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Safe system implementation in three African and three European countries: Preliminary results from a comparison of six countries

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Abstract

The study provides preliminary results from a case comparison of road safety management in three African countries (Tanzania, Ghana, Zambia) with three EU countries, all with a great track record of excellence in traffic safety and practicing Safe Systems principles (Norway and Netherlands & Sweden), based on document analysis and qualitative interviews. Norway, Sweden, and The Netherlands are early adopters of what has been termed the Safe System Approach (termed "Sustainable safety" in the Netherlands). Norway and Sweden have the highest road safety level in world. The objectives of the study are to: 1) Examine the alignment with Safe System principles in the road safety management systems in each country, and 2) Discuss possible policy implications. The study is based on document analyses and focus group interviews with road safety experts (n=73) in the six countries. The European countries' road safety management systems are mainly in line with the Safe Systems principles for road safety management. In the three African countries, we find an insufficient systematic approach and a lower level of implementation of existing plans, mostly related to insufficient data on accidents, low institutional road safety influence and lacking funding. We discuss possible policy implications for the three African countries.

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Keywords: Safe System; road safety; Europe; Africa

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1. Introduction

1.1 Background

According to WHO estimates, 1.19 million deaths occur in traffic each year (WHO, 2023). Low- and middle-income countries in particular struggle with traffic safety problems globally, standing for 93% of traffic fatalities, a share which is completely out of proportion if accounted for their populations and vehicle fleets (Academic Expert Group, 2020). The traffic fatality rate (per population) in Africa is the worst among all world regions and is 3 times as much as in Europe (4 times in comparison to EU-countries). There has been a constant growth in African traffic fatalities and the number is expected to increase by another 68% over the next decade if nothing is done. The experience in many other countries shows that the trend can be broken, and positive dynamics achieved within relatively short time if road safety gets proper attention and is treated in a systematic way. The expertise and experiences of the countries that are best-performers in road safety are highly relevant for African countries. During the 1990s, a real 'revolution' took place in the world of traffic safety. Countries like Sweden, Norway and The Netherlands were pioneers in formulating and then implementing what was later called the Safe System approach to road safety. The approach emerged as a response to a slowdown in traffic fatalities and injuries reduction and realisation that 'doing more of the same' would not bring the ultimate solution to the road safety problem (Green et al., 2022). Partly as a consequence of the adoption of the Safe System approach, Norway, Sweden and The Netherlands experienced strong reduction in traffic fatalities. Norway experienced a 73% reduction in traffic fatalities from 2000 to 2020; Sweden experienced a 63% reduction; Netherlands a 50% reduction (Nævestad et al (forthcoming)). The two former countries have been world leaders in traffic safety in recent years. By now, Safe System has become the state-of-the-art in road safety management, and it is recommended to countries worldwide (WHO & UN, 2021; ITF 2022). Based on a systematic review of Safe system research, Khan and Das (2024) conclude that the Safe system approach holds great promise in reducing road traffic injuries and fatalities, and that the emphasis on shared responsibility, forgiving infrastructure, safe vehicle design, and speed management has shown positive effects in numerous case studies and real-world implementations.

The focus of the study is on the first pillar in the Safe System approach, which is road safety management. According to Muhlrad et al. (2011, 2014), a road safety management system (RSMS) can be defined as a complex institutional structure that involves cooperating and interacting bodies which support the tasks and processes necessary for the prevention and reduction of road traffic injuries. RSMS involves several elements, actors and processes, e.g. national public roads authorities with sector responsibility for road safety, road safety visions, safety performance indicators, targets, effective measures etc. (Varhely, 2016; Elvik and Nævestad, 2023; Elvik, 2023). In a recent study, Elvik and Nævestad (2023) conclude that the annual percentage decline in the number of killed or seriously injured road users in Norway has been considerably greater after Vision Zero was adopted in 2001 than it was before, indicating the importance of the Safe system to road safety management for road safety records.

We see that the success of certain Northern European countries when it comes to road safety records can be attributed to a road safety management system, which is based on the Safe System approach (Elvik and Nævestad, 2023). There is reason to believe that low-and-middle-income countries can learn from these principles (ITF, 2022). This is especially relevant in African countries, as this region has the worst fatality rate (per population) among all world regions. It is, however, important to note that the implementation of the Safe system principles to road safety management may be constrained by factors related to economy, institutional robustness, and national road safety culture etc., and that implementation must be adapted to the national contexts. It is also important to note that some policy elements that are suitable in the European context may be less suitable or effective in e.g. an African context.

1.2 Aim

The study provides preliminary results from a case comparison of road safety management in three African countries (Tanzania, Ghana, Zambia) with three EU countries with good track record of excellence in traffic safety and practicing Safe Systems principles (Norway, The Netherlands and Sweden). These countries are early adopters of what has been termed the Safe System Approach (termed "Sustainable safety" in The Netherlands). The aims of study are to:

1) Examine the alignment with Safe System principles in the road safety management systems in each country.
2) Discuss possible policy implications for the countries.

2. Previous research

2.1 The Safe System approach

The novelty of the Safe System approach is the ethical standpoint that road fatalities cannot be accepted, i.e. there is no 'optimisation problem' to solve and we must improve road safety until no one is killed or severely injured. Hence Vision Zero, which is another name for Safe System adopted in Norway and Sweden (referring to the systematic management approach to fulfil Vision Zero). The goal of Vision Zero may look unrealistic at the first sight, yet Safe System makes it achievable by clearly limiting the scope of the problem. While minor accidents are likely to continue to happen, all efforts and resources must be focused on prevention of the most severe ones with people seriously injured and killed.

In practical terms, Safe System has its grounds in four fundamental principles (ITF, 2016; Green et al., 2022):

1) It is human to make mistakes; the traffic system must be designed to tolerate (unintended) errors made by the road users
2) The traffic system must be designed so that the external forces in accidents do not exceed the human bodies' tolerance for biomechanical impacts
3) The responsibility for traffic safety must be shared by those who design, build, manage, and use roads and vehicles, as well as the providers of the post-crash care and emergency response
4) All system components must be strengthened to multiply the protection effect; if one component fails, road users should still be protected.

The Safe System approach involves a cultural change ("paradigm shift") in the sense that the "blame the victim" culture is superseded by "blaming the traffic system", which throws the spotlight on authorities' accountability (Green et al., 2022). The Safe System approach is generally summed up in six pillars, describing how road safety work should be organized (WHO & UN, 2021; ITF, 2022):

I. Road safety management: Multi-sectoral partnerships and lead agencies to develop and lead national road safety strategies, plans and targets; research-based monitoring of implementation and effectiveness.
II. Safe infrastructure: Inherently safe and protective road networks, especially for the most vulnerable (e.g. pedestrians, bicyclists and motorcyclists) road users.
III. Safe vehicles: Standards, consumer information and incentives to accelerate the uptake of active and passive vehicle safety technologies.
IV. Safe speed: Speeds within the boundaries of biomechanical tolerance.
V. Safe road users: Enforcement and supplementary measures (e.g. public awareness/education) targeting high-risk behaviors.
VI. Post-crash response: Appropriate emergency response, treatment and rehabilitation for crash victims.

2.2 Road safety management system

Muhlrad et al. (2011, 2014) define policymaking as a cyclical series of tasks, e.g. agenda setting, formulate policy, adopt policy, implement policy, evaluate. A key feature of the RSM system is that it involves systematic work to ensure continuous improvement (Plan, Do, Study, Adjust") in road safety (Gitelman & Doveh, 2016). We should however not take for granted that formal plans and strategies always are implemented in line with intentions. Analysing the RSM system, it is therefore important to discern between the formal and informal aspects of RS management. Research on safety indicates that there often may be a considerable gap between the two (Antonsen, 2009). The formal aspects of RS management ("how things should be done") are the above-mentioned formal routines and measures that enable systematic work with RS in line with continuous improvement. The informal aspects of RS management generally refer to safety culture ("how things are actually done"), which can be defined as shared and safety-relevant ways of thinking or actions that are (re)created through joint negotiation by people in social settings (Nævestad, 2010). Analysing the quality of national road safety management systems, safety culture thus refers to

how the processes of continuous improvement in road safety management actually are conducted and implemented by the actors involved in national road safety work (whether the road safety management system is "alive").

2.3 Operationalization of Safe System RSMS

Várhelyi (2016) describes the most important aspects of effective national road safety programs, based on a literature review. The result is summarized in 12 twelve essential elements, which provide a relatively good depiction of full alignment with Safe System principles for road safety management (Elvik and Nævestad, 2023). The elements include both formal and informal aspects of RSM, and they provide a sequential narrative, so to speak, of the elements of RSMS.

1) **Define the Burden and Nature of Road Casualties.** This involves mapping the number and types of fatal accidents, including defining monetary valuation of the prevention of a fatality/injury accident.
2) **Gain Commitment and Support from Decision Makers.** There is accumulated knowledge among road safety scientists on which strategies and measures are the most efficient, but without commitment from the decision makers, these will not be realized.
3) **Establish Road Safety Policy or Vision.** E.g. Vision Zero in Norway and Sweden and the "Sustainable safety" policy in the Netherlands.
4) **Define Institutional Roles and Responsibilities** A crucial issue here is the existence of a responsible body for road safety on the national level, and definitions of institutional roles and responsibilities for important functions of RS management.
5) **Identify Road Safety Problems** As a basis for road safety actions and countermeasures, the road safety problems of the country should be identified in a systematic way.
6) **Set Road Safety Targets** directed at road users, vehicles and infrastructure, including complementary, non-accident-based indicators of RS. Safety performance indicators (SPIs) are crucial here, e.g. the share of drivers using seat belt, speeding, share of vehicles with Euro NCAP 5 stars, share of highways with median barriers etc.
7) **Formulate Strategy, Action Plan,** e.g. with challenging, yet in principle achievable targets, priority to measures with known effectiveness, considerations of costs and expected benefits, a timetable.
8) **Allocate Responsibility for Measures** The responsibility for each of the indicators/actions, such as e.g. "Speed limit compliance", "Share of vehicles having 5 stars on NCAP scale", as well as monitoring of performance and outcome of all the above should be allocated to one respective responsible body.
9) **Ensure Funding** Resource allocation is critical, and it must be part of the road safety programme. The responsible bodies should be supplied with sufficient funding to implement cost-effective road safety measures.
10) **Apply Measures with Known Effectiveness,** e.g. based on the Handbook of Road Safety Measures (Elvik et al., 2009).
11) **Monitor Performance.** The status of the target indicators should be monitored on a yearly basis, and feedback on their performance should be given to the responsible bodies and to the national coordinating body; if any of them does not develop in the right direction, suitable countermeasures should be taken.
12) **Stimulate Research and Capacity Building.** This involves developing research-based knowledge on RS problems and evaluate effectiveness of measures.

3 Method

3.1 Document analysis

To examine national RSM systems' alignment with the 12 elements described by Varhelyi (2016), we collected and analysed different types of documents, e.g. policy documents (road safety plans and strategies), reports on the status of road safety e.g. according to the focus areas in action plans, official websites, research reports, papers etc. in the three European and three African countries that we study. The empirical material was found with purposive sampling, with the pre-specified inclusion criteria being documents concerning the status of the 12 elements described

by Varhelyi (2016), especially the formal aspects of road safety (i.e. the written information about strategies and plans). We then did a thematic content analysis (Braun & Clarke, 2006), focusing on the status of the 12 elements in each country.

3.2 Interviews

We conducted semi-structured interviews, mainly group interviews, with 73 road safety experts in the six countries. These are people working with road safety in different ways, in authorities, NGOs, as researchers etc. (cf. Appendix 1). Interviews were conducted either physically, or digitally via Microsoft Teams between April 2023 and April 2023, with interview durations ranging from 40 minutes to 2,5 hours (for group interviews). We employed a strategic sampling method, where the interviewees were selected based on criteria relevant to the research questions. We focused on assembling a sample that represented various roles in traffic safety work, including e.g. people working in authorities, NGOs and people working as researchers. The purpose was to include people who had knowledge of the 12 elements of road safety management that is highlighted by Varhelyi (2016). These elements include both formal and informal aspects of road safety management. We can to a large extent obtain information about the formal aspects through review of documents. The informal aspects of road safety management, e.g. the perceived level of commitment to road safety from politicians, authorities, the extent to which road safety strategies are known and alive, whether road safety is sufficiently funded and prioritized etc. is different from what we find in formal documents. Thus, obtaining information about this requires other methods, like e.g. interviews.

We conducted thematic analyses of the interviews, systematically recurring themes in the interviewees' descriptions of specific topics. (Braun & Clarke, 2006). In the first step of the process, the interviews were carefully read several times and then coded. The codes were then organized and grouped into broad categories. In the next step, the categories were reviewed. During this part of the process, we assessed the categories in relation to each other and the material, and necessary adjustments were made. Some categories described the same overarching concept and were merged, while others emerged as subcategories under a more general theme. The result is overarching descriptions that address the most prominent trends (similarities and differences) in the interview data, related to each of the research objectives.

4 Results

4.1 Road safety situation in the studied countries

In Table 1, we sum up the road safety situation in the studied countries or regions for 2021, including averages for Europe and Africa (cf. Nævestad et al. forthcoming). The final row includes the groups with the largest shares of killed road users (car= car driver). The numbers are based on estimates from WHO (2024). The estimates from WHO are different from the official numbers of fatal accidents reported by national authorities, especially in the African countries. In Tanzania, the WHO estimated number of road fatalities is seven times higher than the official number reported by national authorities.

Table 1 The road safety situation in the studied countries or regions for 2021, including averages for Europe and Africa†

	NO	SE	NL	GH	TZ	ZA	EUR	AFR
Road fatalities	82	217	600	8494	10052	3338	300	7295
Million population	5,5	10,4	17,5	32,8	63,6	19,5	11,1	38,6
Killed mill. capita	15	21	34	259	158	171	27	189
% killed road users	Car 52%, MC 19%	Car 56%, MC 14%	Cyclists 36%, Car 32%	MC 33%, Ped 31%	Car: 50%, MC 22%	Other/unknown: 48%, Car 35%	Car, MC, Cyclist	MC, Ped. Car

† NO: Norway, SE: Sweden, NL: The Netherlands, GH: Ghana, TZ: Tanzania, ZA: Zambia, EUR: Europe, AFR: Africa

As indicated by the table, the studied African countries have a far higher level of road fatalities per capita than the European countries. The largest difference is between Norway and Ghana, where the number of people killed in traffic per capita is 17 times higher.

4.2 Alignment with Safe system principles in road safety management

The first objective of the study is to examine the alignment with Safe System principles in the road safety management systems in each country.

1) Definition of the burden and nature of road casualties. It is important to note that the estimates from WHO in Table 1 above are different from the official numbers of fatal accidents reported by national authorities. This largely applies to the African countries. In Tanzania, the WHO estimated number of road fatalities is seven times higher than the official number reported by national authorities. In Ghana the WHO estimated number of road fatalities is 2,9 times higher than reported, while it is 1,5 times higher than reported in Zambia. In the European countries, the discrepancies are 2 fatalities (Norway), 7 fatalities (Sweden) and 12 fatalities (Netherlands). These numbers indicate underreporting of road fatalities in the African countries, and that the road accident statistics to a considerable extent are insufficient for effective road safety management. If the officially reported number of fatal road accidents is far lower than the actual numbers, the burden and nature of road casualties is only partly known for authorities. Thus, the basis of effective road safety measures; analysis of the number of accidents in certain areas at certain times, with certain road users etc. will be insufficient. Moreover, with uncertain statistics, it might also be challenging to arrive at reliable estimates of developments and trends over time and effects of counter measures. In contrast to the African countries, the European countries have high quality data on accidents, risk and non-accident-based Safety Performance Indicators (SPIs).

In contrast to the European countries, the African countries do not have monetary valuation of statistical life. Monetary values of statistical life are necessary in socio-economic assessments of infrastructure investments. The expected changes in accident costs (direct costs for damage, medical treatment, administration, loss of productive capacity, loss of welfare) are to be compared to other cost items (such as travel time savings/losses, environmental costs, etc.) that can be monetised. So, monetary values of statistical life are a necessary base for informed decisions on infrastructure investments. Thus, on this point, the policies of the African countries are not in accordance with the first Safe System principle of road safety management.

2) Commitment for road safety and support from decision makers. Data from the European countries indicate a relatively high commitment for road safety and support from decision makers. It was suggested, however, that there is not a "feeling of urgency" related to road safety, in European countries, e.g. compared with politicians' focus on climate change. Several interviewees in the European countries said that the focus on road safety among decision makers was higher a couple of decades ago. Some were however concerned that there was a high concern for mobility over road safety among politicians, and that the safety of pedestrians and cyclists was not given enough attention.

It is somewhat challenging to measure and assess commitment for road safety and support from decision makers through interviews, as most will agree that road safety is important. Support and commitment can be on the "linguistic" level (Schein, 2004) (reflected in statements that "road safety is important") but without actual implementation (i.e. "do not walk the talk"). One indicator is the therefore the extent to which road safety measures actually are implemented by decision makers in a given country (or whether expressed road safety commitment "is just talk").

Commitment for road safety and support from decision makers was, however, considered relatively high in the European countries, given that these countries have comprehensive institutional systems in place focusing on road safety, and relatively high public spending on road safety measures. Commitment for road safety and support from decision makers was generally rated far lower among the focus group participants in the African countries, although there were diverging views.

Another possible indicator of decision makers' commitment to road safety could be how important road safety is perceived as a priority among decision makers compared to other prioritizations. Funding of road safety was e.g. compared with funding during COVID-19 in African countries, or funding to address environmental problems in European countries. Some of the interviewees from the African countries said that with COVID, they saw a strong response from government, policy makers and private institutions.

3) Road Safety Policy. Vision Zero was adopted in Sweden in 1997, when the parliament passed the Road Traffic Safety Bill, stating that "No one will be killed or seriously injured within the road transport system". Vision Zero was also adopted as the basis for transport safety policy in 2001 by the Norwegian parliament in 2001. Moreover, The Netherlands implemented the "Sustainable safety" policy in 1998, stating that "The transport system shall be adjusted to the limitations and possibilities of road users". These road safety policies also involve several other key principles regarding shared responsibility, road system owner responsibility, meaning that the traffic system must be designed to tolerate (unintended) errors made by the road users, so that the external forces in accidents do not exceed the human bodies' tolerance for biomechanical impacts etc. i.e. the key principles that make up the Safe System approach. The African countries do not have visions and road safety policies like this (with the principles of Safe System when it comes to system owner responsibility), although it can be mentioned that Ghana's vision for road safety is to make Ghana the nation with the safest road transport system in Africa. When it comes to deficiencies, it is noted that the Ghanaian policy do not have specific targets related to SPIs and that the Tanzanian policies require a much-needed update and improvement.

4) Definition of Institutional Roles and Responsibilities. Sector responsibility for road safety (e.g. for public roads administrations) is established in the European countries, although it can be noted that the Dutch system involves far more freedom for e.g. regional authorities. Thus, it is more difficult to ensure that Sustainable safety actually is implemented at lower levels, by regional and municipal authorities. Additionally, national road safety committees exist, which follow up action plans targets, etc. When it comes to the African countries, responsible bodies are defined, but Tanzania stands out as an example where it is unclear which body has the main responsibility for road safety. The studied countries also have definitions of institutional roles and responsibilities for important functions of road safety management to be defined, i.e. who should be the responsible for the accident data register, road maintenance, vehicle inspection, vehicle register, driver training, driver testing, driving-license register, enforcement of traffic rules, emergency assistance, traffic safety analyses, research and documentation services, training of professionals. A crucial issue is however the coordination of these functions. In Norway, Sweden and the Netherlands, it occurs through sector responsibility or something relatively equal to that, and joint committees working with road safety action plans, with clear definition of responsibilities.

5) Identification of Road Safety Problems. As a basis for road safety actions and countermeasures, the road safety problems of the country should be identified in a systematic way. Norway, Sweden and the Netherlands have high quality data on exposure (e.g. person kms per year) and accidents to be able to calculate risk (number of injury accidents per person-kilometres per year) for different modes of transport. Based on this, countermeasures can target factors related to infrastructure, road user and vehicles when it comes to factors reducing exposure, probability of accidents (risk) and consequences of accidents. Additional non-accident-based Safety Performance Indicators (SPIs) are also relevant, as these are statistically related to accidents or injuries and indicate safety performance. SPI examples are: speed limit compliance, DUI rule compliance, seat belt use, share of cars with five Euro NCap stars etc. The European countries have a relatively good identifications of road safety problems, with measures of accidents, exposure and risk, including SPIs that are used actively. The European countries also have risk estimates and SPI numbers for different groups of the population, in different areas, at different times of the year, different days, hours etc. which allow for tailored countermeasures. Among the African countries, Ghana has defined SPIs in the road safety plan, but their status is not followed up systematically. The accident data in the African countries are less complete, as indicated by the discrepancies between official data and WHO (2024) estimated numbers. Good data on accidents and SPIs is a precondition for Safe system RSMS.

6) Road Safety Targets. The European countries have quantified targets related to the number of fatalities and severe injuries and quantified targets for SPIs related to all the different Safe System pillars. Ghana is about to set quantified targets related to the number of fatalities and severe injuries and several SPIs. Tanzania and Zambia do not have the same types of quantified targets.

7) Strategy, Action Plan. When the Road Safety Targets are in place, a Road Safety Strategy and Action Plan can be formulated. The action plan should: 1) be balanced (actions in all key areas); 2) have challenging, yet in principle achievable targets; 3) give priority to measures with known effectiveness; 4) consider costs and expected benefits; 5) be realistic (taking account of financial constraints); 6) have a timetable (Varhely, 2016). The European countries have action plans which seem to fulfil many of these criteria. The Swedish and Norwegian road safety plans largely fulfil these criteria. In the Netherlands, regional authorities make their own action plans, due to the Dutch decentralized

approach. Ghana and Zambia, also seem to fulfil these criteria to some extent, as they have action plans in line with the UN's decade of action for road safety. However, when it comes to the question of whether the action plans are alive, and whether the measures in the action plan are implemented in line with the plans, there seems to be an important difference between the European and the African countries.

8) Responsibility for Measures. The responsibility for each of the indicators/actions, as well as monitoring of performance and outcome of all the above should be allocated to one respective responsible body (Varhely, 2016). Additionally, the responsible bodies should receive incentives to ensure their commitment to the targets, and they should be given the authority to decide on how best to realize the targets. Responsibility is clearly allocated in the Swedish and Norwegian plans. The situation is a bit different in the Netherlands, where the road safety strategic plan highlights that each party operates on the basis of its own responsibility and knowledge. Moreover, the Dutch plan does not contain concrete measures, as these will be included in the national and regional implementation plans, prepared by the road authorities responsible. Responsibility for measures does not work properly in Ghana, as the action plans have no unique/dedicated budget for these activities. Instead, actions listed in the plans are to be funded with the operational funds of the agencies. The evaluation of the National Road safety strategy III, in Ghana, has revealed that this practice has partly led to the non-fulfilment of intended activities in the plans. And there is a lack of one responsible body to ensure all safety measures are monitored in Tanzania. This is not in accordance with Safe system principles.

9) Funding. In the European countries, most of the road safety measures in the road safety action plans are implemented by the public sector. Most measures are funded by general taxation, but large road investments (motor ways) are also funded by road users. Results from the African countries indicate that funding sources for road safety do not provide adequate funding for road safety activities. It is evident that funding of road safety activities is far from perfect in the European countries also, but the funding is far better than in the African countries. This is related to different economic conditions in the studied countries.

10) Measures with Known Effectiveness. Results from the European countries indicate that road safety policy to a considerable extent is evidence-based, and/or that measures in the action plans are not described in detail which makes it hard to draw any strict conclusions on their known effectiveness. Moreover, lack of stakeholder knowledge about the effectiveness of various measures is a major challenge (Varhely, 2016). Our data seem to indicate that the situation is worse in the African countries. Finally, it is also important to note that even if countermeasures have been tested in various countries, they should also be tested in the country in question, since there may be differences in geographical settings, traffic culture, regulatory aspects, norms and other preconditions that may influence the effect of any countermeasure (Varhely, 2016).

11) Monitor Performance. The status of target indicators should be monitored on a yearly basis, and feedback on their performance should be given to the responsible bodies and to the national coordinating body; if any of them does not develop in the right direction, suitable countermeasures should be taken. In Norway, Sweden and the Netherlands, there are annual reports and meetings on the status of road safety and the status of measures in the action plans. In the African countries the document study indicates that the safety performance is monitored regularly. However, the focus group interviews do not indicate that there is such systematic monitoring of accidents, and safety performance indicators related to all the Safe System pillars, like in the European countries. In Ghana, the need for such indicators and their usefulness was recognised, but no data was collected on performance indicators. In Zambia, other than speed cameras and police checkpoints, there were not mentioned any systematic monitoring of road safety performance indicators by a government body in the focus group interviews. One of the participants exclaimed that: "It is difficult to know if you are improving or not, if you do not have good data. We cannot evaluate if you have improved or underperformed."

12) Research and Capacity Building. Comparing the different levels of road safety research in the studied countries, it is evident that there is far more road safety research in the European countries, with large and nationally funded research programs over several years. This is not present in the African countries to the same extent.

5 Discussion

5.1 What are the main differences between the African and European countries?

5.1.1 Insufficient systematic approach in the African countries

The first objective was to examine alignment with Safe System principles for road safety management. The European countries' road safety management systems are mainly in line with the Safe Systems principles for road safety management, as described by Varhelyi (2016). This is not surprising, as Pillar 1 in Safe System largely is based on what these countries do, including principles from occupational safety management (e.g. the Haddon matrix).

First, the African countries do not have visions and road safety policies like Vision Zero or Sustainable safety, e.g. with the principles of Safe System when it comes to system owner responsibility, forgiving and anticipating road system etc. However, Safe System implementation is not just about vision, it concerns the continuous improvement process: "Plan-Do-Check-Adjust", which Varhelyi (2016) presents a nuanced and extensive presentation of. What the European Safe System countries have in common is an ongoing continuous improvement process; with alignment between formal and informal aspects of RSM. They have:

1) Relatively good statistics and data on accidents, exposure and risk for different groups,
2) Comprehensive safety performance indicators (SPSIs) measuring all Safe system pillars,
3) Quantified targets related to SPIs,
4) Strategies and action plans to improve the SPIs to reach the targets,
5) Relatively clearly defined responsibilities for implementation of the measures in the action plans and
6) The status of all the SPIs targets is monitored annually and reported in public reports.

The African countries do not have this continuous improvement process to the same extent. The last road safety policies from Tanzania are e.g. from 2009. As noted, the accident data in the African countries are less complete, as indicated by the discrepancies between official data and WHO (2024) estimated numbers. Good data on accidents and SPIs is a precondition for Safe system RSMS, as noted in step 1 and 2 of the continuous improvement process listed above.

5.1.2 Lower level of implementation of existing plans

Previous research indicates that the weakest components of RSM systems in Europe are policy implementation and funding, and the lack of knowledge-based road safety policy making (Alfonsi et al., 2016). This applies to an even greater extent in the studied African countries. Ghana and Zambia have formal road safety strategies in place, with SPIs related to different Safe system pillars, but the status for these SPIs is not followed up, neither are the effects of different measures evaluated. Thus, when it comes to the question of whether the road safety action plans and strategies are living systems that are used in practice, and whether the measures in the action plan are implemented in line with the plans, there seems to be an important difference between the European and the African countries. The African data indicates challenges related to implementation of the plans, while the action plans seem to be far more "alive", i.e. implemented in the European countries. Thus, there seems to be a larger discrepancy between formal and informal aspects of road safety management (cf. Antonsen, 2009) in the African countries; between plans and implementation.

5.2 How can we explain the differences between European and African countries?

Preliminary results and previous research indicate that this discrepancy between formal and informal aspects of road safety management, which is the main difference between the European and African countries can be attributed to: 1) limited financial and human resources in the African countries, 2) insufficient commitment and support for road safety among decision makers, in a situation with scarce resources, where road safety competes with other concerns, and 3) The institutional capacity of road safety agencies and stakeholders in the African countries is too weak. These issues will be studied in the continuation of the project.

5.3 Possible policy implications for the African countries

Based on the preceding discussion of preliminary results, we develop general recommendations as to how the three studied African countries can learn from the studied European Safe System countries in their road safety management. These are:

1) Establish a lead agency with coordinating responsibility for road safety, and a monitoring and coordination forum, consisting of the parties involved in road safety work.
2) Base the general road safety strategy on Safe System and Vision Zero, and work systematically with the Safe System pillars, as described in the following points:
3) Improve the collection of road accident statistics and data, as this is a basic premise of an effective road safety management system.
4) Establish comprehensive safety performance indicators (SPIs) measuring all Safe System pillars, and monitor and report the status of these at least annually.
5) Set quantified targets related to accidents and SPIs measuring all Safe System pillars.
6) Develop strategies and action plans to improve the SPIs to reach the targets. Choose the most effective and relevant measures based on scientific research.
7) Provide a clear definition of responsibilities for implementation of the measures in the action plan.
8) Monitor and report annually the status of the measures and their effectiveness when it comes to fulfilling the targets.

We also provide recommendations taking impeding factors into account. Given the factors impeding road safety management system implementation in the studied African countries, e.g. economical conditions, insufficient institutional robustness etc., it might be more realistic to start off in a smaller scale than suggested above. At least a smaller scale approach seems to be more realistic as an immediate approach, while building institutional robustness and a systematic continuous improvement approach is a more long term project. The same applies to e.g. improving national economy, as we have seen that poor economy is an important constraining factor. Thus, the point of departure for the recommendations taking impeding factors into account is e.g. resource scarcity, which requires prioritizations.

With this in mind, we recommend to choose one main road safety challenge and have a primary effort on this (e.g. pedestrian fatalities). It is probably also necessary to focus on certain routes, areas or destinations (e.g. schools). This means to have a living continuous improvement process related to one main challenge in one limited area; to implement Safe System elements related to one specific issue in a given area, instead of a “total makeover”. If resources only allow a full continuous improvement process in one geographical region, that might also be possible. We presuppose that this is possible, with limited resources. Thus, this means to follow the continuous improvement steps we have described with respect to one road safety challenge in one specific area. It might also be possible to implement the steps within one organisation.

Finally, it is important to note that neither the European countries fully comply with the Safe system principles in general (although they seem to be relatively well aligned with the principles for Pillar 1 Road safety management). Focusing on speed limits, road design, road maintenance, vehicle safety and road user compliance with road traffic law, Elvik (2023) states that estimates for Norway indicate that by complying perfectly with Safe System principles in all these areas, the number of fatalities could be reduced by 50–70%. This indicates that road safety improvement is an ongoing process which requires constant attention, and which never is finished.

6 Conclusion

Preliminary results indicate that the European countries’ road safety management systems are mainly in line with the Safe Systems principles for road safety management. In contrast to the European countries, we find an insufficient systematic approach and a lower level of implementation of existing plans in the African countries. The lack of good data on killed and severe injured road users, including road safety indicators in the African countries is also an important difference and challenge. This is a crucial premise of the continuous improvement approach in the European countries. Preliminary results and previous research indicate that lacking Safe system implementation in the African countries that were studied seem to be related to low institutional road safety influence and lacking funding. Finally, Green et al. (2024) note that Safe System application continues to be a challenge, and that putting Safe System into practice requires a clearer concept and policy. We hope to contribute to clarifying what Safe system implementation

means in practice through our illustration and discussion of Pillar 1 implementation, defined through the 12 steps of Varhelyi (2016).

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Appendix 1:

Appendix 1: Types of organisations and functions in each country

Country	Number	Types of organisations, functions
Norway	11	NGO, authorities, researcher
Sweden	7	Authorities, NGO
Netherlands	7	Road safety authority, researcher, NGO
Ghana	25	Authorities, researchers, NGOs
Zambia	11	Authorities, researchers, NGOs
Tanzania	12	Authorities, researchers, NGOs working with road safety
Total	73	Authorities, researchers, NGOs

7 References

Academic Expert Group (2020) Saving lives beyond 2020: the next steps: Recommendations of the Academic Expert Group for the 3rd Global Ministerial Conference on Road Safety. https://www.roadsafetysweden.com/contentassets/c65bb9192abb44d5b26b633e70e0be2c/200113_final-reports ingle.pdf

Alfonsi, L., Persia, L., & Tripodi, A. (2016). Advancements in road safety management analysis. In *Proceedings of the 6th Transport Research Arena*, Warsaw.

Antonsen, S. (2009). The relationship between culture and safety on offshore supply vessels, Safety Science, 47

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Elvik, R. (2023). What would a road safety policy fully consistent with safe system principles mean for road safety?, Accident Analysis & Prevention, Volume 193

Elvik, R., & Nævestad, T.-O. (2023). Does empirical evidence support the effectiveness of the Safe System approach to road safety management? *Accident Analysis & Prevention, 191*, 107227. https://doi.org/10.1016/j.aap.2023.107227

Elvik, R., Høye, A., Vaa, T., & Sørensen, M. (2009). *The Handbook of Road Safety Measures* (2 ed.). Emerald Group Publishing Limited.

Gitelman, V. and Doveh, E. (2016) Investigating Road Safety Management Systems in the European Countries: Patterns and Particularities. *Journal of Transportation Technologies*, *6*(5), 378-404. https://doi.org/10.4236/jtts.2016.65032

Green, M. C. Muir, J. Oxley, A. Sobhani (2022) Safe System in road safety public policy: A case study from Victoria, Australia, IATSS Res., 46 (2022), pp. 171-180

Green, M. C. Muir, J. Oxley (2024) What is the purpose? Practitioners' perspectives of the Safe System approach to road safety in Australia, IATSS Research, Volume 48, Issue 1, pp. 84-99,

ITF (2016), *Zero Road Deaths and Serious Injuries: Leading a Paradigm Shift to a Safe System*, OECD Publishing, Paris, https://doi.org/10.1787/9789282108055-en.

ITF (2022). *The Safe System Approach in Action: Road-safety management and capacity building in Cameroon.* https://www.itf-oecd.org/sites/default/files/itf-safe-system-case-study-cameroon.pdf

Khan, N., S. Das, (2024). Advancing traffic safety through the safe system approach: A systematic review,Accident Analysis & Prevention,Volume 199,

Muhlrad, N., Vallet, G., Butler, I., Gitelman, V., Doveh, E., Dupont, E., Thomas, P., Talbot, R., Papadimitriou, E., Yannis, G., Persia, L., Giustiniani, G., Machata, K., & Bax, C. (2014). Analysis of road safety management systems in Europe. In *Proceedings of the Transport Research Arena 2014*. Paris.

Muhlrad, N, Gitelman V, Buttler I. (Ed) (2011). Road safety management investigation model and questionnaire, Deliverable 1.2 of the EC FP7 project DaCoTA

Nævestad, T.-O. (2010). *Cultures, Crises and Campaigns: Examining the Role of Safety Culture in the Management of Hazards in a High-Risk Industry*. Ph.D. Dissertation, Centre for Technology, Innovation and Culture, Faculty of Social Sciences, University of Oslo, Oslo, Norway.

Nævestad, T.-O. et al (forthcoming) *Deliverable 2.1: State of road safety management in selected African countries—review and recommendations, AfroSAFE report.*

Schein, E. H. (2004). *Organizational culture and leadership* (3rd ed.). San Francisco: Jossey-Bass.

Varhelyi, A. (2016). Road safety management–the need for a systematic approach. *The Open Transportation Journal, 10*(1), 137-155 https://doi.org/10.2174/1874447801610010137

WHO (2023, December 13). *Road Traffic Injuries*. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries

WHO & United Nations Regional Commissions. (2021). *Global plan for the decade of action for road safety 2021-2030.* World Health Organization. https://cdn.who.int/media/docs/default-source/documents/health-topics/road-traffic-injuries/global-plan-for-road-safety.pdf?sfvrsn=65cf34c8_35&download=true

WHO (2024) Country profiles: https://www.who.int/teams/social-determinants-of-health/safety-and-mobility/global-status-report-on-road-safety-2023