



Reframing Powered Two-Wheeler (PTW) Safety

A Positioning Paper for the WHO Global Road Safety Research Agenda Consultation –
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This short paper proposes a conceptual reframing of Powered Two-Wheeler (PTW) safety within the emerging WHO Global Road Safety Research Agenda. It builds upon analytical findings from European research (RIDERSCAN, 2015), global industry feedback (IMMA, 2026), and field-based observations from West Africa (IRD Road Safety Projects, 2026). The aim is to identify structural blind spots that persist across regions and stakeholders.

1. Beyond a Data Gap: An Epistemic Gap

Across Europe, industry stakeholders, and West Africa, a central convergence emerges:

- Lack of harmonized exposure data
 - Weak linkage between police and hospital data
 - Underreporting of PTWs and related casualties
 - Limited in-depth and micro-level crash investigations
- ⇒ **Risk is still predominantly analyzed through vehicle instability and post-crash outcomes, rather than through exposure structures, mobility systems, cognitive anticipation capacity, and socio-economic embedding of PTW use**
- ⇒ **This is a structural global weakness. Without accurate exposure and causation intelligence, policy prioritization, benchmarking, and evaluation remain fragile.**

2. PTWs as Structurally Embedded Mobility Actors

A second convergence highlights the heterogeneity of PTW users. Travel patterns differ significantly by age, purpose, geography, and socio-economic context.

PTWs operate within distinct mobility ecosystems:

- Recreational and leisure riding in high-income countries
 - Urban commuting systems
 - Livelihood-based motorcycle taxi systems in rapidly motorizing regions
 - Novice and returning riders across age groups
- ⇒ **Risk patterns are structurally produced by mobility systems themselves.**
- ⇒ **A global research agenda must integrate typologies of use and differentiate between these exposure structures.**

3. Safe System for PTWs: From Principle to Operational Model

The Safe System framework is widely accepted, yet its operationalization remains uneven.



RIDERSCAN emphasizes Safety Critical Events, mental processing failures, and rider anticipation. IMMA highlight naturalistic riding studies and human-machine interaction. While West African experience underscores training gaps and the importance of early education. Those distinct layers need to be addressed by SSA:

- Micro-cognitive processes and perception failures;
- Formal rider training effectiveness;
- Early road safety education and socialization.

⇒ **The integration of the different layers remains insufficiently addressed at global level.**

⇒ **For PTWs, SSA implementation must explicitly integrate kinetic energy compatibility, interaction with heavier vehicles, cognitive processing limits, training ecology, and infrastructure forgiveness adapted to PTW dynamics.**

4. Institutional capacity and Implementation Realism

Research needs converge on vehicle-road interaction, maintenance, and forgiving road design. However, implementation capacity varies significantly across contexts.

Significant differences in institutional capacity across regions. High-income setting possess advanced research architectures; rapidly motorizing regions face acute exposure growth with limited enforcement capacity.

Research must therefore

⇒ **integrate implementation science and pilot-based and scalable evaluation models**

5. Strategic Implications for the WHO Research Agenda

A forward-looking global research agenda should therefore prioritize:

- Harmonized exposure and causation intelligence systems
- Integration of macro and micro crash investigations (In-depth and naturalistic investigations)
- Typology-based PTW mobility research (Context-sensitive implementation models)
- Behavioural and cognitive research linked to training systems
- Operational PTW-specific Safe System models (Integrated Safe System operational frameworks)
- Context-sensitive technological evaluation
- Cross-continental benchmarking and data governance

Conclusion

Powered two-wheelers are overrepresented in global road fatalities, yet many countries still lack the essential foundations for informed policymaking: reliable exposure data (kilometers travelled), differentiated usage typologies, pre-crash information, and linked hospital records.

Global road safety agendas often emphasize absolute mortality figures, while giving insufficient attention to mobility patterns, type of use (commuting, leisure, livelihood), and the dynamics of interaction between heavy and light vehicles — all of which structurally shape risk.



The convergence between European research gaps, global industry priorities, and West African field realities reveals a structural blind spot: PTW safety continues to evolve without a sufficiently robust and context-differentiated research architecture. As long as PTWs are framed as a marginal vehicle category rather than as structurally embedded mobility actors, their systemic impact will remain underestimated.

Reframing PTW safety in this way should form a foundational pillar of the WHO Global Road Safety Research Agenda, strengthening both scientific coherence and policy relevance.



Annex 1: RIDERSCAN Synthesis

I. The Structural Knowledge Deficit

Major finding ([Deliverable 5](#), Executive Summary):

- Out of 153 EU research projects listed → only 25 concerned PTWs
- Three quarters dated back to 2007–2012
- Massive lack of harmonized exposure data
- Weak standardization of crash data

II. The Blind Spot of Exposure

Recommendations strongly emphasized:

- Harmonized exposure studies
- Distinction between intrinsic risk and exposure-related risk
- Separation between behaviour / environment / vehicle dynamics

III. The Importance of Safety Critical Events & Naturalistic Studies

2015 research work identified:

- Naturalistic riding studies
- Accident causation models
- Safety critical events
- Cognitive processes
- Perceptual failures

RIDERSCAN findings align today with the current discussion within the TAG:

- Safe System
- Kinetic energy framing
- Human functional failures
- ITS & human-machine interaction

and connects directly to:

- LMIC dependence
- Informal transport
- Livelihood riding
- Novice vs returning riders

IV. The Need for an Integrated Approach (Safe System)

RIDERSCAN emphasized:

- Interaction between vehicle / user / infrastructure / system
- The need for a strategic agenda
- The risk of dispersion of public funding

V. Acceptability & Rider Heterogeneity

A particularly powerful insight in RIDERSCAN work:

- Riders are not a homogeneous group
- Acceptability of measures varies
- Motivations differ depending on motorcycle type
- Culture, usage patterns, and experience matter

VI. The Missing Global Link: Data Governance

RIDERSCAN proposes:

- CADaS harmonization
- iGLAD integration
- Standardization of the definition of “seriously injured”
- GPS accident location
- Angle of impact
- Severity classification



Cross-Reading RIDERSCAN Findings / IMMA Research Priorities / IRD's work in West Africa

Not just a "data gap"

At the surface layer, all three stakeholders call for:

- better data
- exposure measures
- harmonisation
- in-depth investigations

At deeper layer, the issue is that **the epistemology of PTW safety is incomplete** as research still analyses PTWs primarily through:

- crash outcomes
- vehicle instability
- surface conditions

⇒ **The convergence of RIDERSCAN work, IMMA, and Emmanuel Bonnet's work requires a systemic framing shift as it calls that PTW safety is fundamentally about:**

- **exposure structures**
- **usage systems**
- **cognitive anticipation capacity**
- **socio-economic embedding**

The Global Blind Spot Is Exposure-Structure, Not Technology

IMMA pushes ITS and detection. RIDERSCAN pushes in-depth data. Bonnet pushes training and early education.

These are not competing priorities.

Again, these are 3 different system layers.

The missing integrator being *How do different mobility systems structurally produce PTW exposure?*

For example:

- In Europe → lifestyle / leisure / commuting
- In West Africa → livelihood-based structural dependence
- In urban LMIC → rapid motorization gap

⇒ **While the safety agenda today often treats PTW safety as: *How do we make motorcycles safer?* The cross-reading rather highlight the need for a deeper question: *What type of mobility system produces which PTW risk pattern?***

Safe System Is Accepted — But Under-theorized for PTWs

All three sources endorse Safe System in principle.

But:



RIDERSCAN operationalises it via accident phases.

IMMA operationalises it via technology.

Bonnet operationalises it via pilot cities and practical constraints.

⇒ **What is missing globally is: a PTW-specific Safe System operational model that integrates:**

- **cognitive limitations**
- **kinetic energy incompatibility**
- **vehicle-road interaction**
- **informal regulation systems**
- **early education**
- **training ecology**

There is an institutional capacity problem

The three perspectives reveal that:

- Europe → sophisticated research architecture but declining PTW policy focus
- Industry → technological capacity but uneven global transferability
- West Africa → urgent exposure growth but limited institutional capacity

That differentiation is currently missing in most global frameworks.

⇒ **The global research agenda must therefore differentiate:**

- **institutional capacity**
- **enforcement feasibility**
- **mobility dependence**
- **growth trajectory**

Conclusion

All three sources converge on one silent conclusion:

PTWs are not marginal road users. They are structurally embedded mobility actors.

But global road safety still treats them as a sub-category of VRUs.



Annex 3: Strategic Axes for WHO

AXE 1 — Global Exposure & Mobility Intelligence

Research Priority:

- Harmonized PTW exposure metrics
- Usage typology
- Mobility patterns (urban, peri-urban, livelihood)

Without exposure data → distorted risk assessment.

AXE 2 — Global In-depth Accident & Causation Architecture

- Standardized micro/macro accident reporting
- Pre/during/post crash modelling
- Link crash & hospital data
- Global harmonized definition of serious injury

AXE 3 — Behavioural & Cognitive Dimension

- Risk perception
- Functional failures
- Hazard detection
- Cultural patterns
- Rider heterogeneity

AXE 4 — PTW in a Safe System Framework

- Kinetic energy
- Interaction with heavier vehicles
- Infrastructure forgiveness
- Systemic responsibility

AXE 5 — ITS & Emerging Technologies

- Interaction PTW / automated vehicles
- Human-machine interface
- Acceptance & behavioural adaptation
- PTW-specific impact assessment methodology

AXE 6 — Governance & Strategic Research Agenda

- Avoid duplication of funding
- Strategic prioritization
- Cross-continental data sharing
- Inclusion of PTWs in global transport policy frameworks