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Opinion

Capacity building for road safety in LMICs: the need for a sustainable local knowledge and research infrastructure

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Abstract: Road crashes continue to be a major cause of death and serious injury for low- and middle-income countries (LMICs). At the global level, 90% of traffic fatalities occur in these countries with a dramatic daily amount of 3 260 road deaths, many of whom are children. The first UN Decade of Action for Road Safety 2011–2020 was designed to develop a massive movement towards a decrease of these numbers. This resulted in many initiatives to introduce the safe system approach in LMICs, i.e. to implement road safety management, make roads, road users, and vehicles safer, and improve post-crash health care. International organisations together with NGOs and universities prepared road safety guides and manuals, gave courses and webinars, introduced auditing and inspection systems, with the overall intention to build capacity in LMICs. Together these actions contributed to a variety of road safety developments in LMICs but the overall results were still modest. At the third Global Ministerial Conference on Road Safety in Stockholm, 2020, and in the Global Status report by the World Health Organization, 2023, the results of all efforts were presented and evaluated. Many countries made progress through road safety management and better legislation addressing risk factors such as speeding, drinking and driving, failing to use seatbelts, and poor infrastructure design. However, the reduction in road deaths strongly lagged behind the original goals. Continued implementation of programs and development of new approaches are needed to make a breakthrough, and to reach the goals of the 2^{nd} Decade of Action, i.e. a 50% reduction in fatalities by 2030, and the same percentage reduction in injuries. The present position paper argues that despite the enormous amount of road safety information, which has been and is 'sent' to LMICs, and despite the quality and robustness of international organisations behind these programs, there is a shortfall in the scale of the knowledge and research infrastructure currently existing in LMICs, which is needed to 'receive and transfer' this knowledge. In order to develop evidence-based policy, LMICs need research programs that are able to transfer safe system principles to the local context and culture. Several literature overviews illustrate the lack of such research in LMICs, i.e. the limited number of programs at local universities and research institutes. Although recently initiatives have been taken in some countries, the implementation of such programs is urgently needed. Based on this observation we **call on international organisations to establish a special program for the development of a sustainable road safety knowledge and research infrastructure in LMICs**. Such structural local capacity is a prerequisite to translate international road safety knowledge into local guidelines and to develop an evidence-based road safety policy. Most importantly, this local infrastructure will give countries a national knowledge bank, thus providing them with an urgently needed sustainable road safety memory.

Keywords: education, evidence based policy, knowledge infrastructure, low- and middle-income countries (LMICs), research, road safety

1 Background

Road crashes continue to be a major cause of death and serious injury for low- and middle-income countries (LMICs). At the global level, 90% of traffic fatalities occur in these countries with a dramatic daily amount of 3 260 road deaths, many of whom are children. In comparison to high-income countries, where the number of road deaths is 8 per 100 000 population, the fatality rate for middle income countries is double at 16 per 100 000 population, and the fatality rate for low-income countries is even higher, at 21 per 100 000 population (WHO, 2023). Almost half of these deaths are among the most vulnerable road users, including people who cycle, walk and use motorcycles.

The first UN Decade of Action for Road Safety 2011–2020 (WHO, 2010) has brought a series of initiatives and introduced new road safety programs in a variety of areas. During the Decade, numerous studies were initiated all over the world and several, extensive overviews, problem analyses and visions for the future have been prepared (PIARC, 2023a). At the third Global Ministerial Conference on Road Safety (Government Offices of Sweden, 2020), and in the Global Status report (WHO, 2023), the results of these efforts were presented and evaluated. Many countries made progress through road safety management and better legislation addressing risk factors such as speeding, drinking and driving, failing to use seatbelts, and poor infrastructure design. However, the reduction in road deaths and fatality rates strongly lagged behind the original goals. Continuation of existing programs and new approaches are needed to achieve the target, particularly in LMICs. The Stockholm declaration (2020) flags the importance of new initiatives and makes a plea to connect road safety to the broader set of UN Sustainable Development Goals. The ultimate target is to reduce the number of fatalities by 50% by 2030 compared with 2020.

Based on a review of the programs and projects that were presented and initiated during the period as from 2011, PIARC (2023a) presents an overview of issues which together describe the safe system concept as the multi-level approach needed to provide further progress in LMICs. From an overview of case studies PIARC (2023b) concludes that an imbalance exists between the overwhelming number of programs and organizations that focus on the 'sending' of road safety information to LMICs on the one hand and on the other hand the limited amount of knowledge and research infrastructure inside LMICs, that would be needed to 'receive and transfer' this knowledge to the local context and culture.

The present position paper analyses this imbalance and makes a plea to strengthen the knowledge and research infrastructure in LMICs.

2 Transfer of knowledge: actual accomplishments

As noted above, a variety of road safety related knowledge has been transferred to LMICs since 2011. A central notion underlying this knowledge transfer is that the Safe System approach should be adopted as the universal principle to develop road safety strategies. This approach describes the road safety problem as a multi-level phenomenon with measures needed on a strategic, tactical and operational level:

- At the **strategic level** countries are stimulated to develop their road safety management organization and to build a road safety strategy aligned with their safety culture and the broader context of the Sustainable Development Goals. They also need to develop a knowledge infrastructure to enable and facilitate transfer of the safe system principles to the local context.
- At the **tactical level** road safety can be influenced through the implementation of new (public) transport systems and redesigning road networks, cities and villages with the safety of vulnerable road users in mind. Regulation and legislation are considered at this level. Manuals for road design and traffic rules, regulating traffic behavior, use of safety equipment, construction of vehicles, may also be considered as measures at this level. Enforcing the use of seat belts, helmets and speed have proven to be very cost effective and relatively cheap.
- At the **operational level** the 'traditional' safety improvements may be considered as the basis of

a safe traffic system: speed plays a central role and should be regulated through a well-defined speed management approach, roads should be self-explaining, forgiving and exclude high speed crashes, and vehicles should be designed with modern, active and passive safety systems in mind. In the background, a well- organized post-crash health care system should function to reduce the severity of injuries acquired in road traffic crashes.

In line with this logic, adoption of the safe system approach has been advocated on a wide scale. Guides, manuals and books have been published, with many international organizations being involved: GRSF, WHO, UN, FIA Foundation, ITF, IRF, PIARC, WRI, EU projects and others. The World Bank and Multilateral Development Banks took the initiative to build Road Safety Observatories (SSATP, n/d) for different continents. Johns Hopkins University, GRSP, Vision Zero Academy, Delft Road Safety Courses, and many others developed special courses on road safety.

As a result, more and more LMICs implemented lead agencies for road safety, developed road safety strategic plans and took an active role in introducing road safety legislation and enhancing road safety data systems. In addition, programs like the Bloomberg Initiative for Global Road Safety developed projects that aim to fundamentally change the design of cities and regions. Similar initiatives are taken through the Global Designing Cities Initiative. The redesign of roads and transport in cities like Bogota (Colombia) and Fortaleza (Brazil) provide examples of success (PIARC, 2023b). At the same time, knowledge about, and organization of auditing and inspection schemes has developed progressively. iRAP Star Rating for roads is internationally adopted as an effective method to improve the safety of roads. In a similar way the NCAP star rating for cars has proven successful in influencing the safety of vehicles.

From a global perspective, it appears that an extensive amount of road safety knowledge has been made available to LMICs through the actions described above. Also, a variety of international organization and NGOs, both new and pre-existing, are active in the road safety domain. However, despite this large international effort to share knowledge of the safe system approach to road safety, LMICs differ markedly in their level of operational activities devoted to road safety. In many countries there is insufficient funding for road safety, and/or the safety culture still focuses on blaming the driver with (cheap and ineffective) educational and campaigning strategies implemented to overcome this. The question then is what additional action is needed to reach a further breakthrough by progressing from knowledge to action.

3 The need for research to build evidence based policy

In order to develop a robust and effective road safety policy framework, a balance is needed between best practice knowledge promoted through international agencies, and locally generated knowledge and research about the measures most likely to be effective in the local context. This would provide countries with a sound base from which to mobilize forces that

are needed for change. Unfortunately, an analysis of the international literature shows that road safety research in the LMIC context lags strongly behind research in high-income countries.

Haghani et al. (2022) presented a macro-scale analysis of road safety research in the context of low- and middle-income countries. Figure 1 gives the number of scientific publications regarding road safety, illustrating the limited amount of such papers for LMICs.

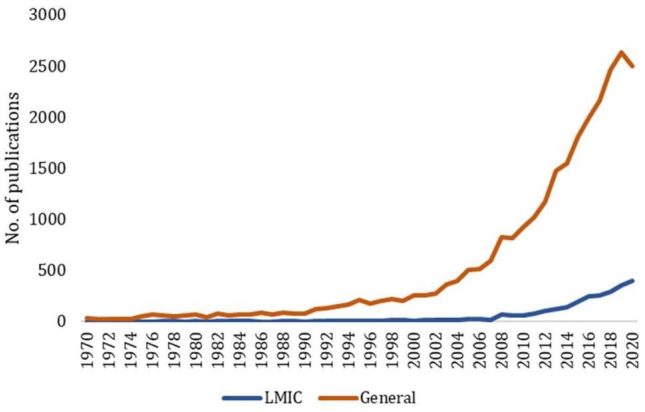

Figure 1 Number of scientific publications regarding road safety (Haghani et al., 2022)

Heydari et al. (2019) give an extensive overview of the state of knowledge and future directions for road safety in LMICs and strongly recommend improvements in the way road safety data collection and research is conducted in the context of LMICs.

Rahman & Rahman (2019) argue that the complex Road Traffic Injury (RTI) landscape in LMICs hinders in priority setting, resource allocation and prevention

efforts: '*It is high time to reinvent new strategies beside existing preventive approach for RTIs prevention considering all these complexities in LMICs through intensive research.*'

PIARC (2023b) gives an overview of 18 successful before-after studies illustrating the effects of some specific road safety measures in LMICs on an evidence basis and as described in international journals. In 16 of these papers international authors are involved, illustrating the lack of the local research capacity.

Vanderschuren et al. (2019) give a nice example of the relevance of a local research program. They analyse the effectiveness of road safety measures for the case of South Africa. It appears that rumble strips, improved lighting and the implementation of motorcycle-based emergency services are the most promising, cost-effective road safety measures to be implemented in the Cape Town province. However, the paper also argues: '*It should be borne in mind that local factors (such as the population density, motorization levels and modal split in a province) can significantly impact the optimal road safety management measures to be applied in that province and, consequently, the road safety gains that can be achieved. In other words, each province will require a tailor-made approach to improve its road safety levels. A detailed, localized analysis of road safety measures (such as the one presented here for the Western Cape) can greatly facilitate the continued improvement of road safety per province, and for the country as a whole.*' As such the paper clearly argues the relevance of local research and evidence building.

Application of scientific Safe System principles in practice requires tuning these principles to the local situation, habits, traffic properties, financial restraints, etcetera. Such tuning would lead to a practical national knowledge base for effective road safety strategies and measures.

We observe that, despite large international efforts, countries differ strongly in their level of national knowledge development and academic research programs. As a result, many countries lack a national evidence base on which policy can be well-founded and that would provide a strong rationale and clear direction for fundamental changes that are 'owned' by the country itself.

Although international programs do encourage countries to set up demonstration projects, an academic approach in designing before and after studies is often missing. Consequently, the effective use and safeguarding of road safety knowledge in the local LMIC context remains limited.

The development of a knowledge and research infrastructure can be placed in pillar 1 of the first Global Plan of the UN Decade of Action for Road Safety, as illustrated in Figure 2. This pillar Road Safety Management highlights the need to create lead agencies with the capacity to develop national road safety strategies underpinned by data and evidential research. In addition, the importance of capacity building for road safety professionals working for these institutions has been emphasized by the second Global Plan (WHO & UN, 2021).

Figure 2 Five pillars as part of the Global Plan of the UN Decade of Action for Road Safety 2011-2020 (WHO, 2010)

Carnis & Mignot (2023) analyzed the performance level of different African countries for 6 items belonging to pillar 1, see Figure 3. Item 5 represents the Knowledge and Research issue. From the respondents, only 20% gave a satisfactory answer, which is very low. The authors conclude that there is a considerable lack of local research and training: '*This means that the implementation of road safety measures will be hampered by the lack of road safety expertise to ensure their effectiveness, monitoring and evaluation'*.

Goel et al. (2024) recently confirmed these findings on the basis of an extensive evidence and gap map: '*The distribution of available road safety evidence is skewed across the world. A vast majority of the literature is from HICs. In contrast, only a small fraction of the literature reports on the many LMICs that are fast expanding their road infrastructure, experiencing rapid changes in traffic patterns, and witnessing growth in road injuries. This bias in literature explains why many interventions that are of high importance in the context of LMICs remain poorly studied. Besides, many interventions that have been tested only in HICs*

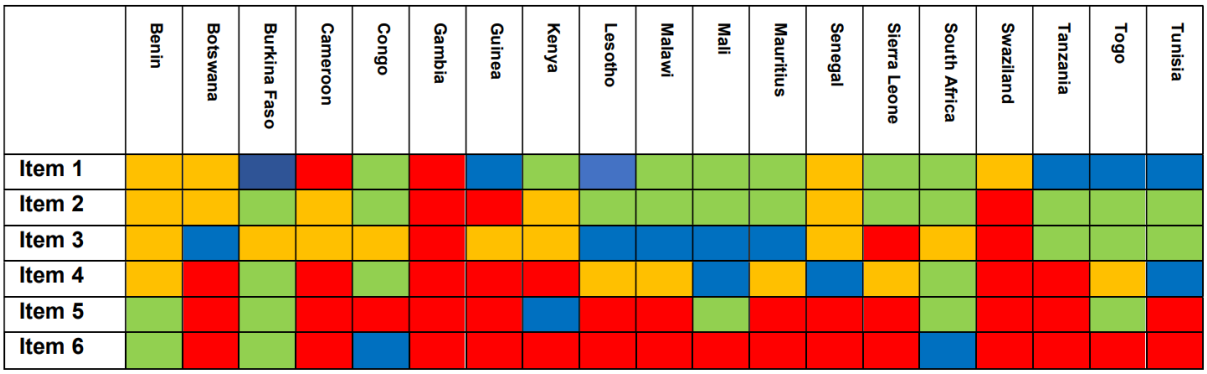

Figure 3 Specific performance level for the Road Safety Management pillar, per items: (*1*) institutional organization and coordination, (*2*) policy formulation and adoption, (*3*) policy implementation and funding, (*4*) monitoring and evaluation, (*5*) scientific support, knowledge and capacity building, and (*6*) key road safety resources; colour codes: red < 25% of the whole total, orange 25%–50%, blue 50%–75%, green 75%–100% (Carnis & Mignot, 2023)

may not work equally effectively in LMICs.'

Taken together these analyses clearly illustrate the lack of a robust knowledge infrastructure in many LMICs. As such this finding seems to us to be an important reason for the limited level of road safety improvements in many LMICs thus far. Given this background—and while acknowledging the efforts of existing capacity building programs—we argue that LMICs need strong(er) university programs and a national road safety research program guided through national road safety research institutes. Such a structural local capacity is needed to translate international road safety knowledge into local guidelines and countermeasures, to develop national research and demonstration programs, and to undertake sound evaluation of progress in road safety.

4 A call for a special program to build a knowledge and research infrastructure in LMICs

Based on Stipdonk (2022), Godthelp (2023) presented the Zipper model as a schematic illustration of the link between research and policy and the underlying role of academic university programs (Figure 4).

The model illustrates the link between research and policy as well as the foundation needed through university programs. Based on this model the following components are considered essential for a knowledge and research infrastructure:

- university road safety programs at bachelor and master level
- research capacity in national centres of road safety excellence.

Past experiences in the Netherlands, Sweden and other countries show that substantial steps forward were reached through an intensive cooperation of local road safety agencies, universities, and road safety research institutes like SWOV, VTI, etc. In their extensive guidelines on management capacity reviews, Bliss & Breen (2009) and Bliss & Breen (2013) clearly indicate the central role of a local research infrastructure.

We think the time has come for special investments in building a strong LMIC knowledge and research infrastructure for further support of evidence-based traffic safety policies in all countries of the world. Several initiatives already support such a development, but a more structural approach is needed. Countries need to develop an internal power to make fundamental changes, resulting from a 'critical mass' of road safety expertise in every country.

Based on the observations mentioned above we call on international organisations to establish a **special program to develop a sustainable knowledge and research infrastructure in LMICs.** Such an infrastructure is a prerequisite to translate international road safety knowledge into local guidelines and to develop an evidence based road safety policy. Most importantly this local infrastructure will give countries a national knowledge bank, thus providing them with an urgently needed sustainable road safety memory.

An ambitious program with sufficient funding for (parts of) this intended infrastructure is needed. This would

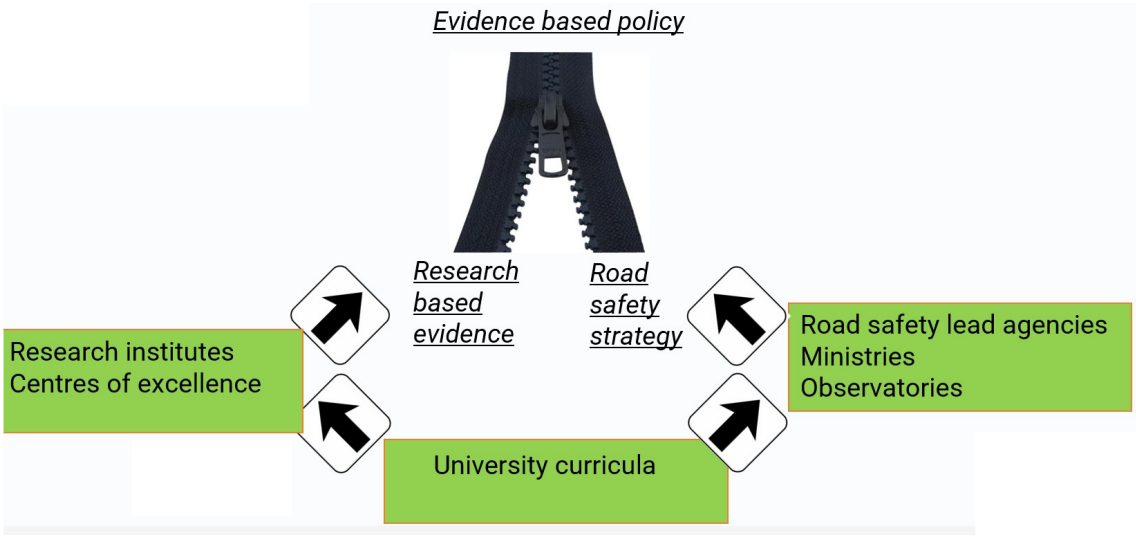

Figure 4 Zipper model illustrating the link between research and policy (Stipdonk, 2022; Godthelp, 2023)

give countries the inside power to mobilize forces that are needed for a fundamental breakthrough.

The development of such a special program requires a long-term and multi-faceted approach that could encompass a variety of components:

- Capacity building conference to define and establish a special program and/or to extend existing programs through international organisations. Leading and/or participating parties may be: Bloomberg Philanthropies, FIA Foundation Road safety program, World Bank Global Road Safety Facility, Multilateral Development Banks, Road Safety Observatories (ARSO, APRSO and OISEVI), SSATP, UNRSF, UNITAR, WHO, GRSP, ITF-OECD, PIARC, EU, etc.
- Building a coalition of partners for: (*a*) twinning and/or exchange programs between international universities with a program for visiting lecturers and curriculum development; (*b*) twinning and/or exchange programs between international research institutes with visiting researchers and program development.
- Building a connection between and with ongoing projects and programs from the parties mentioned above and other ongoing projects like those from Global Alliance of NGOs, iRAP, Global NCAP, GRSP Road Safety Capacity Building Program, Vision Zero Academy, Delft Road Safety Courses, EU-Horizon, AfroSAFE, TransSafe, ICTCT, etc.
- Building an International Organisation of Road Safety Research Institutes.
- Developing an assessment method to rate the quality of a local knowledge infrastructure, i.e. star rating for knowledge and research infrastructure.
- Other options to be determined.

CRediT contribution statement

Hans Godthelp: Conceptualization, Methodology, Visualization, Writing—original draft, Writing—review & editing. **Paul Wesemann:** Writing—original draft, Writing—review & editing. **Henk Stipdonk:** Writing—review & editing. **Mark King:** Writing—review & editing.

Declaration of competing interests

The authors report no competing interests.

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