



Reimagining transport decarbonisation through Daoism: Governance, modelling, and attunement^{*}

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ABSTRACT

Transport decarbonisation has never been better resourced. Multi-level coordination, integrated policy packages, spearheading technological visions, and long-term modelling are now routinely deployed against the climate challenge. Yet rebound effects, implementation gaps, and social backlash persist in ways that more sophisticated instruments have not closed. This paper argues that the difficulty is epistemological and ontological, not merely technical or institutional: dominant approaches treat mobility systems as determinable objects that yield to coordination, optimisation, and prediction, when they are in fact relational, emergent, and practice-dependent. Through conceptual and epistemological analysis, the paper develops a Daoist reading of transport governance and modelling, advancing attunement as a governance disposition oriented to the inherent tendencies of complex mobility systems under climate disruption, social contestation, and socio-ecological complexity. Three concepts — *wu-wei* (non-coercive action), *qi* (vital circulation), and *yin-yang* (dynamic balance) — serve as heuristic resources for interrogating assumptions embedded in contemporary decarbonisation. Through this lens, mobility is reframed as circulation, governance as adaptive attunement for harmony, policy design as provisional and revisable intervention, analytical framing as the holding of plurality, and modelling as an interpretive rather than purely predictive practice. The 15-minute city is the running example, with supporting cases drawn from electric vehicles, road freight, and aviation and maritime governance, illuminating persistent tensions around coordination, rebound, pluralism, infrastructure lock-in, and modelling uncertainty. The paper offers a substantive non-Western theoretical intervention and concludes that metaphorical, relational, and process-oriented reasoning can complement existing analytical approaches, supporting more adaptive, reflexive, participatory, and responsive forms of transport governance under conditions of uncertainty and ecological limits.

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1. Introduction

Transport decarbonisation has never been better resourced. National strategies are integrated across scales, policy packages combine Avoid-Shift-Improve instruments with growing sophistication, long-term models trace pathways to mid-century (ITF, 2025), and bold visions, such as electrification, the 15-minute city (15MC), mobility-as-a-service, organise both research agendas and public investment. And yet the field has a problem it cannot fix from inside this apparatus. Transport emissions rebounded 14% to 8.3 Gt CO₂ in 2023, outpacing electricity, heat, and industry¹ (IEA, 2025). Carbon-pricing schedules collapse politically before they bite; proximity-planning schemes generate displacement and backlash that erode the gains they were designed to secure; long-term models reproduce divergence as scenario range rather than reckoning with the practice-level disruptions that produce it. The difficulty is not the absence of instruments. It is the widening gap between instrument sophistication and the open-ended, contested systems those instruments are asked to govern.

This paper argues that the gap is epistemological and ontological, not merely technical or institutional. Its source is the prior assumption that mobility systems are the kinds of things that yield to coordination, optimisation, and prediction (Schwanen et al., 2011). That assumption is not external to practice: it shapes which futures look realistic, which interventions look reasonable, and which forms of dissent look like obstacles rather than information. The interpretive transport tradition has long pressed against it: Timms (2008, 1999) reframed models as communicative devices rather than predictive engines; Timms et al. (2014) opened utopian thinking as a planning resource; Schwanen (2019) called for engagement with uncertainty, socio-political dynamics, and decolonised knowledge. Yet the conceptual vocabulary through which transport scholarship registers plurality, emergence, and the limits of control remains almost entirely Western (Mbeva et al., 2025; Zhang et al., 2026a) and analytical,² and one conspicuous resource has gone unused: non-Western philosophical traditions that have thought, in some cases for two millennia, about the costs of treating dynamic systems as objects of control.

This paper develops a Daoist reading of transport governance and modelling. Its central concept is attunement: a governance disposition³ that tends the conditions under which mobility systems can adapt rather than forcing them toward predetermined schemes. Attunement is not passivity. It is the considered judgement of when to act, how lightly, and through which feedback. The disposition is oriented to *ziran* (自然), the self-so or self-developing tendency of things, and treats mobility not as an isolated sector to be optimised but as part of an interconnected social, ecological, and cosmological whole, recalling, in classical Chinese thought, *tian-ren-he-yi* (天人合一), the continuity of heaven (nature) and human life. Three further concepts do specific work in the argument and are developed in Section 3: *wu-wei* (無為, non-coercive action), *qi* (氣, vital circulation), and *yin-yang* (陰陽, the dynamic balance of complementary tendencies). What such tending sustains is *he* (和, harmony): the generative coexistence of differences whose interaction produces a dynamic order, as distinct from sameness. Together these concepts articulate a disposition: responsive rather than imposing, adaptive rather than rigid, relational rather than sectoral. Engaging Daoism here is not a comparative gesture or a translation exercise. A tradition that begins from relationality and is sceptical of the impulse to fix systems through naming, targeting, and optimisation has something specific to say to a field whose dominant logics are precisely those.

The paper makes three linked contributions. First, it offers a Daoist conceptual reorientation of transport decarbonisation, reframing mobility systems as relational, emergent, and practice-dependent rather than as determinable objects of coordination, optimisation, and prediction. Through the concepts of *wu-wei*, *qi*, *yin-yang*, and *he*, it recasts mobility itself as circulation and balance rather than throughput and acceleration. Second, it shows how this reorientation changes the practical terms of transport decarbonisation across four domains: governance, where coordination is rethought as relational attunement across scales; policy design, where instruments are treated as provisional and revisable rather than as optimal packages fixed in advance; analytical framing, where plurality is approached as constitutive rather than as variance from a single pathway; and modelling, where models are understood as tools for sensing imbalance, interpretation, and adaptive revision rather than prediction alone. Third, by developing these claims through Daoist thought, the paper broadens the conceptual base of transport scholarship beyond predominantly Western analytical traditions and demonstrates how non-Western philosophical resources can generate concrete implications for transport research and practice.

The 15MC serves as the paper's running example. The choice is deliberate: the 15MC condenses, in a single policy idea, every difficulty the paper diagnoses. Its implementation depends on multi-level coordination that often stalls procedurally (Allam et al., 2022); its proximity logic generates property-market and migration feedbacks that can blunt emissions gains (Mouratidis, 2026, 2024); its definition of which amenities, for whom, within which fifteen minutes is contested across studies and cities (Mahmoudpour and Shirazi, 2026; Wang et al., 2025); and the backlash it has generated reflects genuine divergence over what urban space and autonomy are for, not misinformation (Caprotti et al., 2024; Schwanen et al., 2026). Supporting cases, such as electric vehicles,

¹ In the United States alone, transport accounted for 29% of total emissions in 2022 (EPA, 2025), underscoring its central role in continued fossil-fuel dependence (EPA, 2025).

² Only a small number of studies have explored how Chinese philosophy might inform urban or transport planning (e.g., de Jong, 2012; Hillier and Cao, 2023, 2013), and none has done so explicitly in relation to climate change or decarbonisation.

³ The paper avoids framing attunement as the *cultivation* of dispositions or the pursuit of harmony in a Confucian sense (Sigurðsson, 2019, see also comparisons with key Western thinkers, particularly Maurice Merleau-Ponty and Pierre Bourdieu). Whereas Confucian approaches often emphasise moral cultivation and the achievement of normative harmony (*he*) through the refinement of character and social roles, the Daoist orientation developed here treats attunement as situational, emergent, non-teleological, and open-ended disposition: a responsive, ongoing alignment with changing conditions rather than the realisation of a predefined and stable ethical order.

aviation, maritime, and road freight, sharpen specific points where the 15MC alone cannot carry the argument.

The paper proceeds as follows. [Section 2](#) develops four diagnostic observations across multi-level governance, policy packages, spearheading visions, and long-term modelling, arguing that their shared difficulty is epistemic. [Section 3](#) develops the Daoist reorientation, first philosophically, then through the three working concepts. [Section 4](#) draws out implications for transport research and governance practice in light of the four diagnostic observations. [Section 5](#) concludes.

2. Climate change and transport policy: Limits of control-oriented decarbonisation

The four diagnostic observations in this section are organised around four dominant organisational logics of contemporary transport decarbonisation: the governance architecture through which climate ambitions are coordinated across scales; the instrument design through which that ambition is translated into policy packages; the visioning practice through which those packages are given strategic direction; and the modelling practice through which futures are projected and evaluated. Together they constitute the epistemic cycle through which transport decarbonisation is conceived, justified, and enacted. Other dimensions, such as financing, land-use integration, behaviour change, and supply-chain governance, are acknowledged as consequential but cross-cutting across these four rather than constituting a fifth.

2.1. Multi-level governance: coordination without attunement

Multi-level governance⁴ has become a core strategy for accelerating transport decarbonisation, largely in response to the persistent policy-implementation gap between national ambition and local delivery (Hampton, 2018; Marsden and Rye, 2010; Tsoi et al., 2021). Two broad and ostensibly complementary approaches dominate. Top-down approaches emphasise national visions, quantifiable targets, and centralised planning to secure coordination and accountability across jurisdictions (Bache et al., 2015; Chung et al., 2024; Tsoi et al., 2021). Bottom-up approaches prioritise participatory processes, adaptive governance, and place-specific interventions sensitive to local conditions (Fritz et al., 2024; Niemeier et al., 2015). Conceptually, multi-level governance aims to reconcile “global context, local challenge” dynamics (Keeling, 2009): decarbonisation goals defined at global or national scale must be realised through place-specific delivery.

The difficulty is that coordination across scales does not automatically translate into attunement across practices, meanings, and lived experience (Chan and Erduran, 2026a). Empirical studies of public transport governance illustrate the tension. Long-term viability depends not only on formal institutional arrangements or infrastructure investment but on sustained adaptation to local contexts, by engaging incumbent operators, building informal coordination networks, co-developing services between authorities and operators, and fostering civic participation (Poku-Boansi and Marsden, 2018; Sørensen et al., 2023; Veeneman, 2016). Identifying scale-specific responsibilities can improve policy targeting, since certain instruments perform better at particular spatial scales (Anable and Shaw, 2007; Loo and Tsoi, 2018); yet such alignment often remains procedural rather than relational.⁵

EV promotion illustrates how multi-scale coordination extends beyond the public-sector hierarchy. EV transitions require coordination across national energy strategies and subsidy schemes, regional grid decarbonisation and charging deployment, and local parking incentives, land-use, and street design (Budnitz et al., 2025; Tsoi et al., 2022), as well as at the corporate level, where manufacturers, battery suppliers, charging operators, fleet purchasers, and electricity utilities each operate on distinct planning horizons. Lifecycle emissions, grid capacity, and supply-chain dependencies sit across these scales and cannot be governed at any single one of them. Recent assessments suggest that even where ambitious EV policies are in place, integration between vehicle deployment, charging rollout, and grid capacity is not keeping pace. Public charging will need to grow roughly sixfold by 2035 and heavy-duty charging capacity twentyfold for current policy ambitions to be realised (IEA, 2024).

Deeper integration has, however, been achieved through arrangements suited to local conditions. The Greater Bay Area (GBA) and the San Francisco Bay Area (SFBA) (Tsoi et al., 2022) converged on similar categories of policy instruments, such as visions, sales targets, fiscal incentives, charging investment, R&D support, and bus electrification pilots, yet integrated those instruments through different arrangements. Shenzhen’s electrification of 16,000 transit buses by 2017 was structured as a multi-actor business model bringing local government, power suppliers, vehicle manufacturers, fleet operators, and transmission corporations into a shared commercial arrangement (Li et al., 2016). SFBA pursued similar categories through an information-led and market-oriented coordinating platform supported by demonstration projects (Jeffers et al., 2022). Both achieved decoupling because each was attuned to the institutional and commercial conditions of its setting (Loo and Tsoi, 2018).

Aviation and maritime warrant attention within any account of transport-climate governance. Together they account for around 22% of global transport CO₂ emissions (IEA, 2024), with their share projected to grow as road transport decarbonises more rapidly

⁴ The framework distinguishes Type I institutions, characterised by hierarchical and multitask jurisdictions, from Type II institutions, defined by task-specific and overlapping structures (Marsden and Rye, 2010). Multi-level coordination aligns local transport actions with global sustainability objectives, including the Sustainable Development Goals (Holden et al., 2020; Keeling, 2009).

⁵ By *procedural* we mean that coordination stops at the alignment of mandates, timelines, and indicators across tiers of government; by *relational* we mean the further step of sustaining the practical understandings, trust, and iterative adjustment between actors (e.g., operators, street-level officials, and users) through which aligned mandates are actually translated into altered everyday mobility. The distinction does not deny the importance of formal coordination; it specifies what coordination alone cannot do, and is developed conceptually through *wu-wei* and *he* in 3.2.1 and 3.3.

than long-distance modes whose pathways remain technologically constrained. International aviation and maritime are governed primarily through horizontal coordination across nation-states, with specialised UN agencies setting the framework within which national, corporate, and operational actors are expected to act (Rayner et al., 2021). The International Civil Aviation Organization (ICAO) adopted a Long-Term Aspirational Goal of net-zero by 2050, alongside CORSIA and the 2023 Global Framework for Sustainable Aviation Fuels (CAAF/3) (ICAO, 2023, 2022). The International Maritime Organization (IMO) adopted the 2023 GHG Strategy targeting net-zero by 2050 and the IMO Net-Zero Framework, a binding fuel standard and emissions pricing mechanism for ships above 5,000 gross tonnes, scheduled to enter into force in 2027 (IMO, 2025, 2023). Yet procedural alignment does not by itself produce operational attunement through which frameworks are realised in fleet renewal, bunker procurement, route planning, and port-call scheduling (Rayner et al., 2021). Implementation depends on flag states, port authorities, airlines, fuel producers, and bunkering infrastructure that the agencies do not coordinate directly. Recent initiatives such as green shipping corridors under the 2021 Clydebank Declaration, the Getting to Zero Coalition, and ICAO's ACT-SAF programme (Malmberg, 2023) attempt to embed framework objectives within multi-actor commercial and operational arrangements suited to specific routes, finance structures, or fuel supply chains.

Four structural challenges persist. Responsibilities across spatial scales remain ambiguously allocated, weakening accountability and diluting commitment to demand-management and travel-reduction strategies (Marsden and Rye, 2010). The proliferation of actors can diffuse responsibility rather than strengthen action (Loo and Tsoi, 2018). A persistent gap exists between ambitious national formulation and uneven local implementation, particularly for travel-behaviour change (Tsoi et al., 2021). Financial constraints push local authorities toward opportunistic or short-term responses rather than strategic transformation (Verlinghieri et al., 2024). And the absence of robust accountability mechanisms allows climate targets to function symbolically rather than operationally (Bache et al., 2015), widening the gap between rhetoric and practice (Marsden et al., 2014). These are not incidental failures of implementation; they signal that coordination-as-procedure under-specifies what the governance task actually requires.

2.2. Policy packages: synergy without behavioural grounding

Beyond governance structures, transport decarbonisation increasingly relies on comprehensive policy packages organised around the Avoid-Shift-Improve (ASI) framework⁶ (Mårtensson et al., 2023). Integrating instruments across the three registers is widely treated as essential for deep and sustained emission reductions, on the premise that coordinated instruments will produce coordinated behavioural response. Evidence that well-designed packages can deliver synergistic effects is substantial. Combining Avoid and Shift strategies can reduce congestion externalities while lowering overall travel demand (Zhang and Hanaoka, 2022); Peñasco et al. (2021) show that deployment subsidies paired with regulatory instruments produce cumulative emission reductions exceeding those of individual measures; and a review across sixteen countries (1990–2018) finds that successful strategies typically integrate long-term visions with phased implementation, evaluation and monitoring, R&D investment, institutional coordination, financing, and quantitative modelling (Tsoi et al., 2021). Countries achieving relative or absolute decoupling commonly deploy such packages sequentially over extended timeframes, as in Japan's progression from fuel economy regulations to modal shift and then eco-car subsidies, or France's pairing of land-use coordination with R&D and cycling incentives (Tsoi et al., 2021), with early-phase interventions establishing enabling conditions for later measures (Loo et al., 2020; Tsoi et al., 2021).

Yet policy synergy does not guarantee behavioural alignment: emissions gains from cleaner technologies are partially offset by increased demand and car dependence (Bauer, 2018; Ben-Akiva et al., 2026). The pattern is not confined to passenger transport. Road freight makes the package-behaviour gap especially visible, because the behavioural unit is the firm rather than the household, and firm-level decisions are shaped by supply-chain interdependencies that public instruments do not directly reach. Rebound⁷ in road freight ranges from 49% to 61%, nearly double the passenger-sector figure (Sorrell and Stapleton, 2018), and reflects a structural feature of logistics decision-making: efficiency gains lower the per-tonne-kilometre cost of road freight, which raises its competitiveness against rail and short-sea shipping, which in turn induces additional road tonne-kilometres downstream. The package design does not malfunction; its instruments work as intended. However, it fails to reach the contractual, scheduling, and cost structures through which freight is actually moved (McKinnon, 2018). As a result, efficiency gains at the vehicle and fleet level translate into shifts in modal share and induced demand at the network level (Mulholland et al., 2018; Tsoi et al., 2021). Aviation packages display a parallel difficulty at a different scale: instrument synergy across sustainable aviation fuel (SAF) mandates, demand pricing, and technology incentives depends on capacity decisions by airlines and fuel producers operating under fleet turnover and supply-chain constraints that span longer horizons than the policy cycles in which the packages are designed (Sharmina et al., 2021). The package is internally coherent at the moment of design but does not preserve that coherence across the temporal gap between instrument and response.

These two findings that packages achieve synergies in principle yet encounter rebound and disconnection in practice are not contradictory but sequential. They reflect the operation of an instrument at one level of the system and a response that unfolds at another. A package can generate coordinated effects at the level of instrument interaction while the behavioural and commercial logics that ultimately govern emissions remain outside its reach. This is an epistemic point, not an empirical inconsistency, and it is the thread

⁶ Avoid strategies seek to reduce unnecessary travel through compact development and land-use coordination; Shift measures promote public transport, active travel, and multimodal freight; Improve focuses on technological efficiency through fuel economy and alternative-fuel adoption (Mårtensson et al., 2023).

⁷ Rebound effects are particularly consequential for freight decarbonisation strategies that lean heavily on the "Improve" register.

that connects the rebound discussion here to the broader diagnosis of [Section 2.5](#).

2.3. Spearheading policy: vision without pluralism

Transport decarbonisation policy exhibits a recurring pattern in which particular spearheading themes dominate research agendas and policy attention for extended periods: from transit-oriented development in the 2000s, to electric mobility in the 2010s, to mobility-as-a-service and the 15MC more recently. Such themes become organising visions for policy, funding, and modelling, shaping how decarbonisation challenges are framed and which responses are imaginable. The concentration is not incidental. [Tsoi et al. \(2021\)](#) document how national strategies increasingly revolve around specific technological visions, most notably electrification and alternative-fuel adoption after 2008. Bibliometric work reinforces the pattern: [Meyer \(2020\)](#) records exponential growth in road-freight decarbonisation research tracking policy emphasis on technological solutions, with post-2010 scholarship concentrating on green transport technologies and electric vehicle routing, and [Zhao et al. \(2020\)](#) find sustainable-transport research clustering around indicator development, environmental impact assessment, and alternative-fuel technologies.

Spearheading strategies can mobilise resources and accelerate innovation, but they generate two closely related problems. The first is epistemic narrowing: multi-instrument approaches remain confined within the analytical boundaries set by the dominant vision, obscuring systemic trade-offs that cross those boundaries. Lifecycle⁸ analysis exposes the cost. When embedded production emissions are included, vehicle electrification delivers only about 2% overall emission reduction, compared with roughly 30% when use-phase emissions are considered alone ([Winkler et al., 2023](#)); large-scale electrification also increases grid-capacity demand that can compete with decarbonisation in other sectors ([Mercure et al., 2018](#)). The cost becomes sharper as the vision is asked to do more work: as electrification migrates from private cars to commercial fleets, urban buses, and heavy road freight, battery sizing rises, embedded production emissions per unit grow, fleet duty cycles strain charging infrastructure differently, and dependencies on critical-mineral supply chains become more concentrated ([IEA, 2024](#); [Mulholland et al., 2018](#)). Aviation and maritime transport sit at the far end of this spectrum. Their equivalents are not battery-electric technologies but synthetic and bio-derived fuels. Yet the structural pattern remains the same: a single technological pathway is expected to carry the burden of decarbonisation, while alternatives such as demand reduction, modal shift, slower steaming, and reduced service frequency are systematically overlooked ([Sharmina et al., 2021](#)).

The second is normative closure: spearheading themes project singular visions of desirable futures without adequately engaging societal value pluralism. Transport scenario methodologies have traditionally centred on expert-defined pathways, presenting stakeholders with predefined futures rather than enabling co-creation from the outset ([Banister and Hickman, 2013](#); [Tuominen et al., 2014](#)). Methodological responses such as pluralistic backcasting ([Tuominen et al., 2014](#)) and collaborative backcasting ([Soria-Lara and Banister, 2018](#)) have explicitly sought to keep multiple visions in play rather than converge on a single optimal pathway, yet the dominant policy register continues to favour the singular vision the spearheading logic produces. The gap is visible in participatory outcomes: in the UK Climate Assembly, only 17% of participants supported scenarios requiring the most substantial reductions in car travel, despite such reductions being central to stringent climate targets ([Winkler et al., 2023](#)).

2.4. Modelling temporal dynamics: prediction without disruption

Transport decarbonisation modelling covers a diverse portfolio of approaches⁹ across temporal horizons. Among these, Integrated Assessment Models (IAMs) dominate long-term scenario analysis, typically projecting energy and transport system transitions from the present to the end of the century ([Edelenbosch et al., 2017](#); [Sharmina et al., 2021](#)). IAMs are particularly effective at representing cross-sectoral dynamics, such as competition for bioenergy between transport, power, and industry, and at estimating the economy-wide carbon prices consistent with climate targets ([Sharmina et al., 2021](#)). These strengths are, however, tightly coupled to assumptions of continuity, gradual change, and system optimisation. Transport demand is typically driven by harmonised socioeconomic pathways, exogenous population and GDP projections, and predefined technology cost curves that determine the timing and scale of electrification and alternative-fuel adoption. As a result, behavioural and practice-level drivers of demand are represented in far less detail than technological transitions ([Thomas et al., 2024](#)).

This design creates a persistent gap between global modelling projections and actionable urban and regional policy, where demand management and behavioural interventions are most consequential ([Winkler et al., 2023](#)). Across eleven IAMs, [Edelenbosch et al. \(2017\)](#) show that while models tend to agree on directional trends, they diverge substantially in magnitude, with projected transport activity increases by a factor of two to five by 2100. This divergence constitutes the largest source of inter-model uncertainty in transport emissions, reflecting the sensitivity of outcomes to assumptions about future behaviour. More fundamentally, long-term predictive models struggle to anticipate rapid, disruptive shifts in mobility practices that unfold on much shorter timescales than those embedded in IAM scenarios. The COVID-19 pandemic is the clearest recent example: the sudden uptake of working-from-home produced sharp reductions in peak-hour travel and commuting frequency, while evidence on total travel distance remains mixed and

⁸ The lifecycle point is not a case against electrification but against the treatment of electrification as a *complete* decarbonisation strategy, the paradigmatic move of a spearheading vision.

⁹ Models such as IMAGE, MESSAGE, REMIND, GCAM, and TIAM-UCL rely on cost-optimisation algorithms that minimise system-wide costs or general-equilibrium frameworks that simulate market interactions across sectors ([Edelenbosch et al., 2017](#); [Thomas et al., 2024](#)). Transport emissions are commonly represented through variants of the Kaya Identity, decomposing emissions into activity levels, modal structure, energy intensity, and fuel or carbon intensity ([Edelenbosch et al., 2017](#); [Sharmina et al., 2021](#)).

context-dependent (Halefom et al., 2025), practice-level shifts cascaded beyond mobility, and the rapid expansion of e-commerce raised per-capita household emissions through both scale and structure effects (Liu et al., 2025; Xu et al., 2025).

The mismatch between modelling assumptions and modal dynamics is not uniform across modes, and the asymmetry is itself part of the difficulty. For urban passenger transport, behavioural and practice-level shifts unfold faster than IAM assumptions can accommodate; predictive stabilisation under-represents how quickly mobility practices can change. For road freight, fleet turnover is on the order of 10–20 years and powertrain transitions are contested between battery-electric and hydrogen pathways, so models tend to over-stabilise around currently dominant technology trajectories that the underlying competition may yet unsettle; they also assume continuity in trade volumes, supply chain configurations, and economic conditions that recent disruptions, such as pandemic-induced supply chain reconfiguration, geopolitical fragmentation of trade routes, regional sourcing, have shown to be more contingent than the modelling horizon allows (Mulholland et al., 2018; Tavasszy et al., 2026). For aviation and maritime, infrastructure and asset lifetimes extend further (aircraft and ships typically operate for 25 years or more), and here the difficulty is the reverse: long-lived capital stock and the political economy of fuel transitions can generate lock-in effects that models often under-represent (Belcher et al., 2025; Sharmina et al., 2021). The diagnostic point is not that any one mode is modelled poorly, but that predictive stabilisation as a representational strategy mismatches the temporal dynamics of each mode in a different way.

The same epistemic pattern recurs in climate risk modelling for transport infrastructure, which acts as the adaptation counterpart to IAM-based mitigation modelling. Climate risk models project flood exposure, heat stress, and sea-level rise impact on road, rail, port, and airport assets across multiple decades (Hayes et al., 2019; Palin et al., 2013), supporting resilience planning much as IAMs support mitigation planning, and they reproduce the same representational logic: emissions trajectories enter as exogenous inputs, climate hazards are smoothed across return periods, and asset vulnerability is parameterised through engineering thresholds that do not consider how operators, users, and maintenance regimes adapt as conditions change. The blind spot mirrors the IAM case: compound events, cascading failures across interdependent networks, and abrupt shifts in how infrastructure is used after a disruption sit outside what the stabilised representations can anticipate (Hayes et al., 2019). The 2018 and 2022 Rhine low-water episodes sharply reduced inland barge capacity and forced freight onto road and rail (Vinke et al., 2022); the 2014 Dawlish sea-wall failure severed the UK south-west rail mainline for two months (Dawson et al., 2016). Each disrupted infrastructure operation on timescales shorter than the planning horizons against which the models are deployed. Two further limitations are specific to climate risk modelling.¹⁰ First, resilience is conceptualised as a property of infrastructure to be measured, parameterised, and projected, rather than as a capacity emerging through continuous adaptive cycles of disturbance, reorganisation, and learning (Hayes et al., 2019; Tsoi et al., 2021); predictive models that freeze a snapshot of vulnerability cannot accommodate the co-evolution between hazard and response. Second, the temporal relationship between mitigation and adaptation modelling is itself a blind spot: IAMs assume infrastructure keeps functioning as designed across their horizon, whereas climate risk models assume current emissions trajectories continue across theirs (Schwanen, 2019). This separation is not a technical limitation that better integration could resolve; it is a symptom of the same control-oriented logic that treats complex adaptive systems as objects of prediction rather than fields of unfolding interaction.

2.5. Synthesis: epistemic limits of control-oriented decarbonisation

The four strands of analysis reveal not a lack of policy instruments, governance arrangements, or analytical sophistication, but a recurring pattern in how transport decarbonisation is conceptualised and enacted. Multi-level governance frameworks, comprehensive policy packages, spearheading visions, and long-term modelling together constitute an increasingly mature and coordinated policy landscape. Yet the persistence of uneven progress, implementation gaps, rebound effects, and social resistance suggests that the challenges are not primarily technical or institutional, but epistemic and ontological: assumptions about how mobility can be known shape and are shaped by assumptions about what mobility systems are understood to be.

The claim follows from what each strand demonstrates on its own terms. In Section 2.1, the coordination gap between scales is not solved by additional institutional transmission: the GBA and SFBA cases show that comparable instruments produce attunement or its absence depending on the relational quality of actor interactions, not the completeness of the governance architecture. In Section 2.2, the rebound gap is not solved by better instrument design: road freight and aviation show that instrument synergy operates at one level of the system while the commercial and contractual logics that shape behaviour operate at another, a gap that is structural rather than correctable by refinement. In Section 2.3, the normative closure of spearheading visions is not solved by adding instruments within the existing frame: electrification cases show that the narrowing is prior to instrument design, built into the framing that determines which instruments are imaginable. In Section 2.4, the predictive failures of IAM and climate risk modelling are not solved by more data or higher resolution: the COVID-19 mobility disruption and the Rhine and Dawlish cases show that the mismatches arise from a representational ontology that treats the system as determinable across timescales on which it is in fact non-linear, emergent, and practice-dependent. In each case, the difficulty is not in the tool but in the prior assumption that the tool's task is to close down uncertainty rather than to remain open to what the system is doing.

The 15MC sharpens the diagnostic because each of the four limits can be read through the same policy idea. Its implementation depends on vertical and horizontal coordination across planning, transport, housing, and service provision (Allam et al., 2022), yet procedural alignment alone does not ensure attunement to the everyday rhythms and needs of residents (Caprotti et al., 2024;

¹⁰ Each disruption is not only an event to be anticipated but a moment through which adaptive capacity is itself reshaped, as institutions, operators, and users adjust their practices, expectations, and protocols in light of what the disruption revealed. The events that models try to anticipate are also the events through which future adaptive capacity is built or eroded.

Schwanen et al., 2026) — the pattern in Section 2.1. Its proximity logic combines Avoid and Shift strategies in ways that appear coherent at the level of policy design (Moreno et al., 2021), but in practice interacts with property markets and residential sorting, producing displacement and longer commutes for lower-income households (Bardaka, 2024; Padeiro et al., 2019) — the pattern in Section 2.2. The 15MC also exemplifies the narrowing effects of spearheading visions: contested and context-dependent forms of accessibility are stabilised into standardised proximity metrics and coverage targets (Mahmoudpour and Shirazi, 2026; Mouratidis, 2026; Wang et al., 2025). Like the IAM, the isochrone renders a dynamic and shifting social reality into a fixed representation that can become brittle under changing practices and conditions (Carvalho et al., 2025) — the patterns identified in Sections 2.3 and 2.4.

Across these domains, a shared logic underpins contemporary transport decarbonisation: control-oriented and efficiency-centred approaches that seek to stabilise dynamic systems through predefined visions, targets, and trajectories. Uncertainty is treated as noise to be reduced, plurality as a coordination problem to be managed, and complexity as something governable through abstraction. Yet these assumptions sit uneasily with the realities of climate disruption, social diversity, and temporal instability. Addressing these tensions requires more than refining existing tools. It calls for conceptual resources that emphasise attunement, process, and relational balance over optimisation and fixed baselines. The paper therefore treats questions of representation and control as inseparable from assumptions about the nature of mobility systems themselves. It is in this context that the paper turns to Daoist thought. The remainder of the paper therefore does not treat modelling as the sole site of intervention, but as one of four practices through which control-oriented assumptions are reproduced: governing, designing instruments, framing pathways, and representing futures.

3. Towards approaches with conceptual resources from Daoism

3.1. How to read Daoism in transport research

Laozi's *Dao De Jing* (道德經) opens with a well-known paradox: “the *Dao* that can be spoken is not the enduring *Dao*” (道可道，非常道), a statement¹¹ that neither rejects guidance nor counsels silence, but cautions against treating any articulated *Dao* (道, literally “road”, the Way) as final or exhaustive. Applied to the diagnosis of Section 2, it is a reminder that no single policy framework, target, or model can fully capture the evolving dynamics of mobility systems under uncertainty.

Ancient Chinese philosophy is often treated as difficult to categorise within dominant Western traditions, a difficulty that reflects differences in orientation rather than legitimacy (Jumaniazova, 2023). Rather than privileging formal abstraction or universal definition, many strands emphasise metaphor, analogy, and contextual coherence as ways of understanding the world (Wu, 2025; cf. Hong et al., 2025). Knowledge is conceived as relational and situated, embedded in everyday practice and shaped by pragmatic concerns with conduct, governance, and harmony under uncertainty (Shusterman, 2004). Philosophical reasoning operates through images and symbols that illuminate dynamic and relational phenomena without fully fixing them, offering forms of insight that resist linear or purely quantitative analysis (Zhang et al., 2025).

This mode of reasoning is not entirely foreign to Western thought. Lefebvre's (2004) rhythmanalysis analyses everyday life and urban space through musical and bodily metaphors of rhythm, harmony, and arrhythmia, and has informed transport and mobility research by shifting attention from efficiency and throughput toward lived experience (Chan, 2024; Sun, 2022; Walker, 2021). The point of acknowledging such parallels¹² is not to assimilate Daoism to them, but to establish that metaphor-based reasoning is a legitimate analytical mode in transport scholarship, and that Daoism enters the field on the same epistemic footing as these established interlocutors. That said, Daoism is not simply restating relational insights in another idiom. Where Western relational and critical traditions often remain analytical and intervention-oriented, seeking to diagnose power, stabilise meaning, or reconfigure systems toward normative ends, a Daoist approach begins from relationality as a condition of existence and is sceptical of the impulse to name, fix, or improve relations through assertion. This distinction matters for transport policy and modelling, where the desire for optimisation, definitive targets, or final solutions can itself become a source of rigidity under conditions of climate uncertainty.

The paper's method is accordingly that of conceptual and epistemological analysis: it interrogates the assumptions, framings, and governance logics underpinning contemporary decarbonisation approaches rather than testing empirical hypotheses or constructing

¹¹ The opening line of the *Dao De Jing* admits multiple translations: “the *Dao* that can be named,” “spoken,” “expressed,” or “followed” is not the “constant,” “enduring,” or “eternal” Way. Each highlights the instability of fixing *Dao* through language. Beyond translation, the line can be read as a reflection on the limits of linguistic representation itself: the moment the *Dao* is articulated, it slips beyond what words can hold. In this sense, Laozi's insight anticipates Wittgenstein's (1953) argument that language cannot fully capture the conditions of its own intelligibility. Just as Wittgenstein suggests that forms of life and private experience resist exhaustive articulation, *Dao* may be understood as a plural, relational, and context-dependent process rather than a singular doctrine (Joshi, 2020). In both traditions, the attempt to name or stabilise what is fundamentally relational transforms the very object of understanding: an insight that underpins this paper's caution against treating governance concepts, targets, or models as final or exhaustive representations.

¹² The parallel can be developed further in either direction. Chan's (2024) Lefebvrian rhythmanalysis resembles Daoist concerns in suggestive ways; Hasenkamp and Sun (2023) trace convergences and divergences between Daoist governance thought and contemporary process-relational political theory. The present paper does not attempt a systematic comparison: its aim is conceptual development for transport research, for which the parallel is preliminary rather than constitutive.

predictive models. Chinese philosophy is mobilised as a set of conceptual and epistemic resources¹³ that articulate metaphorical, relational, and context-sensitive reasoning. *Dao* is plural rather than singular: there are many possible *dao*, ways of moving, planning, communicating, and governing mobility, and the present paper develops one such reading rather than offering *the Dao* of transport decarbonisation. Three concepts do most of the work: Section 3.2.1 develops *wu-wei* (無為, non-coercive action) as a reframing of governance action; Section 3.2.2 develops *qi* (氣, vital flow) as a reframing of mobility flow; Section 3.2.3 develops *yin-yang* (陰陽, dynamic balance) as a reframing of evaluative balance. Section 3.3 then draws these together through a Daoist re-reading of the 15MC and other transport policy instruments.

3.2. *Wu-wei, qi, and yin-yang: three concepts for reframing decarbonisation*

3.2.1. *Wu-wei: action as attunement*

Wu-wei is often mistranslated as “doing nothing”.¹⁴ It denotes, more accurately, action that arises from attunement to the inherent tendencies of a system rather than from forceful intervention. Laozi’s image is water: “the highest goodness is like water, which benefits all things without contending” (上善若水, 水善利萬物而不爭). Water¹⁵ nourishes through responsiveness and exerts influence without domination, yet it is never merely gentle: its power lies in its capacity to overflow, erode, and transform when not attentively guided. *Wu-wei* therefore denotes neither passivity nor restraint, but non-coercive action: guiding without forcing, enabling without imposing.¹⁶

Action, on this view, is relational, temporal, and emergent. The most consequential interventions are often indirect, partial, or reversible, while excessive assertion and over-definition disrupt the very alignments they seek to secure. This sensibility resonates with chaos-theoretic accounts of climate as a non-linear system in which subtle, timely adjustments may reshape trajectories more effectively than large-scale forceful measures (Chen, 2005; Jones and Culliney, 1999). Daoist-complexity interpretations further suggest that attempts to impose rigid control can destabilise the very systems they seek to govern, whereas carefully timed and context-sensitive adjustments may reshape trajectories more effectively than large-scale forceful measures. The legendary flood control of Yu the Great¹⁷ (大禹) exemplifies this convergence: disaster is addressed not by damming waters but by guiding their course (Zhang et al., 2025).

Applied to the diagnostic dimensions of Section 2, *wu-wei* directly refuses the assumption that coordinated mandates, packaged instruments, and dominant visions can stand in for relational alignment. Governance is repositioned as the cultivation of conditions under which adaptive behaviour can emerge, rather than as the imposition of predefined outcomes. Naming, from a Daoist perspective, is itself an act of intervention: to define is already to carve, and every carving amplifies certain flows while foreclosing others. This act of naming is *ming* (名), in Daoist thought, no categorisation or definition is neutral, because the moment a phenomenon is named it is already shaped by the name, made governable in some ways and invisible in others.¹⁸ *Ming* operates pervasively through transport governance: every metric, target, and policy frame is an act of *ming* that stabilises some configurations of mobility while suppressing alternatives.

3.2.2. *Qi: mobility as circulation, not acceleration*

Daoists take *qi* (氣) as the vital energy that animates existence — a circulation that permeates the cosmos, the body, and *ziran* (自然,

¹³ The framing as *resource* rather than *doctrine* matters analytically. A doctrine commits its user to a settled set of substantive claims; a resource is engaged for the conceptual work it does, with the user retaining responsibility for what is and is not carried over. This distinction is consistent with the *wu-wei* counsel against over-naming developed in Section 3.2.1: claims about what Daoism is and is not are themselves acts of *ming* (3.3.2), and are held here with corresponding restraint.

¹⁴ The literal characters render “no action”, but the classical usage consistently denotes action without coercion or contrivance, in contrast to *you-wei* (有為), assertive or forced action. See Goodfield (2011) and Hasenkamp and Sun (2023) for treatments that resist the passivity reading. The *wu-wei* principle contrasts with recent “Western” ideas, such as Jenny Odell’s (2019) manifesto *How to Do Nothing*. This bestseller, praised by outlets like Time, The New Yorker, and NPR, and even featured on Barack Obama’s 2019 reading list, encourages resisting the attention economy. Odell presents “doing nothing” as an act of political resistance and advocates for a “downward movement into place”, shifting attention to the local and deepening our connection with our surroundings.

¹⁵ In Daoist thought, water symbolises both nourishment and destructive force: while yielding and life-sustaining, it is also capable of overwhelming and erosion. As the *Dao De Jing* notes, “nothing is softer than water, yet nothing surpasses it in overcoming what is hard and strong” (天下莫柔弱於水, 而攻堅強者莫之能勝。其無以易之). Effective governance, therefore, lies not in suppressing or abandoning flows, but in attentively guiding them; see the later discussions of Yu the Great’s (大禹) flood control for an illustration of this principle.

¹⁶ This reading rules out two common misinterpretations: that *wu-wei* counsels deferring to existing preferences (it does not — that would be *you-wei* in another guise, and would trench the status quo), and that it counsels managerial restraint (it counsels relational alignment, which may demand decisive action when the moment is right).

¹⁷ The story of Yu is widely regarded as legendary in character (Montgomery, 2016); while some scholars have explored its possible physical grounding (e.g., Wu et al., 2016), the archaeological and geological evidence remains subject to ongoing debate (e.g., Wu et al., 2017).

¹⁸ *Ming* (名) recurs at two further points in the argument. Section 3.2.2 analyses cycling suppression in Hong Kong as a form of governance exercised through discursive *ming*: the sustained symbolic framing of cycling as unsafe, rather than through direct physical prohibition (Chan, 2025a). In this case, the act of naming itself becomes the regulatory mechanism. In 3.2.3, the paradigm-divergence discussion shows that both the technocratic framing and the counter-framing of policies such as the 15MC are acts of *ming*, each amplifying certain flows and foreclosing others, and neither identical to the terrain it claims to describe.

nature as it is), in other words, the vitality that moves between human, material, and ecological relations. Classical texts compare *qi* to water: nourishing when it circulates appropriately, generating stagnation and disorder when obstructed or forced. Crucially, *qi* does not imply constant motion. Stillness, rest, and reduction can be as vital as movement when they sustain balance (cf. Bissell and Fuller, 2013). This is embedded linguistically in *tong* (通) — passage, connection, circulation — which lies at the heart of *jiao-tong* (交通), the Chinese term for transport. To enable *tong* is not to move faster or farther, but to maintain relational continuity (*jiao* 交, intersection) between people, places, and environments.¹⁹

Qi functions, then, as a diagnostic lens for sensing imbalance rather than a prescriptive model of optimal mobility. It directly contests the assumption implicit in much of the modelling diagnosed in Section 2.4 that movement is inherently beneficial and that throughput is a proxy for benefit. Two empirical anchors illustrate the diagnostic register. First, coerced mobility is the clearest contemporary symptom of blocked or violently redirected *qi*: climate-induced displacement (Askland et al., 2022), forced mobility under conflict and economic precarity (Adey et al., 2021), and the pandemic's essential workers commuting through lockdowns while others were immobilised (Schwanen et al., 2026) all register as movement that is compelled rather than chosen, excessive rather than nourishing.²⁰ Second, shared-street evidence (Tzouras et al., 2024) shows what *qi*-attuned design looks like in practice: under conditions of spatial ambiguity and social presence, lower speeds and reduced variance emerge through attentiveness and negotiation rather than through prescriptive signage (see also Oviedo-Trespalacios et al., 2019). The diagnostic and design lessons are continuous: *qi*-reasoning treats fatigue, congestion, social strain, and ecological stress not as noise to be filtered but as early warnings of imbalance, and treats environments that allow adaptive flow as more trustworthy regulators than those that force circulation through rigid rules. For example, the contrast with Hong Kong's long-standing discursive suppression of urban cycling, sustained less through formal prohibition than through symbolic framing of cycling as inherently unsafe (Chan, 2025a), illustrates the obverse: regulation through *ming* rather than infrastructure can block *qi* as effectively as a kerb.

3.2.3. Yin-yang: Balance as the holding of ambivalence

Yin-yang (陰陽) expresses holism through the dynamic interplay of complementary forces and energies — light and dark, activity and rest, growth and decline — that co-arise and transform one another within an evolving system. Balance is never static or final; health and well-being are not achieved by eliminating “negative” states but through the ongoing rebalancing of processes across body, mind, and environment. *Yin-yang* is therefore developed here as a conceptual lens for recognising ambivalence, shifting boundaries, and temporal trade-offs as unavoidable features of decarbonisation. Harmony, on this account, is not a final condition but an ongoing process of adjustment and attunement, and crucially, not one whose substantive content can be fixed in advance. Essentially, Daoist harmony is not a normative endpoint to be specified and targeted, but a quality of the governance field itself: its openness, responsiveness, and capacity to sustain difference without collapsing it into rigidity.

Applied to the rebound and packaging problems of Section 2.2 and the spearheading visions of Section 2.3, *yin-yang* refuses the rigid binaries that structure much transport policy: mitigation versus adaptation (Schwanen, 2019), technology versus behaviour, growth versus environment, human systems versus nature. These are not competing agendas to be resolved but interdependent tensions to be navigated. Progress unfolds through feedbacks in which gains in one domain frequently generate costs in another: eco-innovations such as electric vehicles or digital mobility platforms reduce tailpipe emissions while reinforcing resource extraction, infrastructural dependency, and spatial inequality; carbon-neutrality and net-zero targets foreground certain harms (carbon) while backgrounding others (biodiversity loss, displacement, care burdens, the value of slowness). *Yin-yang* cautions against treating any of these targets as a final harmony: they are provisional boundary-making acts, revisable as conditions and values shift.²¹

As the *Dao De Jing* observes, “tackle difficulties while they are still easy; accomplish great tasks by attending to their small beginnings” (圖難於其易，為大於其細). *Yin-yang* cautions against privileging novelty alone: the new (*yang*) cannot be understood without the old (*yin*), for instance, enduring infrastructures, social hierarchies, and institutional legacies continue to shape mobility outcomes, and inequalities persist through both material resources and symbolic status (Piazza and Martens, 2025; Schwanen et al., 2015). Sectoral, modal, and administrative boundaries are not neutral lines but ethical and political choices (Batty, 2023) requiring continual reflection.

¹⁹ The story of Yu the Great, who restored circulation by *guiding and dispersing waters* rather than damming them, is the canonical Daoist illustration of governance as the maintenance of *tong*. It connects directly to the *wu-wei* reading in Section 3.2.1: non-coercive action and the maintenance of circulation are complementary aspects of the same disposition (Xia and Schönfeld, 2013).

²⁰ The point that mobility is not inherently beneficial has been made for two decades in critical human geography (Dant, 2014; Paterson, 2014; Sheller, 2004) and is consistent with Schönfeld's (2016) critique of the Enlightenment-rationalist faith that technological progress would resolve, rather than reproduce, systemic fragility. *Qi*-reasoning adds the diagnostic register: not only that mobility may harm, but that the symptoms of harm are perceptible in embodied experience before they become measurable in conventional indicators.

²¹ The Daoist position should not be confused with relativism. To say there is no final harmony is not to say that all configurations are equally good; it is to say that the standard of evaluation is dynamic balance under changing conditions, not adherence to a fixed endpoint. The conceptual move parallels the shift from *equilibrium* to *resilience* in socio-ecological systems thinking (Chan, 2025b; Hayes et al., 2019), with the difference that *yin-yang* foregrounds the productive role of tension itself.

3.3. Re-reading transport decarbonisation through Daoism

3.3.1. The 15-minute city re-read

The three concepts converge in a consolidated re-reading of the 15MC, the running example of the paper. Read through *wu-wei*, the 15MC works when implemented as reversible pilots, such as low-traffic neighbourhoods, time-limited pedestrianisations, and pop-up amenities, that allow local rhythms to re-emerge and feed back into revision. As an over-named template, it courts the resistance documented in Oxford and elsewhere (Schwanen, 2024), where the issue is not whether proximity is desirable but that a single normative vision of “good mobility” has been fixed in advance of the practices it claims to improve. The corresponding large-scale lessons are that scale-out should proceed by amplifying alignment rather than expanding control (Rigkos-Zitthen, 2025), and that Daoist governance in practice takes hybrid forms, coexisting with regulatory and market-based mechanisms rather than replacing them (Ko, 2025). This must be distinguished from tactical urbanism as such: many tactical interventions predefine what counts as success, such as “people-centred streets” equated with pedestrianisation (te Boveldt et al., 2023), “age-friendly” design reduced to the needs of older adults in isolation (Jaydarifard et al., 2026), and so reproduce the over-definition they appear to escape.²²

Read through the concept of *qi*, the 15MC could be taken quite differently. Where dominant readings frame proximity as a means of reducing travel, a *qi*-oriented reading frames it as a means of restoring *tong* by sustaining relational continuity between everyday destinations such that movement can be voluntary and rhythmic rather than forced. The diagnostic question shifts accordingly: not “how short are the trips?” but “where is *qi* blocked, and where is it forced?”. This exposes a failure mode the proximity-as-reduction framing cannot see: a 15MC that minimises trip distances while exhausting residents through dense scheduling, surveillance, or socially uneven access has not restored *tong*; it has reorganised forced mobility into a smaller spatial envelope. A symmetrical failure follows from scale. Early framings of the 15MC privileged walking and cycling at the neighbourhood scale while downplaying the transit networks through which large metropolitan regions sustain access to dispersed employment, healthcare, and social ties (Mouratidis, 2024); hybrid models integrating proximity with transit (Mouratidis, 2026; Wang et al., 2025) restore the metropolitan-scale *tong* the walk/cycle-only framing blocks. From a *qi* perspective, the scale at which circulation is restored cannot be specified in advance of the practices it serves.

Read through *yin-yang*, the 15MC is simultaneously emancipatory and exclusionary, and the task is not to choose between these readings but to hold them together. Proximity planning expands access for non-drivers, supports active travel, and reduces car-dependence (its *yang* face); it also raises rents, accelerates gentrification, and can displace the very mobilities it claims to enable, particularly for lower-income residents whose access depends on cheaper peripheral housing connected by public transport (its *yin* face). Castañeda’s (2021) decolonial critique of universalist cycling narratives generalises the point: mobility interventions framed as inherently emancipatory tend to privilege particular bodies, rhythms, and lifestyles while marginalising others. *Yin-yang* allows these positions to be held together without collapsing them into a single evaluative frame. The 15MC is neither inherently emancipatory nor inherently exclusionary: it is contextually both, depending on how its *yin* and *yang* dimensions are configured at a given site, and the configuration changes over time.²³

3.3.2. Re-reading transport policy instruments

Two policy instruments make the evaluative move concrete. Carbon pricing, viewed through *yin-yang*, is neither an inherently progressive nor an inherently regressive instrument: these dimensions co-arise and shift across contexts. The same carbon tax that internalises emissions externalities (*yang*) can concentrate costs on lower-income households whose mobility options are constrained by housing location, rural geography, or limited public transport (*yin*). The reasoning is not that carbon pricing should be avoided, but that its design, such as exemption thresholds, geographical differentiation, pairing with complementary measures, should anticipate the distributional feedback the policy will generate. Read through *wu-wei*, the same instrument is more durable when introduced incrementally and reversibly, with mechanisms for revision as the behavioural response unfolds. France’s 2018 fuel-tax trajectory, which would have raised diesel duty by around 6.5 cents per litre from January 2019 without compensating measures, was suspended within three weeks of the gilets jaunes mobilisation in late 2018 (Mehleb et al., 2021): a single-rate imposition lacking reversibility, geographical differentiation, or revenue-recycling collapsed politically before any behavioural response could take hold. Read through *qi*, carbon pricing functions only as well as the alternative circulations it enables: a price signal in a context where public transport, active mobility, and proximity-based access are blocked produces frustration rather than redirection.

ZEV mandates illustrate the same evaluative move at the technology-regulation interface. A mandate that aligns with the planning horizons of vehicle manufacturers, battery suppliers, charging operators, and grid utilities, with built-in review points as technology, supply chain, and grid evolve, exemplifies *wu-wei*’s emphasis on working with the inherent tendencies of the system rather than against them. The UK ZEV mandate (in force from January 2024) sets new-car targets escalating from 22% zero-emission in 2024 to 80% in 2030 and 100% in 2035, with credit-trading and trajectory-review provisions allowing flex as battery costs, charging deployment, and

²² A fuller reading would connect *wu-wei* to the *be water* (似水無形) ethos of Hong Kong’s recent social history (Chan, 2026) and to grassroots mutual-aid organising during COVID-19 (Chan et al., 2021). Both register *wu-wei* as resilience through continuous adjustment rather than rigid control. Space precludes their development here.

²³ This connects to the Daoist refusal of the nature/culture dualism, *tian-ren-he-yi* (天人合一), the unity of humans and nature (Chen and Wu, 2009), in which mobility is situated within ecological flows of air, carbon, water, and energy rather than treated as a human system acting upon an external environment; for instance, late Qing transport practices often followed terrain and seasonal rhythms and resisted infrastructural alteration in order to maintain harmony between human activity and the natural-cosmic order (Li, 2025).

grid capacity evolve (Department for Transport, 2023). The EU's 2035 zero-emission new-car regulation includes a 2026 review clause that explicitly reconsiders technology pathways including e-fuels (European Commission, 2023). Both exemplify *wu-wei* reversibility built into the instrument from the outset. A mandate that fixes a single technology pathway at the expense of alternatives whose comparative advantages may shift, e.g., hydrogen for heavy freight, synthetic fuels for aviation, or that ignores the *yin* face of the chosen pathway (upstream lifecycle emissions, grid integration constraints, mineral-supply dependencies), tends toward the rigidity *yin-yang* reasoning warns against.

Infrastructure investment criteria offer the clearest case for *qi* reasoning. Criteria that prioritise corridor-level throughput, such as vehicle-kilometres, average speeds, level of service, measure what is most easily measured but not necessarily what most affects the circulation of access, opportunity, and everyday practice across the network. The contrast is visible in UK practice between the Department for Transport's WebTAG framework, which monetises travel-time savings and vehicle operating costs as the primary appraisal currency, and Transport for London's Healthy Streets framework (Transport for London, 2017), which scores schemes against ten qualitative indicators including pedestrian comfort, perceived safety, places to stop and rest, and choice of active modes (Aldred et al., 2019). The shift is not merely from quantitative to qualitative metrics but from measuring corridor throughput to measuring *qi*: the everyday flows of physical movement, social use, and inclusive presence that the street enables. The diagnostic question shifts from "how much capacity does this investment add?" to "what flows does this investment enable, for whom, and what blockages persist alongside it?"

4. Reimagining transport decarbonisation practice through Daoist attunement

With the diagnosis of Section 2 and the conceptual reorientation of Section 3 in place, this section draws out implications for four interconnected areas of transport decarbonisation practice: governance across scales, policy-instrument design, analytical framing, and modelling. These correspond to the four diagnostic dimensions developed in Sections 2.1–2.4. Across all four, the transport system is understood not as a closed mechanism of demand, supply, and performance to be optimised, but as a living field of *qi* flows: an open ecology that breathes, transforms, and co-adapts across human, material, and ecological relations. Governance arrangements, policy instruments, analytical frames, and models are therefore treated as tools for sensing and tending that ecology rather than for controlling it.

4.1. Governance attunement across scales

Recent empirical work has advanced beyond simple coordination-failure framing toward policy-implementation gap analysis (Tsoi et al., 2021), and calls for multiscale measurement of externalities at regional, national, and city levels (Tsoi and Loo, 2026). Yet the gap framing reproduces a control disposition: it presupposes that an objectively correct policy exists upstream and fails to be transmitted downstream, treating coordination as a problem of better institutional plumbing rather than of relational quality. The relational dimension regarding how scales tune to each other through informal practice, repeated interaction, and mutual adjustment remains under-theorised precisely because it is not captured by gap-against-target metrics. There is no informal practice through which airlines and bunker-fuel suppliers adjust to ICAO targets, no regular interaction through which vehicle manufacturers and grid utilities co-develop planning horizons with national mandates, and no mutual adjustment between city access regulators and regional charging-network deployment. In each case, the alignment problem is the structural absence of a relational field in which scales adjust to one another in practice. A Daoist reframing treats the gap not as a deviation to be closed but as a relational fact to be understood, and attunement names a quality of cross-scale interaction that hierarchical-implementation metrics cannot register. It calls for ethnographic governance studies, dialogical process analysis, and longitudinal case studies of how scales develop mutual responsiveness over time. These methodological orientations complement rather than replace the panel-data and quasi-experimental designs that currently dominate the literature (Marsden and Reardon, 2017).

This reframing also carries implications for how paradigm divergence is governed across scales. Disputes over policies such as low-traffic neighbourhoods and 15MC are not only coordination failures; they reflect deeper divergences in how urban space, governance, and individual autonomy are understood, what Bueskens (2024) terms paradigm divergence, in which actors operate within partially incommensurable worldviews that share neither a common evidentiary standard nor a common account of legitimate authority. Both the technocratic framing that positions such policies as accessibility and emissions interventions, and the counter-framing that positions them as incursions into everyday life and individual choice, are acts of *ming*: each names and carves the situation in ways that amplify certain flows and foreclose others, and neither carving is identical to the terrain it describes. Under these conditions, governance approaches, which assume a shared epistemic foundation that parties can be brought to agreement through better evidence, more inclusive consultation, or clearer targeting, face structural limits and risk intensifying conflict rather than achieving the attunement they seek. A Daoist-informed governance does not resolve such divergence but reorganises it, shifting from convergence-as-goal toward sustaining the conditions under which heterogeneous actors can continue to interact and adjust without requiring ontological agreement as a precondition.

What *he* requires in this context is consequently narrower than the reconciliation of worldviews: it is the preservation of material plurality sufficient to allow coordination to continue despite incommensurable readings of what is being coordinated. In practice, this means non-digital access routes maintained alongside app-based ones; reversibility built structurally into policy from the outset rather than conceded under pressure; and resistance treated as information about rate and manner rather than as misinformation to be corrected. Legitimacy cannot rest on agreement about outcomes or adherence to predefined targets; it arises from the perceived fairness, openness, and responsiveness of the processes through which decisions are made and revised (Miller, 2001). A Daoist account

also requires a clearer account of power.²⁴ Its critique of coercive overreach, rigid imposition, and artificial ordering provides a way of identifying forms of power that disturb relational balance, visible when some actors are able to define mobility futures, allocate resources, and secure benefits, while others bear the costs of transition through displacement, reduced accessibility, higher mobility costs, exposure to pollution, or symbolic exclusion from decision-making. Daoist harmony therefore cannot mean the suppression of conflict; it requires attention to the conditions under which different actors can participate in shaping change, and would favour non-domination, responsiveness, and continual adjustment through mechanisms such as deliberative forums, participatory modelling, community-led evaluation, place-based review, and iterative policy adjustment.

4.2. Instrument design beyond compositional logic

The literature has moved visibly beyond magic-bullet thinking toward multi-component frameworks (Churchman et al., 2026; Holden et al., 2020; Tsoi et al., 2021), and these advances are genuine. Yet they share a compositional logic: the assumption that sustainability is achieved by assembling the right components together, and that the core analytical task is to identify the optimal mix in advance of deployment. This stops short of the *yin-yang* claim that any instrument's stabilising and destabilising faces are dynamically reconfigured by context and cannot be settled at a single point in time. Bøe et al. (2025) classify country clusters as trade-off, synergy, or neutral at a single observation point, with no analytical space for shifts in loop dominance as land-use and distributional pressures accumulate. Zhang et al. (2026b) build parametric uncertainty into freight modelling but still produce a single Pareto-optimal configuration via TOPSIS ranking, settling the best mix in advance precisely where stakeholder criteria are most likely to diverge over time. Churchman et al. (2026) treat codesign as a precondition to be established before transition begins, rather than as an ongoing relational practice that must survive the transition itself and be renegotiated as conditions change.

The research opening this creates is longitudinal rather than configurational. The task is not to identify the right policy mix before deployment but to track how instruments interact with their contexts as those contexts evolve, and to design formal revision mechanisms that allow adjustment as the system being regulated changes around the instrument (Jacobs and Weaver, 2015; Pierson, 2004; Yildiz, 2026). A carbon price applied to road freight in 2024, when zero-emission heavy-goods-vehicle alternatives are barely commercially available, is not the same instrument as the same price applied in 2030, when battery-electric and hydrogen heavy-duty options are plausible competitors: the political economy, the available modal alternatives, the distributional burdens, and the relationship between the carbon signal and actual investment behaviour have all shifted, such that the balance between intended stabilising effect and unintended consequences is structurally different. Methodologically, this builds on adaptive policy-mix and reflexive governance traditions but reconfigures their aim: rather than searching for optimal configurations, the analytical task is to track how complementary tensions between an instrument's two faces evolve under changing conditions, and to build trigger criteria for revision that are sensitive to those shifts rather than fixed at the moment of design (Nair and Howlett, 2016; Walker et al., 2013).

4.3. Pluralism beyond Western analytical frames

The empirical evidence now contradicts singular framings of transport decarbonisation from several independent directions. Holden et al. (2020) conclude that the three grand narratives, including low-mobility societies, collective transport 2.0, and electromobility, are each necessary but none is sufficient, and that their interaction rather than any single trajectory accounts for observed transitions. Decoupling trajectories across sixteen leading economies over twenty-five years show no convergence toward a single pathway template (Loo et al., 2020). Selseng et al. (2022), examining 127 countries, find that different democratic configurations produce similar climate outcomes, with no institutional form reliably predicting stronger decarbonisation. The single significant exception being inequality, which suggests that distributional rather than institutional dimensions of governance, shape climate performance. Pluralism is the empirical condition with which the field must now think. It operates not only across countries and governance systems but across modes: passenger road, road freight, aviation, maritime, and active travel each follow distinct decarbonisation logics on different timescales, with different technology pathways, infrastructure inheritances, and behavioural dynamics that resist integration within a single analytical frame.

Yet the frameworks doing this empirical pluralism work still draw almost entirely from Western liberal-environmentalist traditions: decoupling indices that impose a normative direction by ranking countries against a single benchmark; OECD-style democracy taxonomies; and sustainable mobility narratives whose conceptual vocabulary emerged from the 1990s European policy context. Pluralism is consequently recognised at the level of visions, pathways, and governance forms (Martin et al., 2024; Stirling, 2011) while the analytical apparatus that registers it remains conceptually unitary, working through variance from a norm rather than through the relational co-constitution of differences. The *yin-yang* sensibility implies a stronger move: divergent configurations are not deviations from an optimum whose magnitude can be measured and reduced but co-arising arrangements whose differences are constitutive of how each system actually functions (Roysen et al., 2026). To hold this analytically requires a conceptual vocabulary structured around

²⁴ A Daoist approach should not be understood as politically quietist or indifferent to inequality. Applied to transport policy, interventions such as compact urbanism, demand management, or low-emission mobility cannot be justified only by technical optimisation or moral declaration; they must also be developed through context-sensitive, participatory, and revisable processes that recognise how policies are experienced by different communities. Daoism thus contributes not by supplying a new ideology of transport governance, but by cultivating a mode of political reasoning suited to deep disagreement: one that shifts attention from winning a contest of worldviews to asking what forms of intervention preserve conditions for coexistence while minimising domination, rigidity, and unnecessary resistance.

relational co-arising rather than variance: one that can ask not only which pathway performs best against a shared metric but what each configuration makes possible that the others foreclose, and how their interaction produces dynamics that none would generate alone. Daoist concepts offer one such vocabulary; engaging them forces the field to examine whether its analytical apparatus can think with genuine difference or only catalogue it, and opens productive dialogue with other non-Western knowledge traditions that have developed comparable relational frameworks.

4.4. *Modelling for attunement: from alignment to translation*

Methodological responses to the predictive-stabilisation problem diagnosed in Section 2.4 already exist within the field. Dynamic adaptive policy pathways (Haasnoot et al., 2013) and robust decision-making (Lempert et al., 2003) build revisability and robustness to deep uncertainty into intervention design from the outset. Exploratory and participatory scenario modelling (Wright et al., 2019) generates pluralities of plausible futures rather than projecting a single optimal trajectory. Fuzzy stochastic and chance-constrained programming, as demonstrated by Zhang et al. (2026b), build imprecision and ambiguity directly into model parameters. These are substantive contributions, and a Daoist-informed modelling practice builds on rather than displaces them. Yet they typically retain an optimisation core, a single decision-maker frame, or a predictive ambition: uncertainty and plurality are built in, but the underlying ontological assumption, that the modelled system has a determinable structure and a knowable best policy, largely remains intact. The question a Daoist reorientation presses is not whether models should accommodate uncertainty but what models are for when the system being represented is understood as relational, emergent, and non-linear rather than determinable. Recent critiques of geographical representation reinforce this shift. For example, Unnithan Kumar et al. (2026) show how dominant Euclidean and network-based frameworks privilege metric stability, continuity, and control, while marginalising relationality, embodiment, and disruption (see also Unnithan Kumar, 2024).

On this view, a model is a tool for sensing imbalance and cultivating responsiveness rather than for forecasting demand or justifying investment. Validation follows Timms (2008) and Shepherd (2014) in prioritising interpretive plausibility and sensitivity analysis over predictive accuracy. A model's credibility therefore rests on its capacity to reproduce recognisable system dynamics under changing conditions and to illuminate the mechanisms through which transport systems adapt, resist, and transform, rather than on its statistical fit to historical data. This does not lower the methodological standard; rather, it reorients the purpose of that standard. Chan and Erduran (2026b) reach a closely related orientation by a different route: a Wittgensteinian and non-representational reading of scientific practice that arrives at attunement as a disciplined attentiveness to language-in-use, hesitation, and the affective texture of practice, treating description, rather than explanation or prediction, as the analytical task. That an analytical posture organised around sensing and interpretive plausibility is converging across philosophically distinct traditions suggests that the reorientation pursued here is not parochial to transport scholarship or to Daoist reasoning but answers a broader limit of representational closure increasingly registered across the human and social sciences. The central question shifts accordingly from "How well does the model predict?" to "What can the model reveal about how this system tends to behave, and where are the points at which intervention can work with, rather than against, those tendencies?"

System dynamics (SD) modelling is the closest existing methodological exemplar of this orientation. Rooted in feedback thinking (Forrester, 1961; Sterman, 2000), SD represents systems as interconnected stocks, flows, and feedback loops evolving through time, an image that parallels *yin-yang* co-transformation and the movement of *qi*: when feedback loops become blocked or dominated by a single reinforcing dynamic, the modelled system generates instability analogous to what Daoist diagnosis would identify as obstructed flow; when balancing and reinforcing loops interact in shifting configurations, adaptive order can emerge without being imposed. SD models can incorporate social diffusion and informal practice as explicit variables, through Bass diffusion structures (Bass, 1969), for instance, translating word-of-mouth, trust dynamics, and shared perception into feedback that captures how mobility practices spread, stabilise, or unravel through social interaction rather than through price signals or infrastructure provision alone. This makes visible the behavioural and practice-level dynamics Section 2.4 diagnosed as absent from IAM representations. Participatory model-building through causal loop diagrams, workshops, and iterative stakeholder engagement expresses the *yin-yang* logic methodologically: quantitative simulation and deliberative reflection are complementary and mutually corrective phases of the same modelling practice. Recent work demonstrates that this orientation can be embedded in contemporary analytical workflows: Liao et al. (2025) show how classical *feng-shui* (風水, literally "wind-water") spatial reasoning, including *qi*, can be translated into structured criteria analysable at scale via satellite imagery and machine learning, illustrating that interpretive and relational logics can inform rigorous empirical

analysis without requiring predictive closure as their justification.²⁵

The 15MC makes the modelling stakes concrete. The defining instrument of the 15MC, the isochrone, stabilises a contested and time-varying construct (what proximity means, for which amenities, for whom) into an apparently settled representation whose outputs can be compared, ranked, and targeted. From a Daoist perspective, this is not a methodological flaw to be corrected by higher resolution or richer parameterisation, but a representational choice that the system's character does not bear. A *qi*-informed accessibility metric (cf. Ramos and Schwanen, 2026) would extend isochrone coverage with cost barriers that exclude low-income households despite formal infrastructure availability, fragmented connectivity that interrupts journeys at modal interchange points, perceived unsafety and symbolic discouragement that prevent women and minoritised groups from using public transport at certain times of day, and forms of forced mobility, such as climate-induced displacement (Marcus, 2026), essential-worker commuting through restricted conditions (Schwanen, 2021), spatially-induced over-travel (De Vos et al., 2024), that aggregate accessibility scores routinely mask. Hung and Chang (2024) demonstrate that environmental *qi* perception can be operationalised psychometrically across dimensions of landscape quality, social use, microclimate, and restorative experience, with strong correlations to biophilic preference and wellbeing. Alongside recent geographical work on embodied mobilities and the circulation of *qi* (Yu et al., 2026), and the spatial operationalisation developed by Liao et al. (2025), this illustrates that *qi*-informed accessibility measurement is feasible within existing methodological traditions, extended rather than replaced. A *yin-yang*-informed model would couple proximity gains to property-market feedback and residential sorting, tracking shifts in loop dominance over time rather than producing a snapshot ranking, with adaptive review points triggered by changes in loop dominance rather than fixed performance thresholds. And a *wu-wei*-informed pathway would specify revision criteria sensitive to stakeholder-reported signals of resistance, disengagement, and unexpected coalition, treating these as valid indicators that the conditions assumed in the pathway design have shifted, rather than as noise to be filtered before clean outputs.

5. Concluding remarks and outlooks

This paper closes by returning to the opening line of the *Dao De Jing*: “the *Dao* that can be spoken is not the enduring *Dao*”. The line cautions against treating any articulation as final, including the one possible pathway — one *dao*²⁶ — this paper has just developed. What the preceding sections offered is a reorganisation rather than a refinement of the terrain on which transport decarbonisation is debated. Multi-level coordination, instrument packaging, spearheading visions, and long-term modelling are not separate failure modes but expressions of a single ontological commitment: that mobility systems are determinable objects that yield to the right configuration of targets, instruments, and forecasts. Section 2 showed that this commitment misreads what the systems actually do. Section 3 offered an alternative not by displacing existing analytical traditions but by changing the question they are asked to answer. Models become instruments for sensing imbalance rather than closing it down; instruments become provisional acts of ming whose stabilising and destabilising faces must be tracked over time; governance becomes the cultivation of relational fields in which scales adjust to one another rather than the transmission of upstream decisions to downstream sites. The paper's contribution is therefore not confined to transport modelling, although modelling is one important site where the argument becomes methodologically concrete. Its broader contribution is to show how Daoist attunement reorients the epistemic and practical foundations of transport decarbonisation: how mobility is conceptualised, how governance is organised, how instruments are designed, how plurality is analysed, and how models are used.

Read together through the three concepts, the 15MC ceases to be either a template to be scaled or a controversy to be managed. *Wu-wei* identifies its mode: reversible pilots and incremental adjustment, attentive to which neighbourhood rhythms it amplifies and which it disrupts. *Qi* reframes its purpose, not minimising trip distance, but restoring *tong*, relational continuity between everyday destinations, across whatever scale the practices it serves actually require, which cannot be specified in advance. *Yin-yang* holds its evaluative ambivalence open: emancipatory for non-drivers and exclusionary for those displaced by rising rents, simultaneously, with the configuration shifting over time. None of this lifts the 15MC out of difficulty. It relocates the difficulty to where it can be worked

²⁵ How Daoist-informed practice relates to non-control-oriented traditions already present in Western transport and environmental modelling is a question the paper has not space to develop fully. Complexity theory (Batty, 2023), evolutionary economics, Wittgensteinian precautionary modelling (Read, 2017), and Bayesian-pragmatic approaches (Beven, 2002) each contest the predictive-stabilisation logic diagnosed in Section 2.4 on grounds that partially converge with the Daoist critique: all resist optimisation, embrace deep uncertainty, and treat models as tools for learning rather than control. The key divergence is one of disposition rather than conclusion. Western critical and reflexive traditions typically retain a commitment to diagnosis, improvement, or normative reconstruction, even in their most pluralist forms they are oriented toward identifying what should be done differently. Daoism questions the impulse to stabilise, fix, or resolve in the first place, treating this impulse itself as a potential source of rigidity. Modelling, from a Daoist perspective, is less a tool for deciding what should be done and more a practice of sensing imbalance, remaining open to the self-developing tendencies of the system, and knowing when restraint is more responsive than intervention. For developing convergences and divergences, see Hasenkamp and Sun (2023) on Daoist governance thought and process-relational political theory, and Chan (2024) for a Lefebvrian rhythm-analytical perspective with *qi*-like resonances.

²⁶ The use of *dao* instead of *Dao* here is deliberate. While the Chinese character 道 does not distinguish between upper- and lowercase forms, some English-language scholarship uses *Dao* to denote the enduring or absolute *Dao* (常道) and *dao* to refer to a particular way, path, method, or teaching. This paper adopts the latter usage to emphasise that its argument offers one possible path of interpretation rather than an articulation of the enduring *Dao* itself. In this sense, the capitalisation is intended to remain faithful to the *Dao De Jing*'s opening caution against identifying any spoken formulation with the enduring *Dao*. The distinction also resonates with the Zhuangzi's critique that “the *Dao* is obscured by partial achievements” (道隱於小成), warning against mistaking any particular *dao* for the whole.

with rather than wished away.

The reorientation has practical consequences for the practices it touches. Appraisal frameworks should extend isochrone-based accessibility with cost barriers, perceived unsafety, fragmented connectivity, and forms of forced mobility that aggregate scores routinely mask. Mandates and pricing instruments should embed review points calibrated to shifts in supply chain, grid capacity, and distributional burden rather than to fixed performance thresholds, with reversibility built in structurally, such as the UK ZEV mandate and the EU's 2035 regulation, with its 2026 review clause, sit nearer to this register than the gilets-jaunes-era French fuel-tax trajectory. Causal-loop workshops should precede quantitative simulation, with stakeholder-reported signals of resistance and disengagement treated as data about the relational field rather than noise to be filtered. None of these moves demands methodological revolution; each can be embedded within existing analytical workflows, as recent work by [Liao et al. \(2025\)](#) and [Hung and Chang \(2024\)](#) demonstrates for *qi*-informed measurement.

[Table 1](#) summarises how the three concepts and the broader notion of harmony (*he*) translate into research design. Each translation extends an established method rather than replacing it: composite accessibility metrics extend accessibility modelling ([Zeng et al., 2026](#)); coupled balancing-and-reinforcing feedback loops extend system dynamics ([Sterman, 2000](#)); adaptive pathway design extends Dynamic Adaptive Policy Pathways ([Haasnoot et al., 2013](#)); and model-stakeholder dialogue extends participatory system dynamics modelling ([Rodrigues et al., 2025](#)). What changes is not the technical apparatus but its purpose: from forecasting equilibria to tracking shifts in loop dominance, from optimising configurations to specifying the conditions under which configurations are revised.

Three avenues invite further development. First, interpretive-plausibility validation criteria need to be tested experimentally against the predictive-accuracy criteria that currently dominate model assessment, asking whether feedback structures produce recognisable system dynamics under scenario stress and whether outputs support governance learning rather than governance

Table 1

Daoist concepts and transport research implications.

Daoist concept	Primary domain of contribution	Diagnostic gap addressed	Methodological translation	Research design implications
<i>Wu-wei</i> (無為) · non-coercive action	Governance and policy design	- Cross-scale coordination remains procedural, not relational (2.1) - Predictive stabilisation mismatches emergent system dynamics (2.4)	- Adaptive pathway design based on relational revision criteria, sensitive to shifts in stakeholder signals and quantitative tipping points. - Extends: Dynamic Adaptive Policy Pathways	- Integrate DAPP with group model-building - Co-develop participatory signpost design with communities - Embed revision mechanisms in mandates, calibrated to emerging shifts in the relational field rather than threshold exceedance
<i>Qi</i> (氣) · vital circulation	Mobility, circulation, and appraisal	- Forced mobilities and symbolic barriers absent from models (2.4) - Spearheading visions suppress unequal access and relational continuity (2.3)	- Composite accessibility metrics capturing physical, social, and symbolic dimensions of mobility flow, such as cost barriers, perceived unsafety, and symptoms of obstructed circulation. - Extends: accessibility modelling	- Extend appraisal frameworks beyond isochrones to cost, safety, and symbolic access - Validate against community-reported conditions via participatory signal structures - Treat congestion, fatigue, and social strain as symptoms of imbalance, not residuals to filter
<i>Yin-yang</i> (陰陽) · dynamic balance	Evaluative framing and instrument design	- Rebound and unintended consequences unaddressed in policy packages (2.2) - Spearheading visions rely on binary framings, backgrounding trade-offs (2.3)	- Coupled balancing and reinforcing feedback loops registering how shifts in loop dominance reconfigure an instrument's stabilising and destabilising faces as context evolves. - Extends: system dynamics modelling	- Use longitudinal system dynamics models to sense how instrument interactions are already reconfiguring across contexts - Trigger policy-mix adjustments when loop dominance shifts, not at fixed thresholds - Build in review points attuned to distributional burden and modal-alternative availability
<i>He</i> (和) · attunement for harmony	Cross-cutting analytical and governance frame	- Coordination procedural rather than relational (2.1) - Instrument coherence breaks down across the temporal gap between design and response (2.2) - Plurality registered as variance, not constitutive difference (2.3) - Models privilege predictive closure over practice-based knowledge and interpretive responsiveness (2.4)	- Iterative model and stakeholder dialogue orienting model specifications and system boundaries through the engagement process, towards sensing imbalance rather than forecasting equilibria. - Extends: participatory modelling	- Conduct causal loop workshops before quantitative simulation - Adopt interpretive plausibility as a validation criterion, asking whether a model reveals emerging tendencies recognisable to practitioners - Formalise mechanisms for revising model boundaries as stakeholder engagement reveals unregistered dynamics - Maintain material plurality (e.g. non-digital access) as a governance condition for ongoing coordination and adaptive responsiveness

justification. Second, the engagement developed here invites extension toward other non-Western and Indigenous frameworks whose relational and place-based orientations bear directly on mobility, ecological stewardship, and collective governance. Third, the institutional question of what governance architectures, funding structures, and accountability mechanisms allow plural decarbonisation pathways to coexist without premature convergence remains both methodologically open and politically pressing. One boundary condition is worth stating clearly. A Daoist disposition works where a relational field exists to be tended. Where parties refuse the field itself by rejecting not only specific policies, but also the legitimacy of governing institutions, evidentiary standards, and the social categories through which coordination is attempted, attunement alone cannot restore the conditions for collective action. What it can do, however, is interpret the rate and manner of that refusal as information rather than as an obstacle.

Under accelerating climate instability, social contestation, and ecological interdependence, the central capacity of transport governance is no longer the capacity to predict. It is the capacity to remain responsive to systems whose dynamics are emergent, relational, and unfinished: to govern, in an older register, by tending the field rather than commanding its harvest. To conclude with the *Dao* is therefore not to close inquiry, but to resist closure itself.

CRediT authorship contribution statement

Tommy H.Y. Chan: Writing – review & editing, Writing – original draft, Project administration, Methodology, Conceptualization. **Ka Ho Tsoi:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **Shirley Chan:** Writing – review & editing, Writing – original draft, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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No data was used for the research described in the article.

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