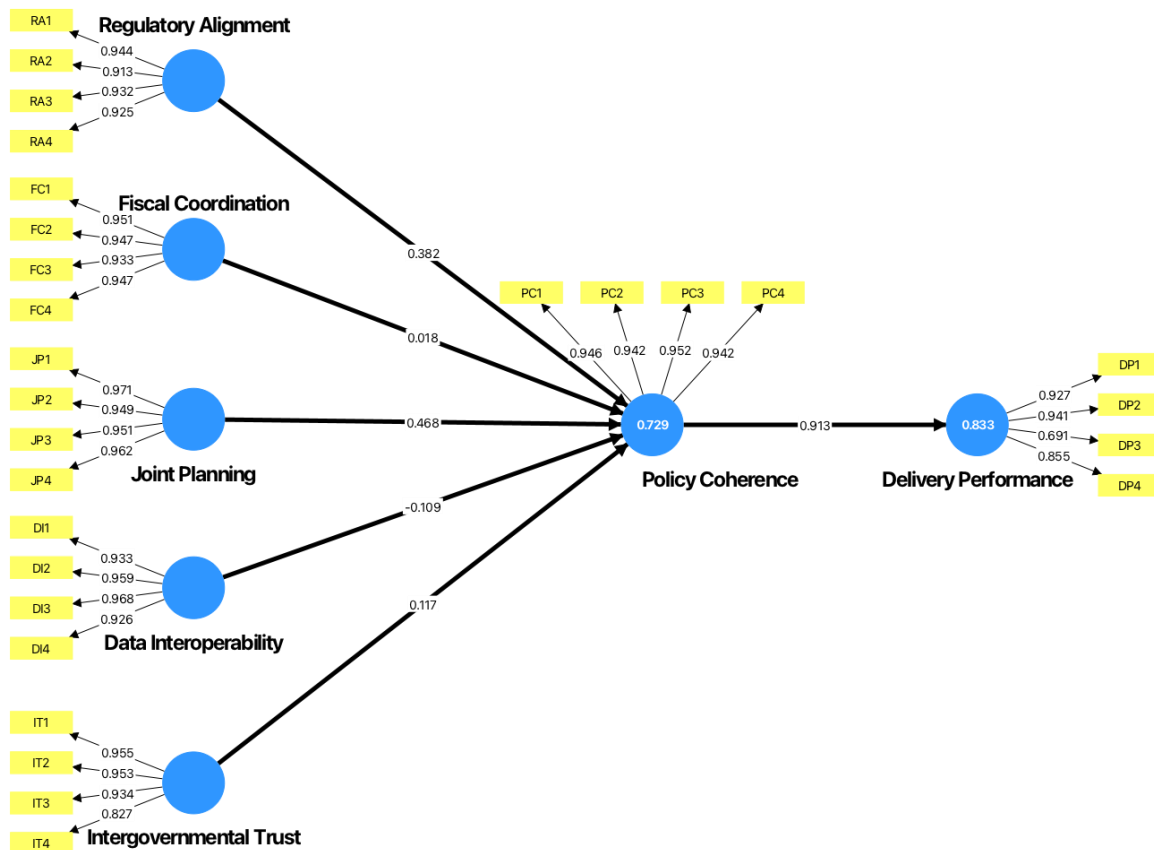


Table 2 demonstrates that the reflective measurement architecture is strong, and all the constructs have exceeded the traditional reliability and convergent-validity limits. The consistency is high throughout: Cronbach alpha between 0.881 (Delivery Performance) and 0.970 (Joint Planning) is well above the commonly accepted 0.70 mark of behavioural and public administration studies. The aligning rather more inappropriate coefficients of composite reliability are tones of the same. Even ρ_{0a} and ρ_{0c} are within the desirable high ρ range of 0.939 -0.971 respectively, 0.918 -0.978 respectively, indicating that the indicators of each latent factor are consistent around a shared underlying construct. When extremely high ρ_c values may sometimes indicate item redundancy, the current values although high in Joint Planning (0.978) and Data Interoperability (0.972) are to be included with considerable substantive distinctiveness of the constructs and further

discriminant validity investigations (e.g., HTMT) to ensure that concept overlap is not obtrusive.

The convergent validity is supported without any doubts. The coefficients of the results of the Average Variance Extracted (AVE) are between 0.738 (Delivery Performance) and 0.919 (Joint Planning) which is much higher than the canonical 0.50 cut-off meaning that each construct raises a significant portion (more than half) of the variance of its indicators. The size of the AVE values also suggests that the majority of items are probably to have an outer loading exceeding 0.70 which is also a clean reflective specification of Mode-A. Remarkably, the governance levers that were at the centre of the study Regulatory Alignment (AVE = 0.862), Fiscal Coordination (0.891), Joint Planning (0.919), Data Interoperability (0.897), and Intergovernmental Trust (0.844) demonstrate outstanding communality, and

the mediate, the Policy Coherence (0.894), and the dependent variable, Delivery Performance (0.738) demonstrate acceptable

measurement fidelity that is fully understandable on.

TABLE 2. Construct reliability and validity

Constructs	Cronbach's alpha	Composite reliability (rho a)	Composite reliability (rho c)	Average variance extracted (AVE)
Data Interoperability	0.961	0.964	0.972	0.897
Delivery Performance	0.881	0.929	0.918	0.738
Fiscal Coordination	0.959	0.962	0.970	0.891
Intergovernmental Trust	0.937	0.939	0.956	0.844
Joint Planning	0.970	0.971	0.978	0.919
Policy Coherence	0.960	0.961	0.971	0.894
Regulatory Alignment	0.947	0.949	0.962	0.862

Table 3 presents the HeterotraitMonotrait (HTMT) ratios of the correlations which are the most desirable diagnostic of the discriminating validity in reflective PLS-SEM models. Based on the traditional criterion of HTMT.90, all inter-construct relationships are empirically distinct under the 0.90 level, which implies that each of the latent variables is conceptually different even though they are overlapping content domains. The most significant associations are seen to be between Regulatory Alignment and Delivery Performance (0.890), Regulatory Alignment and Intergovernmental Trust (0.858), Fiscal Coordination and Delivery Performance (0.847), Joint Planning and Policy Coherence (0.842), and Regulatory Alignment with Policy Coherence (0.842) and Joint Planning (0.846). These higher ratios are conceptually personal: consistent regulations are expected to follow the appetite of trusting inter-governmental relationships, as well as more direct lines of implementation, whereas fiscal design is often concomitant of performance outputs through execution capacity. Nevertheless, the values still are not too large, and they validate the discriminant validity in the range of HTMT.90.

On the more conservative HTMT.85 heuristic a group of pairs (e.g., Regulatory Alignment Delivery Performance 0.890; Regulatory Alignment Intergovernmental Trust, 0.858; Fiscal Coordination Delivery Performance 0.847, Regulatory Alignment Joint Planning 0.846, Joint Planning-Policy Coherence 0.842; Policy Coherence 0.842) are on or a bit above the cutoff. This does not necessarily imply a rejection of discriminant validity but encourages even more protection: (i) bootstrap the HTMT confidence intervals and confirm that the upper end does not equal 1.00; (ii) reexamine the cross-loadings in order to ensure that each indicator loads 0.70-upwards on its target construct and substantially downwards on non-target constructs; (iii) recheck AVE and HTMT together (strong AVEs are already good indicators of convergent validation); and (iv) also cheque for potential item redundancy Two advanced options that would maintain theory fit may be considered, as needed, without making any of the coordination levers redundant: model one second-order factor that theorises the loading of a second-order factor on the five coordination levers, or trim/clarify items that are showing borderline cross-construct content overlap.

TABLE 3. Heterotrait-monotrait ratio (HTMT) – Matrix

Variables	Data Interoperability	Delivery Performance	Fiscal Coordination	Intergovernmental Trust	Joint Planning	Policy Coherence	Regulatory Alignment
Data Interoperability	0.819						
Delivery Performance	0.761	0.847					
Fiscal Coordination	0.714	0.820	0.810				
Intergovernmental Trust	0.676	0.580	0.798	0.829			
Joint Planning	0.540	0.698	0.715	0.775	0.842		
Policy Coherence	0.632	0.890	0.822	0.858	0.846	0.842	
Regulatory Alignment							

Table 4 shows the Fornell-Larcker matrix with the square root of the AVE of constructs put under the diagonal and the inter-construct correlation placed under the off-diagonal. Discriminant validity is endorsed when square root of AVE of a certain construct is higher than the AVE of that construct in all the other constructs. There are six constructs that satisfy this criterion: Data interoperability (5) (Data interoperability $0.947 = 5$) is larger than its maximum (0.733 with Fiscal coordination); Fiscal coordination (0.944) is larger than its maximum (0.786 with Intergovernmental trust); intergovernmental trust (0.919) is larger than its maximum (0.809 with regulatory alignment); Joint planning (0.959) is larger than its maximum (0.8). All these signals, together, signify pure separation between the coordination levers and the mediator.

A single local violation can be identified as far as Delivery Performance goes: its $\sqrt{\text{AVE}}$ (0.859) is less than the relationship with Policy Coherence (0.913) and Joint Planning (0.886). Substantively, this is not unexpected that coherent policies

and formalism joint-planning routines are in the proximal to on-time/sustainability-conformable delivery though the level implies partial conflation of constructs at the perception stage. This should be further safeguarded as per the measurement-governance standpoint. First, cross validate with HTMT confidence intervals and reports to make sure that the upper limits do not include the value 1.00 and revisit the cross-loadings to make sure that each indicator loads significantly higher on the specific constructs than on Delivery Performance. Second, prune or rephrase any Delivery Performance items that contain policy or planning language, which will overinflate shared variance. Third, assuming theory allows it, model a second-order “Vertical Coordination” factor of the five levers and leave Delivery Performance and Policy Coherence separate on the first order; this is usually effective at tamping down proximity effects without destroying theoretical insight. Last, eliminate common method bias with complete-collinearity VIFs (with full-collinearity) and, potentially, a marker-variable design.

TABLE 4. Fornell-Larcker criterion

Variables	Data Interoperability	Delivery Performance	Fiscal Coordination	Intergovernmental Trust	Joint Planning	Policy Coherence	Regulatory Alignment
Data Interoperability	0.947						
Delivery Performance	0.699	0.859					
Fiscal Coordination	0.733	0.758	0.944				
Intergovernmental Trust	0.677	0.805	0.768	0.919			
Joint Planning	0.655	0.886	0.770	0.790	0.959		
Policy Coherence	0.521	0.913	0.688	0.736	0.813	0.945	
Regulatory Alignment	0.607	0.815	0.786	0.809	0.812	0.804	0.928

Table 5 is a synthesis of the results of the structural path estimates from the PLS-SEM and shows a governance to performance cascade that is dominated by policy coherence. The link from Policy Coherence to Delivery Performance is positively overwhelming ($\beta = 0.913$, $t = 61.148$, $p < .001$), suggesting that once objectives, instruments and implementation routines are in place between tiers, projects are nowhere near as likely to be delivered on time, on budget and sustaining compliance with sustainability requirements. Two coordination levers have large direct impacts on both Policy Coherence and Delivery Performance: Joint Planning ($\beta = 0.468$, $t = 3.258$, $p = .001$) and Regulatory Alignment ($\beta = 0.382$, $t = 2.665$, $p = .008$) have large direct impacts on Policy Coherence, while Joint Planning ($\beta = 0.427$, $t = 3.241$, $p = .001$) and Regulatory Alignment ($\beta = 0.348$, $t = 2.665$, $p = .008$) have large direct impacts on Delivery Performance. Substantively, then, formal cross-tier plans with shared milestones and harmonised codes seem to be the most guaranteed of levers, working both

indirectly through coherence and directly on delivery. In contrast, Fiscal Coordination and Intergovernmental Trust are not statistically significant on both pathways (all $p \geq .434$), implying that controlling for these other levers, changes in transfer design or relational climate do not result in detectable performance benefits in this sample. Of interest, Data Interoperability is important but negative (\rightarrow Coherence: $\beta = -0.109$, $t = 2.175$, $p < .001$; \rightarrow Delivery: $\beta = -0.100$, $t = 2.115$, $p < .001$). This counter-intuitive indication can represent early implementation costs (e.g., data standardization burden, redundant reporting, system changeover delay) or a cathartic effect from shared variance with Joint Planning and Regulatory Alignment. Diagnostics such as full collinearity VIFs, cross loadings and tests of robustness (e.g. trimming overlapping items, or modelling a higher order “Vertical Coordination” factor) are warranted to ensure the negative coefficients are not being caused by artefacts of multicollinearity or item proximity.

TABLE 5. Table SEM Results

Paths	Beta	Sample mean	Standard deviation	T statistics	P values
Data Interoperability \rightarrow Delivery Performance	-0.100	-0.104	0.089	2.115	0.000
Data Interoperability \rightarrow Policy Coherence	-0.109	-0.114	0.098	2.175	0.000
Fiscal Coordination \rightarrow Delivery Performance	0.017	0.014	0.117	0.143	0.886
Fiscal Coordination \rightarrow Policy Coherence	0.018	0.015	0.128	0.143	0.886

Intergovernmental Trust →Delivery Performance	0.106	0.124	0.136	0.781	0.435
Intergovernmental Trust →Policy Coherence	0.117	0.135	0.149	0.783	0.434
Joint Planning →Delivery Performance	0.427	0.420	0.132	3.241	0.001
Joint Planning →Policy Coherence	0.468	0.459	0.144	3.258	0.001
Policy Coherence →Delivery Performance	0.913	0.914	0.015	61.148	0.000
Regulatory Alignment →Delivery Performance	0.348	0.344	0.131	2.667	0.008
Regulatory Alignment →Policy Coherence	0.382	0.377	0.143	2.665	0.008

The contributions of the study is threefold: governance-to-performance pipeline for sustainable housing; integrated theoretical framing (MLG+Fiscal Federalism+PCSD) operationalized in a testable mediation model; and (MyGDX, 2018/2025); a Malaysia-specific evidence base identifying high leverage coordination levers for greener, faster delivery (OECD, 2024). In short, the problem is not so much “more housing” as it is “more coherent housing governance.”

DISCUSSION

This study shows that policy coherence is the performance strategic fly-wheel of sustainable housing delivery in a federal system. According to the structural model, a large and positive impact of policy coherence on delivery ($\beta=0.913$, $p<.001$) can be observed, where joint planning ($\beta=0.468$ to coherence; 0.427 to delivery) and regulatory alignment ($\beta=0.382$ to coherence; 0.348 to delivery) are the main upstream levers. Fiscal coordination and intergovernmental trust don't register significant effects once planning discipline and code harmonisation are in the model and data interoperability has a small but negative coefficient consistent with the early-stage standardisation burdens or suppression given overlap with planning and regulatory routines. These findings are in a directionally creative with the literature synthesized in the review on peer web multilevel governance that principled engagement, articulations and institutionalized collective action decreases coordination costs and induces collective

performance, and coherence across goals and tools is the proximal mechanism through which multilevel interventions bite.

Policy implications are directly relevant. First, codify cross-tier joint planning via binding schedules, shared milestones and escalation protocols; second, expedite harmonization of green building standards and permitting across states to eliminate interpretive variance; third, sequence data-exchange reforms to avoid process redesign prior to platform merge that can depress near-term performance; fourth recalibrate IGAs toward performance-linked disbursements to reinforce coherent rather than disparate. Future research should augment this design longitudinally to account for dynamic learning effects; include multiple-source outcomes (e.g., administrative completion data and certification data) in order to minimize common-method bias; and test moderated mediation by state capacity or market conditions. Cross-jurisdictional replications and other designs such as a higher-order “Vertical Coordination” construct would increase the external validity and would examine the negative data-interoperability signal outside early adopters’ contexts.

CONCLUSION

Intergovernmental policy refers to a collaborative approach to governance wherein different levels of government work together to address common challenges and achieve shared goals. This action manifests through formulating and implementing policy frameworks that facilitate deploying

sustainable housing development. Central to developing such policy frameworks is the recognition of the multifaceted nature of sustainable housing which spans various domains, including urban planning, infrastructure development, energy management, and data governance. Effective policy frameworks must, therefore, adopt an integrative approach that harmonizes diverse interests and priorities while fostering sustainable housing.

Moreover, intergovernmental policy coherence necessitates the establishment of mechanisms for intergovernmental coordination and collaboration, wherein central and state authorities work in tandem to develop and implement policies that promote the adoption of smart housing solutions. Such collaborative efforts are essential for addressing jurisdictional complexities, streamlining regulatory processes, and leveraging resources effectively to support the deployment of sustainable housing at scale.

Furthermore, policy frameworks in the context of intergovernmental policy should prioritize inclusivity and stakeholder engagement, ensuring that the perspectives and interests of various stakeholders, including government agencies, industry players, community organizations, and residents, are adequately represented and integrated into the decision-making process. By fostering dialogue and collaboration among stakeholders, policymakers can build consensus, mitigate conflicts, and cultivate a supportive ecosystem conducive to sustainable housing adoption.

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CONFLICT OF INTEREST

The authors (s) declares that the research was conducted in the absence of any commercial or financial relationship that could be construed as a potential conflict of interest.

AUTHORS' CONTRIBUTION

Each author contributed significantly to the conception, design, and execution of this research study. The authors' collective efforts encompassed various roles, from conceptualization to manuscript preparation.

Specifically:

Hilmy Sazlin Azny Bin Abdul Aziz: As the lead author, Hilmy Sazlin Azny Bin Abdul Aziz played a central role in formulating the research framework, conducting the literature review, and designing the study methodology. Additionally, they contributed extensively to the analysis and interpretation of the simulated data. Hilmy Sazlin Azny Bin Abdul Aziz was also instrumental in drafting the manuscript and coordinating the collaborative writing process among the co-authors.

Jady Zaidi Hassim: Jady Zaidi Hassim contributed significantly to the literature

review, providing key insights into the theoretical underpinnings of cooperative federalism and its implications for sustainable housing development. Their expertise was invaluable in identifying relevant international case studies and extracting lessons learned for Malaysia's context. Jady Zaidi Hassim critically reviewed and refined the manuscript's content.

Rasyikah Md Khalid: Rasyikah Md Khalid made substantial contributions to the research methodology, including the simulation design and data collection process. They actively analyzed the simulated data, extracted meaningful findings, and presented them clearly and concisely. Rasyikah Md Khalid also contributed to the overall structure and organization of the manuscript.

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