Economic evaluation of road safety measures:

What can be learned from past approaches, and can they be transferred to the African context?

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Outline

- What is economic evaluation?
- How can it be done?
- What information is needed?
- What are fallback options?
- Transferable to Africa?

Economic evaluation

Economic evaluation = the balance between upsides (benefits) and downsides (costs) of some possible actions.

Reasons to set up economic evaluations of road safety investments:

- Justify (public) money spending
- Establish priority between projects

Economic evaluation

Typical methods:

- Cost-effectiveness analysis
- (Social) Cost-Benefit analysis
- Cost-utility analysis
- Multicriteria analysis

Cost Effectiveness Analysis

- *Costs per crash prevented (for each severity category separately)*

Cost Benefit Analysis

- *Net present value (benefits – costs)*
- *Cost benefit ratio (benefit / costs)*

What information is needed?

What information is needed?

- Cost of the measure
- Target crashes
- Expected effect of the measure
- (for CBA): valuation of the effect

Costs?

- Weakly available in literature
- Change over time
- Dependent on local market conditions
- Should be available to the decision-maker

Target crashes?

- Depend on the measure under study:
  - Infrastructure => local
  - Education/awareness raising: area-wide
- Crash data need to be available

Effects?

- Scientific literature (Researchgate...)
- Handbook of road safety measures (Elvik et al.)
- CMF Clearinghouse (https://www.cmfclearinghouse.org/)
- SafetyCube (www.roadsafety-dss.eu)

SafetyCube DSS

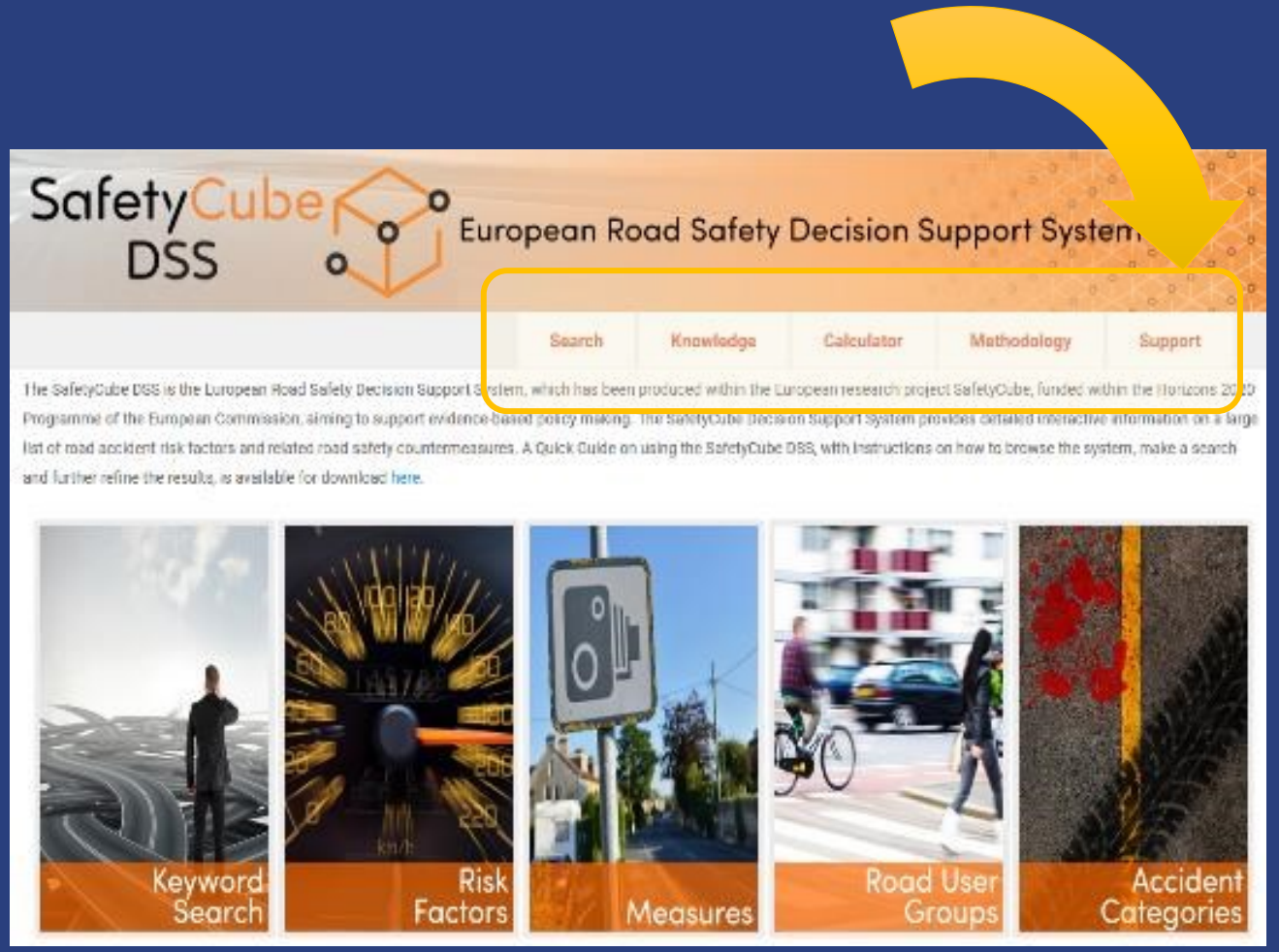
Search
Risk Factors & Measures

Knowledge
211 Synopses, Serious Injuries, Accident Scenarios

Calculator
Economic Efficiency Evaluation

Methodology
System documentation

Support
ntact, help, feedback



www.roadsafety-dss.eu

Synopsis

Key conclusion

Overview

Scientific summary

Supporting background

For risk factors and counter-measure

Effect of traffic volume on road safety: ● *RED (RISKY)* -

Most of the reviewed studies find higher traffic volumes to be associated with a net increase in crashes. However, the crash increase is less than proportional to traffic volume increases, indicating a lower risk for each road user. The effect of traffic volume on crash occurrence appears to differ between crash types. The studies reviewed concern motorways

Congestion as a risk factor: ● *YELLOW (PROBABLY RISKY)* -

Some studies find congestion to be associated with adverse road safety outcomes, but this finding is not consistent across studies and conditions investigated. The effects might differ based on the crash types and/or congestion indicators considered. All reviewed studies concern motorways

Absence of access control: ● *RED (RISKY)* -

Absence of access control seems to have negative effects on road safety. More access points on road segments is mostly negatively associated with road safety, and a greater distance between an intersection and the nearest driveway (corner clearance) has positive effects on road safety.

Occurrence of Secondary crashes: ● *YELLOW (PROBABLY RISKY)* -

The presence of a crash or an incident can contribute to the occurrence of additional (secondary) incidents or crashes. The prevalence of secondary crashes, and the factors contributing to their occurrence is unclear, as this varies between studies. The available literature concerns motorways in the United States

Risks associated with the distribution of traffic flow over arms at junctions: ● *GREY (UNCLEAR RESULTS)* -

There was an adequate number of studies investigating the risk factor 'distribution of traffic flow over arms at junctions', but it was rarely the main variable of interest included in the crash models. Furthermore, the risk factor was not expressed in a consistent way across the studies, resulting in an unclear picture of its overall effect.

Quantification of benefits

What is the value of having 1 crash less?

STANDARD VALUES PER COST COMPONENT AND TYPE OF CASUALTY/CRASH (Europe)

	Medical costs	Production loss	Human costs	Property damage	Administrative costs	Other costs	Total (unit) costs
Fatalities	€ 5,430	€ 655,376	€ 1,587,001	€ 11,555	€ 6,346	€ 3,638	€ 2,269,346
Serious injuries	€ 16,719	€ 43,627	€ 230,385	€ 7,622	€ 4,364	€ 413	€ 303,130
Slight injuries	€ 1,439	€ 2,669	€ 15,597	€ 5,317	€ 1,876	€ 519	€ 27,418
Fatal crashes	€ 11,757	€ 727,616	€ 1,809,467	€ 17,542	€ 8,891	€ 3,817	€ 2,579,089
Serious injury crashes	€ 19,158	€ 50,285	€ 263,945	€ 11,143	€ 5,557	€ 709	€ 350,796
Slight injury crashes	€ 1,957	€ 3,629	€ 21,212	€ 7,231	€ 2,677	€ 634	€ 37,340
PDO crashes	€ 0	€ 0	€ 0	€ 2,795	€ 764	€ 400	€ 3,960

Cost-Benefit Analysis (CBA)

Monetarisation of costs and benefits

$$Benefits_n = \sum_s TargetCrashes_s * Effectiveness_s * Crashcost_s$$ (s= severity levels)

Future costs and benefits are expressed in Net Present Values (NPV) by applying discount rates (applied DR = 2.5%)

$$\text{NPV} = \sum_{n=1}^{N} \frac{nominal\ value}{(1+discount\ rate)^n}$$

Possible to account for – positive and negative – side effects, e.g. environmental or mobility impacts

Two indicators used for prioritisation

- Benefit-cost ratio (benefits/costs)
- Net present value (benefits – costs)

An example

A road authority considers to install an enforcement camera at a certain intersection

- Avg Annual number of crashes : 2 crashes with serious injuries
- Effectiveness : crash reduction 12%
- Crash costs: 332 000 € / serious injury crash

$Benefits_n = \sum_s TargetCrashes_s * Effectiveness_s * Crashcost_s$ (s= severity levels)

= 2*0.12*332 000 = 79 680 €

- Annual avg cost for installation and maintenance of the camera: 10 000 €

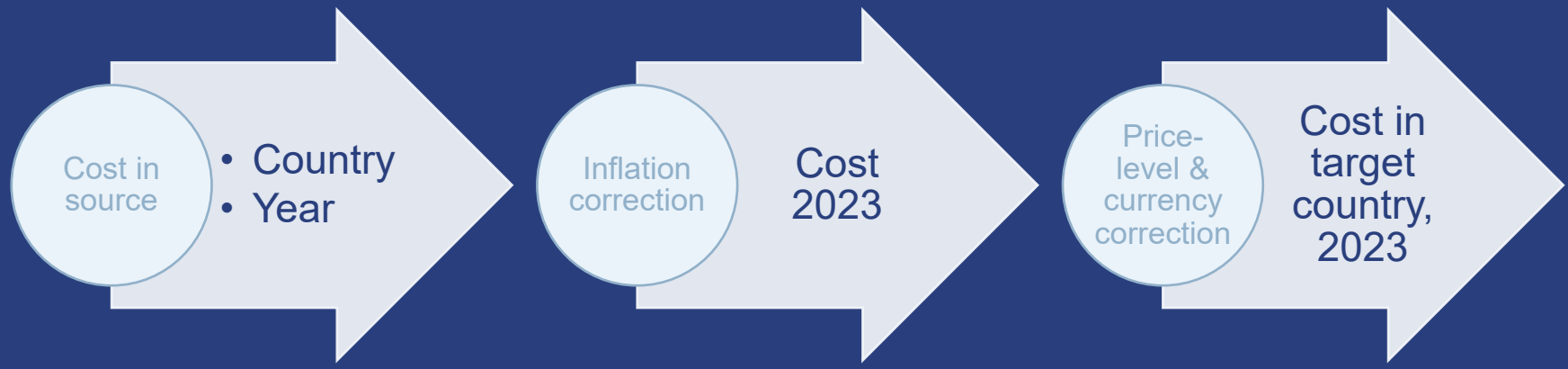
- Benefit-cost ratio (benefits/costs) = 7.97
- Net present value (benefits – costs) = 69 680 €

SafetyCube: an attempt for a standardized approach

- New/updated CBA for 29 different road safety measures
- Common method for estimating crash costs
- All costs and benefits in EUR EU 2015 Purchasing Power Parity
- Showing uncertainty by carrying out sensitivity analyses
  - Lower-than-expected and higher-than-expected effects (95% CI limits)
  - Measure costs -50% and +100%
  - ‘worst case’ and ‘ideal case’ scenarios
- Summary documents for every measure with description of assumptions

Value transfer

Costs for counter-measures can be adjusted from one country to another, by means of *value transfer*.



Transferability to Africa?

- Ideally (longer term):
  - Replicate effect evaluation studies
  - Determine own VoSL
  - Perform CBA
- Short term:
  - Use existing effectiveness studies
  - Select the most applicable
  - Perform economic evaluation

Conclusions

- Economic evaluation can help to make rational decisions
- Results are dependent on input values => GIGO
- Why not applying this to African contexts?
- Much room for proper research

Thank you! Questions?