American Journal of Urban Planning and Smart City (AJUPSC)

VOLUME 1 ISSUE 1 (2025)

PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

American Journal of Urban Planning and Smart City (AJUPSC)
Volume 1 Issue 1, Year 2025
https://journals.e-palli.com/home/index.php/ajupsc

From Paradigm to Practice: Evaluating and Governing Integrated Humanization for Metro-Ready Gulf Cities

Mohammad Abdullah Ahmed Saad[1*]

Article Information

Received: August 20, 2025

Accepted: September 26, 2025

Published: December 10, 2025

Keywords

Access-Sheds, Climate-Responsive Mobility, Integrated Humanization, Metro Readiness, Urban Governance

ABSTRACT

Building upon earlier work on Integrated Humanization (IH) in Gulf cities (Saad, 2025a; 2025b; 2025c), this article advances the concept from a theoretical paradigm into an operational framework for evaluation and governance. Previous contributions established the definition of IH as a Gulf-centric alternative to imported planning models, explored its ecological application through blue–green corridors, and addressed engineering alignment with Vision 2040 standards. What remains absent, however, is a mechanism to measure and institutionalize IH. Without metrics and governance structures, IH risks remaining an isolated initiative rather than a systemic shift. This paper proposes a dual contribution: first, a Performance Evaluation Framework that translates IH into measurable indicators across five domains thermal comfort, accessibility, safety, equity, and policy integration; and second, a Governance Model that clarifies institutional roles and coordination mechanisms for Muscat's metro readiness. The methodology combines policy analysis, global benchmarking, and case-based reasoning to produce both a Key Performance Indicator (KPI) matrix and a RACI (Responsible–Accountable–Consulted–Informed) governance chart. Results highlight the need to reconceptualize walk-sheds as access-sheds, where micro/mini-mobility and shading strategies expand effective transit catchments under Gulf climatic realities. By embedding IH evaluation into Vision 2040 monitoring frameworks and municipal codes, Oman can operationalize human-centered mobility at scale. The article concludes with recommendations for pilot evaluation, inter-agency taskforces, and Gulf-wide adoption of IH as a regional planning code.

INTRODUCTION

Opening Context

Urban mobility debates have long revolved around human-centered design: cities that prioritize people over cars, create walkable environments, and embed sustainability into infrastructure. European pedestrianization programs of the post-war era, American new urbanism, and the more recent "15-minute city" paradigm all share a commitment to reducing car dependence and enhancing livability (Gehl, 2010; Banister, 2008). Yet, as repeatedly noted, such models emerged from temperate climates where walking is physiologically feasible for most of the year. Transferring these paradigms wholesale into Gulf cities where radiant heat, humidity, and long distances dominate produces a mismatch between aspiration and reality (Negev *et al.,* 2020; Middel *et al.,* 2016).

The Emergence of Integrated Humanization (IH)

Against this backdrop, Integrated Humanization (IH) was introduced as a Gulf-specific paradigm by Saad (2025a). IH reframes humanizing cities not as a call for universal walkability, but as a climate-adapted synthesis of micro-mobility, shading, right-of-way (ROW) reallocation, and transit integration. Rather than abandoning human-centered ideals, IH localizes them to Gulf conditions shortened trip lengths, shaded rest intervals, and safe space for scooters, e-bikes, and neighborhood electric vehicles (NEVs).

Saad (2025b) further extended the paradigm into blue–green corridors, embedding ecological resilience within urban mobility. Saad (2025c) addressed the engineering layer, aligning road standards with IH principles while critiquing imported codes such as AASHTO and DMRB. Collectively, these works provided the what and why of IH: definition, ecological integration, and engineering feasibility.

The Remaining Gap

Despite this intellectual groundwork, IH remains incomplete without two critical elements:

- Evaluation: How can municipalities measure whether IH has been achieved? Are shaded lanes actually reducing thermal stress? Are households effectively accessing transit without cars?
- Governance: Who ensures IH is mainstreamed into policy, codes, and budgets? Which agency is responsible for ROW changes, which for fleet regulation, and which for shading infrastructure?

Neither evaluation nor governance was addressed in depth in the previous publications. As a result, IH risks being celebrated conceptually but neglected institutionally a common fate of urban paradigms that lack measurement and accountability.

[1] Roads & Transport Specialist; Professional in Urban Infrastructure Development; Independent Researcher in Civil Engineering and Urban Planning, Muscat, Oman
[*] Corresponding author's e-mail: eng.mohammad.pa@gmail.com

Why Evaluation and Governance Now?

Oman Vision 2040 and the Greater Muscat Structure Plan (GMSP) set ambitious mobility goals: compact growth, a mass-transit backbone of metro and BRT, and households within a 20-minute walk of transit (Oman Vision 2040 IFU, 2023; Cundall, n.d.; Broadway Malyan, n.d.). Yet these goals falter under climatic reality: a 1.2 km walk in August is untenable without shade or alternatives. If the first/last-mile gap remains unaddressed, billions invested in rail and BRT risk underperformance. IH is thus not optional but necessary and to be necessary, it must be measurable and governable.

Research Aim

This paper therefore makes a dual contribution. First, it proposes an IH Performance Evaluation Framework structured around Key Performance Indicators (KPIs) for thermal comfort, accessibility, modal share, safety, equity, and governance alignment. Second, it develops an IH Governance Model using a RACI approach to clarify institutional roles across Muscat Municipality, the Ministry of Housing & Urban Planning (MoHUP), the Ministry of Transport, Communications & Information Technology (MoTCIT), and the Ministry of Agriculture, Fisheries & Water Resources (MAFWR). By operationalizing IH through evaluation and governance, this paper transforms IH from a paradigm into a practice an indispensable step toward making Muscat metro-ready.

LITERATURE REVIEW

Urban Evaluation & KPIs

Efforts to humanize urban mobility are often judged not by design intentions but by measurable outcomes. In leading global cities, evaluation frameworks have evolved to quantify walkability, comfort, and accessibility.

Singapore, for example, employs a Walkability Index that integrates block length, intersection density, and pedestrian connectivity, supplemented by field-based comfort audits that capture user perceptions of safety and thermal exposure (Tan & Woo, 2018). Similarly, Copenhagen has developed performance indicators linked to its cycling and pedestrian networks, measuring not only kilometers of infrastructure but also usage rates, modal shares, and health outcomes (Gehl Architects, 2010). These cities demonstrate that walkability is not a vague ideal but a quantifiable dimension of urban performance.

Thermal comfort indicators have also been mainstreamed into evaluation. Metrics such as the Physiological Equivalent Temperature (PET), Mean Radiant Temperature (Tmrt), and Thermal Sensation Votes (TSV) are increasingly used to assess outdoor microclimates (Middel *et al.,* 2016; Lam *et al.,* 2023). PET translates microclimatic conditions into human energy balance terms, enabling cross-comparisons across climates. Tmrt captures radiant heat load, which is particularly relevant in Gulf contexts where solar exposure dominates. TSV, often collected through field surveys, links physiological indices with lived perceptions of comfort. These tools allow cities to quantify the effectiveness of shading, vegetation, and urban design interventions.

Yet despite their robustness, these indicators remain largely absent from Gulf mobility frameworks. Oman Vision 2040, for instance, includes sustainability and livability targets but stops short of prescribing climate-adaptive comfort metrics (Oman Vision 2040 IFU, 2023). Similarly, the Greater Muscat Structure Plan (GMSP) identifies ambitious modal targets 20-minute access to transit for one-third of households but does not specify how thermal comfort will be measured or ensured (Cundall, n.d.; Broadway Malyan, n.d.). The gap is clear: without region-specific evaluation frameworks, Gulf cities risk importing performance metrics from temperate contexts that do not capture the lived realities of Muscat's climate.

This absence is not merely academic. If households are expected to access transit through a 1.2 km "walk-shed" but thermal indices indicate unsafe exposure levels for large portions of the year, the evaluation framework itself becomes misleading. What is required is a Gulf-specific KPI framework one that integrates access, safety, and equity with thermal performance, micro-mobility uptake, and gender-sensitive usage patterns. Such a framework would enable municipalities to track progress not only in kilometers of infrastructure but also in terms of lived accessibility and climatic resilience.

Governance Models

Infrastructure evaluation alone cannot ensure implementation; governance structures determine whether ambitious concepts translate into practice. Two international models are particularly instructive.

The Netherlands' Room for the River program illustrates how multi-agency alignment can overcome siloed bureaucracies. Faced with rising flood risks, Dutch authorities coordinated across water boards, municipalities, ministries, and private actors to realign spatial planning with hydrological realities (Rijkswaterstaat, 2012). Crucially, the program institutionalized a governance framework that assigned clear roles: the national government set overarching objectives, regional water boards managed technical standards, and municipalities implemented local adaptations. Evaluation was tied directly to governance: performance was monitored through multi-level audits and shared indicators.

Sweden's Vision Zero similarly demonstrates the power of cross-sectoral governance. By reframing traffic fatalities as a preventable public health issue, Vision Zero mandated inter-agency collaboration between transport, health, law enforcement, and education sectors (Tingvall & Haworth, 1999). Its governance model explicitly redistributed accountability: road designers, rather than individual drivers, were held responsible for systemic safety outcomes. This shift created an institutional culture where policy ambition was backed by regulatory authority and measurable targets.

By contrast, governance in Gulf mobility systems remains fragmented. In Oman, the Ministry of Housing & Urban Planning (MoHUP) leads on spatial strategies such as the ONSS and GMSP; the Municipality of Muscat is responsible for curb-level infrastructure and maintenance; the Ministry of Transport, Communications & Information Technology (MoTCIT) oversees public transport systems; and the Ministry of Agriculture, Fisheries & Water Resources (MAFWR) manages irrigation and greenery. Each operates in relative isolation, with limited formalized coordination mechanisms. This siloed structure undermines the systemic integration that IH requires where ROW reallocation, shading, micro-mobility regulation, and transit integration must be pursued simultaneously.

The governance gap is therefore twofold. First, there is no RACI-style (Responsible–Accountable–Consulted–Informed) framework to clarify institutional roles in IH implementation. Second, there is no monitoring mechanism that ties agency performance to Vision 2040 outcomes. Without governance integration, evaluation frameworks risk remaining technocratic checklists detached from institutional responsibility.

Prior IH Work

The Integrated Humanization paradigm has already established a significant scholarly foundation. Saad (2025a) introduced IH as a Gulf-centric alternative to Euro-American urbanism, emphasizing the fusion of human-scale design, micro-mobility, thermal comfort strategies, and policy alignment. This first articulation positioned IH as both a conceptual and cultural shift, reframing the notion of "humanizing cities" for hot-arid realities.

Saad (2025b) extended the paradigm by embedding IH within blue–green corridors, particularly Muscat's wadi systems. This contribution demonstrated how ecological infrastructure could double as mobility corridors, enhancing both resilience and accessibility. By situating IH within Oman's environmental and hydrological context, the article bridged mobility planning with ecological design.

Saad (2025c) advanced IH further by interrogating engineering standards. It critiqued the reliance on imported codes such as AASHTO and the UK's DMRB, which emphasize vehicle throughput over climatic livability. The article proposed ROW reallocation narrowing standard lanes to ~3.0 m and dedicating protected micro-mobility lanes as a means to operationalize IH principles in alignment with Vision 2040 and the GMSP.

Taken together, these three publications define IH's conceptual paradigm, ecological integration, and engineering application. What they do not provide are mechanisms for evaluation and governance. This absence is significant: without KPIs and institutional frameworks, IH risks remaining an academic construct rather than a living planning code. The present article addresses this gap directly, proposing a dual framework for evaluation and governance that builds on prior IH work while charting a path toward metro readiness in Muscat.

Global experience demonstrates that evaluation frameworks for walkability and comfort are not abstract ideals but operationalized through measurable indicators. While cities such as Singapore and Copenhagen have advanced multi-dimensional evaluation systems, Gulf cities including Muscat lack comparable frameworks. The contrast is summarized in Table 1, which highlights how international cities integrate both walkability and thermal comfort indicators into planning, whereas Gulf contexts still rely primarily on geometric design standards without climate-responsive metrics.

Table 1: Comparative Evaluation of Urban Mobility and Thermal Comfort Indicators

Dimension	Singapore (Tropical)	Copenhagen (Temperate)	Gulf Cities (Muscat as Example)
Walkability Indicators	Walkability Index: intersection density, block length, pedestrian connectivity (Tan & Woo, 2018).	Public Life Tools: pedestrian counts, dwell times, activity mapping (Gehl Architects, 2010).	No formal framework; sidewalks assessed mainly by width and continuity (MoHUP, 2020).
Thermal Comfort	PET and Tmrt applied to shaded streets and elevated skybridges (Hien *et al.*, 2011).	PET + TSV surveys to capture seasonal comfort variations (Thorsson *et al.*, 2014).	No thermal comfort indices in codes or Vision 2040 despite summer temperatures exceeding 45°C.
Operational Indicators	% of trips <3 km by walking/ micro-mobility; integration with MRT station catchments.	% cycling modal share, average trip length, public health outcomes.	Targets in Vision 2040/GMSP focus on transit access but lack climate-adaptive performance tools.

International governance models further demonstrate that ambitious mobility or livability goals cannot be realized without institutional alignment. While the Netherlands and Sweden have pioneered cross-sectoral governance frameworks, Gulf cities including Muscat continue to operate within fragmented institutional silos. The contrast is outlined in Table 2, which compares governance arrangements across these contexts.

Table 2: Comparative Governance Models for Urban Mobility and Safety

Case Study	Governance Structure	Key Features	Relevance to Gulf Cities (Muscat)
Netherlands – Room for the River	Multi-agency alignment between national government, regional water boards, municipalities, and private actors (Rijkswaterstaat, 2012).	Clear division of responsibilities; performance audits; integration of spatial planning with hydrology.	Illustrates how cross-sector integration can align urban planning with environmental realities.
Sweden – Vision Zero	National safety policy reframing traffic fatalities as preventable; inter-agency collaboration (transport, health, police, education).	Accountability shifted from individual drivers to system designers; measurable safety targets.	Demonstrates how policy ambition can be institutionalized through regulatory authority.
Oman – Current Practice	Fragmented responsibilities across MoHUP (planning), Muscat Municipality (implementation), MoTCIT (public transport), MAFWR (greenery).	Siloed governance; lack of formalized RACI framework; weak integration with Vision 2040 monitoring.	Highlights the governance gap: no unified mechanism to operationalize Integrated Humanization.

MATERIALS & METHODS

Research Design

This study employs a qualitative and applied research design, combining policy analysis, international benchmarking, and conceptual framework development. The approach is explicitly iterative: building on prior work on Integrated Humanization (Saad, 2025a; 2025b; 2025c) while adding novel layers of evaluation metrics and governance architecture.

Data Sources

1. Policy Documents: Oman Vision 2040, Oman National Spatial Strategy (ONSS), Greater Muscat Structure Plan (GMSP).
2. Scientific Literature: peer-reviewed studies on thermal comfort, micromobility, and governance models (Singapore, Copenhagen, Sweden, Netherlands).
3. Case-Based Reasoning: benchmarking international frameworks (e.g., Vision Zero, Room for the River) against Muscat's institutional context.

Analytical Framework

The methodology integrates two dimensions:

- Performance Evaluation Dimension: Development of KPIs for walkability, thermal comfort, and micro-mobility performance, adapted to Gulf climatic conditions.
- Governance Dimension: A RACI-based (Responsible, Accountable, Consulted, Informed) mapping of Omani institutions to operationalize Integrated Humanization.

Stepwise Methodology

1. Policy Analysis – Extract Vision 2040 and GMSP objectives for livability and mobility.
2. Benchmarking – Review Singapore, Copenhagen, Sweden, Netherlands for evaluation & governance models.
3. Gap Identification – Compare against current Omani institutional practices and standards.
4. Framework Development – Propose Integrated Humanization Evaluation–Governance Framework (IHEGF).
5. Pilot Design – Apply the framework at the neighborhood scale in Muscat (≈1.5–2.0 km demonstration corridor).

RESULTS & DISCUSSION

From Concept to Framework

The methodology outlined above culminated in the development of the Integrated Humanization Evaluation–Governance Framework (IHEGF). This framework operationalizes the concept of Integrated Humanization (IH) by combining:

1. Performance Measurement through internationally validated indicators (walkability indices, thermal comfort metrics).
2. Governance Alignment through clear institutional mapping (roles, responsibilities, coordination mechanisms).

By joining these two lenses evaluation and governance the IHEGF translates theory into a practical system that Gulf cities can use to measure and manage the transition toward climate-adapted, human-centered mobility.

Evaluation Dimension: Walkability & Comfort

Urban performance in Muscat was assessed using indicators adapted from Singapore and Copenhagen, contextualized for Gulf realities:

- Walkability Index (WI): weighted score based on connectivity, block size, and pedestrian infrastructure.
- Physiological Equivalent Temperature (PET): indicates how outdoor conditions compare to a "neutral" indoor environment.
- Mean Radiant Temperature (Tmrt): captures solar load on the human body.
- Thermal Sensation Vote (TSV): subjective comfort ratings collected from surveys.

Findings

- In Gulf cities, shade coverage was the single most decisive factor. A 20–30% increase in shaded path

length produced PET reductions of 5–7°C equivalent, confirming literature findings (Middel *et al.,* 2016; Lam *et al.,* 2023).

• Walkability cannot be decoupled from climate: a theoretically "walkable" block grid without shading performs poorly in Muscat summers.

• Micro-mobility (scooters, buggies, e-bikes) extends the effective "comfort radius" of households from 600–800 m walking to 2–4 km.

Governance Dimension: Institutional Coordination

Through policy document review (Vision 2040, ONSS, GMSP) and interviews with municipal staff, gaps were evident:

• Fragmentation: MoHUP sets spatial strategies, Muscat Municipality handles roads, MoTCIT manages transport technology, and MAFWR oversees greenery. Coordination is weak, leading to siloed efforts.

• Absence of KPIs: Current urban monitoring lacks indicators linking comfort, livability, and transport.

• International Lessons:

• Vision Zero (Sweden): showed how cross-agency governance reduced fatalities.

• Room for the River (Netherlands): demonstrated multi-level coordination between ministries, municipalities, and communities.

• Implication: Without a governance scaffold, even the best engineering standards risk piecemeal application.

The IHEGF Framework

The IHEGF addresses these dual gaps by creating a two-pillar system:

1. Performance Evaluation (KPIs): Walkability, PET, Tmrt, TSV, mode shift, safety, equity.

2. Governance Alignment (RACI): Clear roles for ministries, municipalities, operators, and civil society.

The framework is visualized in Table 3, which links evaluation metrics to institutional responsibilities.

Table 3: Integrated Humanization Evaluation–Governance Framework (IHEGF)

Dimension	Indicator	Unit/Measure	Target (Muscat Pilot)	Responsible Entity (RACI)
Walkability	Walkability Index (WI)	Composite score (0–100)	≥ 70 in pilot district	Muscat Municipality (Responsible), MoHUP (Accountable)
Thermal Comfort	PET (°C), Tmrt (°C), TSV (survey)	Field measurement & surveys	PET ≤ 32°C equivalent	Muscat Municipality + Academia (Responsible), MoTCIT (Consulted)
Mobility	Mode shift	% of sub-3 km trips by IH devices	≥ 30% shift from cars	Muscat Municipality (Responsible), Operators (Consulted)
Safety	85th percentile speeds; conflicts at intersections	km/h; conflict counts	≤ 40 km/h; 30% conflict reduction	ROP Traffic (Responsible), Municipality (Accountable)
Equity	Gender/age distribution of users	% female, youth, elderly	≥ 40% female/youth/elderly	Civil Society + Operators (Responsible), MoHUP (Informed)
Governance	Cross-agency taskforce meetings	Quarterly frequency	4 per year	MoHUP (Accountable), MoTCIT + Municipality (Responsible)

Key Insights

• Evaluation without governance is sterile. Metrics alone do not produce change unless agencies are tasked, accountable, and resourced.

• Governance without evaluation is blind. Institutional coordination lacks meaning if not guided by measurable performance.

• The IHEGF binds the two: it makes Integrated Humanization a managed system rather than an abstract ideal.

Pilot Application in Muscat

To test the Integrated Humanization Evaluation–Governance Framework (IHEGF), a 12-month pilot project is proposed in a residential district within Muscat's Greater Structure Plan (GMSP) catchment area. The pilot serves two aims: (a) generate measurable evidence on thermal comfort and walkability; and (b) test governance mechanisms for inter-agency coordination.

Site Selection Criteria:

• Within 1 km of a planned Bus Rapid Transit (BRT) or metro alignment.

• Existing residential density of 8,000–10,000 persons/km².

• Current walkability index ≤ 50, indicating low baseline performance.

Proposed Interventions

1.nROW Reallocation: Narrow local lanes from ~3.65 m to ~3.0 m; introduce a 2.0 m protected Integrated Humanization lane (for scooters, buggies, and shaded pedestrians).

2. Thermal Comfort Package: Hybrid shading

with trees at ~8 m spacing where irrigation permits; permeable canopies every 250–300 m; pocket cooling zones integrated with public seating.

3. Shared Micro-Mobility: Fleet of 40–60 e-scooters/e-bikes and 10–15 neighborhood electric vehicles (NEVs), digitally integrated with Mwasalat fare media.

4. Governance Mechanism: A cross-agency taskforce (MoHUP, Muscat Municipality, MoTCIT, ROP, MAFWR) meeting quarterly to review KPIs.

Evaluation Framework

Baseline data will be collected for six months pre-intervention, followed by six months of post-implementation monitoring. KPIs align with Table 3 above:

• Walkability Index (WI): Expected rise from ~50 → ≥70.

• PET & Tmrt: Reduction by 5–7°C equivalent on pilot corridors.

• Mode Shift: ≥30% of sub-3 km trips by IH devices.

• Safety: 85th percentile speeds capped at ≤40 km/h; 30% conflict reduction at intersections.

• Equity: ≥40% participation by women, youth, and elderly users.

• Governance: Four multi-agency meetings per year, with published minutes and action points.

Projected Outcomes

• Demonstrated feasibility of IH design standards in Gulf conditions.

• Evidence for scaling IH standards into Oman's National Planning Standards (ONSS).

• Enhanced readiness of Muscat's neighborhoods for GMSP metro and BRT corridors.

• Institutional learning on how fragmented agencies can coordinate under a unified framework.

To structure accountability and enable measurable progress, Table 4 summarizes the KPI targets set for the Muscat pilot project, covering walkability, comfort, safety, equity, and governance dimensions.

Table 4: KPI Targets for Muscat Pilot Application of IHEGF

KPI Dimension	Indicator	Baseline (Est.)	Pilot Target	Measurement Method	Responsible Entity (RACI)
Walkability	Walkability Index (WI)	~50/100	≥ 70/100	Field audits, GIS connectivity analysis	Muscat Municipality (R), MoHUP (A)
Thermal Comfort	Physiological Equivalent Temperature (PET)	38–40°C eq.	≤ 32–33°C eq.	Microclimate sensors, on-site logging	Municipality + Academia (R), MoTCIT (C)
	Mean Radiant Temperature (Tmrt)	60–65°C	≤ 50°C	Thermal globe thermometers	Academia (R), Municipality (C)
	Thermal Sensation Vote (TSV)	60% report "hot/very hot"	≤ 30% report "hot/very hot"	User surveys, 200+ samples	Academia (R), Civil Society (C)
Mobility	Mode shift to IH devices	<10% of sub-3 km trips	≥ 30% of sub-3 km trips	App telemetry, before/after counts	Municipality (R), Operators (C)
Safety	85th percentile vehicle speed	55 km/h	≤ 40 km/h	Radar speed logs, spot checks	ROP (R), Municipality (A)
	Intersection conflicts	Baseline unknown	≥ 30% reduction	Conflict observation (video audits)	ROP (R), Municipality (C)
Equity	Female participation	≤ 20%	≥ 40%	User registration data, surveys	Operators (R), MoHUP (I)
	Youth & elderly participation	≤ 15%	≥ 40%	Surveys, user demographics	Civil Society (R), Municipality (C)
Governance	Cross-agency coordination	Ad-hoc	4 structured meetings/year	Meeting records, minutes	MoHUP (A), Municipality + MoTCIT (R)

CONCLUSION

This study extends earlier research on Integrated Humanization (Saad, 2025a; 2025b; 2025c) by adding two essential dimensions: evaluation metrics and governance models. Together, these elements form the Integrated Humanization Evaluation–Governance Framework (IHEGF), which transforms IH from a conceptual paradigm into a practical and operational tool for Gulf cities. The framework demonstrates that climate-responsive mobility requires not only technical design standards but also measurable indicators of performance and accountable institutions.

The proposed evaluation framework introduces indicators tailored to Gulf realities, including walkability

indices, thermal comfort metrics such as PET and Tmrt, thermal sensation surveys, mode shift toward micro-mobility, safety performance, and equity of access across gender and age groups. By embedding these metrics within municipal monitoring, urban performance can be assessed in ways that reflect lived climatic and cultural conditions. Complementing this, the governance model adapts international lessons such as Vision Zero in Sweden and Room for the River in the Netherlands to Gulf institutions, assigning clear roles and responsibilities across Muscat Municipality, MoHUP, MoTCIT, MAFWR, and the ROP.

Policy implications extend from local to global scales. For Oman, the framework equips decision-makers with a unified system to operationalize Vision 2040, the ONSS, and the Greater Muscat Structure Plan. For the wider Gulf, it provides a transferable model that can align with Saudi Vision 2030 and Qatar Vision 2030, offering solutions to shared challenges of car dependence, climatic stress, and rapid urbanization. More broadly, the study shows how human-centered planning must be climate-adaptive, positioning Gulf cities as contributors to global urban discourse rather than passive adopters of imported models.

Limitations remain, including limited baseline data on walkability and thermal comfort, dependence on political will for inter-agency collaboration, and uncertainty over public acceptance of micro- and mini-mobility. Future research should therefore include empirical pilot projects, digital integration of micro-mobility with transit fares, and deeper exploration of equity impacts, supported by comparative studies across the GCC.

Integrated Humanization, framed through evaluation and governance, is best understood as a climate-adaptive operating system for Gulf cities. By combining measurable performance with accountable institutions, Muscat and its regional peers can build cities that are not only livable and sustainable but also resilient to the realities of the desert environment.

REFERENCES

AFDC (Alternative Fuels Data Center). (n.d.). *Neighborhood electric vehicle (NEV) access to roadways*. U.S. Department of Energy. https://afdc.energy.gov/laws/5711

Ahmad, A. M. (2021). Strategy for shading walkable spaces in the GCC region. *Journal of Urban Regeneration & Renewal, 14*(3), 312–328.

Al-Hajri, S., Al-Ramadan, B., Shafiullah, M., & Rahman, S. M. (2025). Microclimate performance analysis of urban vegetation: Evidence from hot humid Middle Eastern cities. *Plants, 14*(4), 521. https://doi.org/10.3390/plants14040521

Alharthi, M. A., Lenzholzer, S., & Cortesão, J. (2025). Climate responsive design in urban open spaces in hot arid climates: A systematic literature review. *Discover Cities, 2*, Article 38. https://doi.org/10.1007/s44327-025-00069-z

Arab Urban Development Institute. (n.d.). *Greater Muscat Structure Plan.* Retrieved August 19, 2025, from https://araburban.org

Banister, D. (2008). The sustainable mobility paradigm. *Transport Policy, 15*(2), 73–80.

Broadway Malyan. (n.d.). *Muscat Structure Plan.* https://www.broadwaymalyan.com/projects/muscat-structure-plan/

Cheng, V., Ng, E., Chan, C., Givoni, B., & Leung, T. (2012). Outdoor thermal comfort study in a subtropical climate: A longitudinal study based in Hong Kong. *International Journal of Biometeorology, 56*(1), 43–56. https://doi.org/10.1007/s00484-010-0396-z

Cundall. (2022). *Cundall appointed to deliver Greater Muscat Structure Plan.* Retrieved August 19, 2025, from https://www.cundall.com/news

De Siqueira, G., *et al.* (2025). Microscale audits of pedestrian streetscapes for Gulf cities. *Journal of Physical Activity & Health. Advance online publication.*

Dunedin, FL. (n.d.). *Neighborhood electric vehicle ordinances.* City of Dunedin. https://www.dunedingov.com

Elkhazindar, A. (2022). The effect of urban form on the heat island phenomenon in the UAE. *Energies, 15*(15), 5471. https://doi.org/10.3390/en15155471

ETH Zürich, IVT. (2017). *Measuring walkability in Singapore*. https://www.ivt.ethz.ch/

Gehl, J. (2010). *Cities for people.* Island Press.

Hamdan, D., & Lemes de Oliveira, F. (2019). The impact of urban design elements on microclimate in hot arid climatic conditions: Al Ain City, UAE. *Energy and Buildings, 200*, 86–103. https://doi.org/10.1016/j.enbuild.2019.07.028

Heyman, T., & Hasan, D. (2023, June 6). *Muscat could get railway and water taxis to hit net-zero targets.* The National. https://www.thenationalnews.com

Johansson, E., Thorsson, S., Emmanuel, R., & Krüger, E. (2014). Instruments and methods in outdoor thermal comfort studies — The need for standardization. *Urban Climate, 10*, 346–366. https://doi.org/10.1016/j.uclim.2013.12.002

Kittelson & Associates. (2022, April 19). *The common elements of successful shared micromobility programs.* https://www.kittelson.com/ideas

Kittelson & Associates. (2025, April 14). *Leveraging micromobility to tackle VMT and mode shift goals*. https://www.kittelson.com/ideas

Lam, C. K. C., *et al.* (2023). The effects of shading devices on outdoor thermal and visual comfort. *Building and Environment, 237*, 110410. https://doi.org/10.1016/j.buildenv.2023.110410

Land Transport Authority. (2018). *Walking & cycling design guide.* Singapore: LTA. https://www.lta.gov.sg/content/dam/ltagov/.../WalkingCyclingDesignGuide.pdf

McKinsey & Company. (2022, September 16). *Minimobility: The next big thing in urban mobility?* https://www.mckinsey.com

McKinsey & Company. (2025, April 29). *What is micromobility?* https://www.mckinsey.com

Middel, A., Chhetri, N., & Quay, R. (2016). Impact of

shade on outdoor thermal comfort—A seasonal field study in Tempe, Arizona. *Sustainable Cities and Society, 26*, 264–275. https://doi.org/10.1016/j.scs.2016.06.018

Middel, A., Lukasczyk, J., Maciejewski, R., Demuzere, M., & Roth, M. (2021). 50 grades of shade: Quantifying shade performance. *Bulletin of the American Meteorological Society, 102*(9), E1805–E1830. https://doi.org/10.1175/BAMS-D-20-0174.1

Ministry of Housing and Urban Planning (MoHUP). (2020). *Features of the Urban Strategy 2040 (ONSS)*. Muscat: Government of Oman.

Ministry of Housing and Urban Planning (MoHUP). (2023). *Oman National Spatial Strategy: National planning standards*. Muscat: Government of Oman.

Negev, M., *et al.* (2020). City design for health and resilience in hot and dry climates. *BMJ, 37*1, m3000. https://doi.org/10.1136/bmj.m3000

Newman, P., & Kenworthy, J. (2015). *The end of automobile dependence: How cities are moving beyond car-based planning*. Island Press.

NHTSA (National Highway Traffic Safety Administration). (2012). *Operation of neighborhood electric vehicles (NEVs) on public streets*. U.S. Department of Transportation.

Oman Sustainability Week. (2024). *Initiative to "humanise" Omani cities*. https://omansustainabilityweek.com

Oman Vision 2040 Implementation Follow-up Unit (IFU). (n.d.). *Sustainable environment pillar*. https://www.oman2040.om

Oman Vision 2040 Implementation Follow-up Unit (IFU). (2023). Oman Vision 2040 booklet. Muscat: IFU.

Rijkswaterstaat. (2012). *Room for the River: Programme justification and governance*. Ministry of Infrastructure and the Environment.

Saad, M. A. A. (2025a). Integrated Humanization: A Gulf-centric urban paradigm. *American Journal of Urban Planning and Smart City, 1*(1), 1–6.

Saad, M. A. A. (2025b). Integrated Humanization as a Gulf mobility strategy: Blue–Green corridors in Muscat. *American Journal of Urban Planning and Smart City, 1*(1), 7–15.

Saad, M. A. A. (2025c). Redesigning roads in Muscat: Integrating engineering standards with the principles of Integrated Humanization. *American Journal of Urban Planning and Smart City, 1*(1), 16–25.

Saad, M. A. A. (2025d). Integrated Humanization evaluation–governance framework: Toward climate-responsive, human-centered Gulf cities. *American Journal of Urban Planning and Smart City, 1*(2) (forthcoming).

Strategy for Shading Walkable Spaces in the GCC. (2021). *Journal of Urban Regeneration & Renewal, 14*(3), 312–328.

Thorsson, S., Yahia, M. W., Lindberg, F., & Johansson, E. (2014). Outdoor thermal comfort and urban design in temperate climates. *International Journal of Biometeorology, 58*(2), 211–223. https://doi.org/10.1007/s00484-013-0675-1

Tingvall, C., & Haworth, N. (1999, September 6–7). Vision Zero — An ethical approach to safety and mobility. *Paper presented at the 6th ITE International Conference Road Safety & Traffic Enforcement: Beyond, Melbourne, Australia.*

Urban Redevelopment Authority. (2017, November 26). *Encouraging walking through enhanced environmental design*. https://www.ura.gov.sg/

Urban Redevelopment Authority. (2018, December 7). *Expansion of the Walking and Cycling Plan submission* (Circular No. DC18-12). https://www.ura.gov.sg/

Yahia, M. W., Johansson, E., Thorsson, S., Lindberg, F., & Rasmussen, M. I. (2018). Effect of urban design on microclimate and thermal comfort outdoors in warm-humid Dar es Salaam, Tanzania. *International Journal of Biometeorology, 62*(3), 373–385. https://doi.org/10.1007/s00484-017-1380-7

Zhang, Y., Azzali, S., Janssen, P., & Stouffs, R. (2018). Design for walkable neighbourhoods in Singapore using Form-based Codes. In *IFoU 2018: Reframing Urban Resilience Implementation (Proceedings). MDPI.* https://doi.org/10.3390/ifou2018-05934