From Provision to Actual Use: Measuring Comprehensive Service Mismatch among Road Freight Drivers in Beijing

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Abstract. Metropolitan freight policy often counts facilities, hotlines, and insurance products as service supply, although mobile drivers may be unable or unwilling to use them under operating constraints. This study develops an actual-use framework for diagnosing comprehensive service mismatch and applies it to Beijing as an exploratory mixed-methods case. The evidence comprises 2,072 questionnaires, 3,640 km of ride-along observation, more than 60 driver interviews, field visits, and policy documents. Four dimensions are assessed: spatio-temporal access, protection uptake, organizational connection, and grievance response. Aggregate records show that 70.87% had never used a Truckers' Home and more than 62% lacked driving-related insurance and labour protection. The record also reports 87.77% hotline non-use when disputes occurred, but the original item wording and eligible denominator are unavailable; this value is therefore a flagged diagnostic, not a prevalence estimate. The paper specifies a normalized composite mismatch index and provides an illustrative partial calculation. Governance proposals are reframed as four hypotheses for future pilot testing rather than effects established by the descriptive evidence.

Keywords: road freight, public service mismatch, mobile workers, digital governance, service accessibility

1 Introduction

Road freight drivers cross jurisdictional, organizational, and platform boundaries, while services remain attached to fixed sites, office hours, employment categories, or departmental mandates. A listed service may therefore be absent from a driver's feasible workday. Recent studies distinguish calculated from experienced access and show that spatial proximity alone does not establish usable opportunity (Lukina et al., 2021; Negm et al., 2025). Parking reliability and stop quality likewise shape whether a facility supports driver health and continued work (Gutmann et al., 2021; Lise et al., 2024). Actual use, rather than facility counts, is thus the appropriate evaluation point.

Platform mediation sharpens the conversion problem. Chinese truck drivers use online networks for mutual aid and rights protection (Liu & Wang, 2022), while algo-

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rithmic scheduling and information asymmetry may reduce discretion, fragment organization, and transfer risk (Huang, 2023; Mendonça & Kougiannou, 2023). Workers outside standard employment may also face incomplete labour and social protection (ILO, 2022; Lin, 2022; Sieker, 2022). Nominal provision therefore does not guarantee effective receipt.

Beijing is a relevant megacity case because peripheral freight nodes coexist with delivery windows, access controls, uncertain waiting time, and detour costs. National policy has expanded Truckers' Homes and recognized a Beijing demonstration site (MOT, 2024), yet preliminary Beijing evidence records limited uptake. This study asks how mismatch can be measured around actual operations, what mechanisms are visible, and what digital-coordination design follows. It contributes a four-dimensional framework without presenting descriptive records as causal estimates.

2 Conceptual Framework

Comprehensive service mismatch is the gap between supply conditions and a driver's ability to discover, reach, qualify for, trust, and complete a service. The definition treats route, schedule, vehicle, and legal parking as access conditions and institutional eligibility and organizational mediation as delivery conditions. It therefore compares modeled opportunity with lived feasibility (Lukina et al., 2021; Negm et al., 2025) and treats data exchange as a governed collaboration with explicit roles and accountability (Ruijer, 2021).

Table 1. Actual-use measurement framework.

Dimension	Supply condition	Actual-use test	Mismatch signal
Spatiotemporal access	Fixed site and stated opening hours	Route fit, detour, arrival window, legal parking	Reachable on map but unusable during work
Protection uptake	Insurance, social security, emergency support	Eligibility, affordability, continuity, claim usability	Protection exists but risk is not absorbed
Organizational connection	Party, union, industry and service organizations	Known contact, trusted intermediary, repeated engagement	Drivers remain disconnected from resource brokers
Grievance response	Platform and government complaint channels	Entry cost, transfer, resolution, feedback and appeal	A channel exists but disputes remain informal or silent

The framework can be operationalized at driver level. For indicator j in dimension d, x(j,d) is oriented so that 0 denotes complete match and 1 complete mismatch; bounded indicators are min-max normalized, while binary indicators retain values 0 or 1. The dimension score is D(d) = sum[a(j,d)x(j,d)], and CMI = sum[w(d)D(d)]. Equal indicator weights, a(j,d) = 1/m(d), and equal dimension weights, w(d) = 0.25, are the defaults. An expert alternative may use two Delphi rounds, normalized median allocations, and Kendall's W to document agreement; W >= 0.70 may serve as a pre-specified acceptance rule. CMI should then be recomputed under equal weights, expert weights, and +/-25% perturbations. Conclusions are considered robust only when substantive

classifications are stable across specifications. Indicators must share a defined analytic population and reference period; otherwise, dimensions remain separate.

3 Materials and Method

An exploratory mixed-methods case design used the archived project record of 2,072 questionnaires, 3,640 km of ride-along observation, more than 60 driver interviews, visits to Dou Dian, Hancunhe, Hangrun gas station, Majuqiao logistics park, and freight areas in Daxing, Fengtai, and Fangshan, plus institutional materials. Topics included Truckers' Home use, platform charges, insurance, complaint hotlines, regulation, safety systems, and interdepartmental coordination. This secondary analysis accessed only the consolidated description and aggregate percentages, not questionnaires, respondent-level records, recruitment logs, or transcripts.

Reported evidence was coded against Table 1 and triangulated with documented ride-along and interview themes. The archive does not identify a sampling frame, probability-selection procedure, recruitment mode, invitation count, response rate, or vehicle-type composition. Probability sampling therefore cannot be demonstrated, and the questionnaire is treated conservatively as non-probability field evidence. Geographic coverage is documented, but representativeness across Beijing districts, vehicle classes, platform affiliation, and employment arrangements cannot be assessed. The design supports diagnostic inference, not effect estimation or population prevalence.

The driver-service episode, defined by the driver, vehicle, route, time window, service sought, and observed outcome, was the unit of analysis. Aggregate indicators identified potential mismatches; consolidated ride-along and interview materials contextualized operating conditions; and policy documents described formal provision. Evidence was organized by the four dimensions. Where the sources could not distinguish among competing explanations, alternatives were retained rather than ranked.

4 Results

4.1 Descriptive Mismatch Profile

The available indicators show gaps between provision and reported use (Table 2): 70.87% had never used a Truckers' Home, and more than 62% lacked driving-related insurance and labour protection. The record states that 87.77% did not call a hotline when encountering a dispute, but the wording, screening rule, denominator, and proportion experiencing disputes are unavailable. The value is therefore a diagnostic warning, not a conditional reporting rate. Replication should use a two-stage item: (1) "In the past 12 months, have you experienced a dispute related to freight work?" and, for respondents answering yes, (2) "Did you contact a government or platform hotline about that dispute?" Studies should report the eligible count and the percentage answering yes to item 2.

Table 2. Reported diagnostic evidence and bounded interpretation.

Indicator	Reported result	Primary dimension	What the result supports
Never used a Truckers' Home	70.87%	Access / connection	High non-use; cause cannot be isolated from aggregate data
Lacked driving-related insurance and labour protection	>62%	Protection uptake	A substantial protection gap in the surveyed records
Source-reported hotline non-use when a dispute occurred	87.77% (denominator unavailable)	Grievance response	Diagnostic warning only; conditional reporting rate cannot be calculated

Worked example. Using the three percentages only as arithmetic inputs gives D(access) = 0.7087, D(protection) > 0.6200, and D(grievance) = 0.8777. Equal weighting across these observed dimensions yields CMI(partial) = (0.7087 + 0.6200 + 0.8777) / 3 > 0.7355. This demonstrates the calculation, but it is not the four-dimensional Beijing CMI: organizational connection is missing, the protection value is a lower bound, and the grievance denominator is unauditable. Under the stated missing-data rule, the full CMI is not reported.

4.2 Mechanisms Visible Across the Evidence

Facility non-use is associated in the project record with delivery deadlines, detour and waiting costs, legal parking, service content, and incomplete information. Reliable parking and service quality are operating requirements, not amenities (Gutmann et al., 2021; Lise et al., 2024). Beijing's mismatch is therefore spatiotemporal and organizational: a nearby facility may be incompatible with a route or delivery window, unknown to the driver, or disconnected from an immediate problem.

The protection gap is institutional. Platform workers may be managed intensively while remaining outside conventional employment (Huang, 2023; Lin, 2022), and standard-employment protection systems may provide discontinuous coverage (ILO, 2022; Sieker, 2022). In Beijing, income pressure, enterprise margins, insurance pricing, vehicle type, and claim history appear together. Aggregate evidence cannot rank them, but it shows why eligibility, affordability, continuity, and claim usability matter more than product availability.

The field record links complaint non-use with expected effectiveness, jurisdictional transfers, time costs, platform dependence, and feedback, but the aggregate statistic cannot test these explanations. Digital networks can reconnect Chinese truck drivers (Liu & Wang, 2022), while platform changes may disrupt collective capacity (Mendonça & Kougiannou, 2023). These mechanisms remain plausible interpretations to be tested with dispute-screened questions, channel-choice data, and case-resolution records.

5 Discussion and Governance Path

The findings support a shift from provision accounting to conversion management. Counts of sites, products, contacts, or calls measure output but not whether a driver could stop, qualify, trust the channel, or obtain resolution. Modeled and perceived access can diverge (Lukina et al., 2021; Negm et al., 2025), and mobile freight demand widens that divergence. The proper unit is the driver-service episode: driver, vehicle, route, time window, risk, and requested outcome.

The proposals are testable hypotheses, not established effects. Beijing pilots should compare intervention nodes with matched usual-service nodes, or use phased rollout with pre-intervention baselines. Illustrative pre-registered success criteria are: H1, at least a 20% reduction in median detour time and a 15-point increase in completed service episodes; H2, a 15-point increase in eligible protection uptake or completed claims; H3, a 20% increase in completed referrals; and H4, a 15-point increase in eligible cases resolved within 30 days. Each criterion should have a 95% confidence interval excluding no improvement. Success also requires no more than a 5-point deterioration in illegal parking, schedule delay, exclusion complaints, or privacy incidents. These thresholds are planning benchmarks, not findings, and should be recalibrated using baseline variation and statistical power. The mechanisms remain grounded in prior work (Liu & Wang, 2022; MOT, 2024; Ruijer, 2021; Weißmüller et al., 2023).

The data architecture should follow a minimum-necessary rule. Vehicle, permit, safety, platform, hotline, and claim data should not become an unrestricted driver dossier. Some fields may be shared for case processing, others verified by yes/no responses, and others aggregated for planning. Purpose limits, access logs, retention, correction rights, and responsibility for erroneous matches are necessary to avoid increasing surveillance or distrust.

5.1 Limitations

Only three aggregate percentages and a consolidated field description were available. Although field locations are documented, the sampling frame, recruitment procedure, response rate, vehicle-type distribution, field dates, item wording, subgroup distributions, trajectories, and transcripts are unavailable. The hotline denominator is unauditable, and the partial index is illustrative rather than a population estimate. The findings are most informative for driver-service episodes at the documented Beijing freight nodes and comparable operating settings. They should not be generalized to all Beijing districts, unvisited logistics parks, unobserved vehicle classes, or the national long-haul network. Future work should use dispute screening, harmonized denominators, probability or documented quota sampling, psychometric testing, weighting sensitivity analysis, spatial validation, and comparisons across vehicle classes and cities.

6 Conclusion

Beijing's freight-driver services cannot be evaluated by supply inventories alone. The study converts four conceptual dimensions into an explicit scoring procedure, while showing why incompatible or undocumented denominators must block a full composite estimate. The reported facility and protection gaps support a diagnostic agenda; the hotline value requires denominator verification. Route-responsive services, transparent protection rules, organizational intermediation, and closed-loop grievances are hypotheses for pilot evaluation, not causal conclusions. This bounded interpretation provides a replicable starting point for megacity freight governance without overstating the available evidence.

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Data Availability. The aggregated evidence used in this article is reported in the text. Underlying records are restricted because they may contain personal, enterprise, and platform information.

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