EvalForward

Evaluation for Food Security, Agriculture and Rural Development

COST-BENEFIT ANALYSIS IN EVALUATION:

OVERVIEW ON OPTIONS AND APPLICATIONS

Silvia Vignetti

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CSIL Centre for Industrial Studies
Corso Monforte 15, 20122 Milan, Italy
tel.+39 02 796630
www.csilmilano.com

OUTLINE

1 THE **EFFICIENCY CRITERION** AND RELATED CHALLENGES

2 **COST-BENEFIT ANALYSIS** TO ADDRESS EFFICIENCY

3 **ONE EXAMPLE**

4 **FINAL REMARKS**

EFFICIENCY: DEFINITION

The extent to which the intervention delivers, or is likely to deliver, results in an **economic** and **timely** way

HOW WELL ARE RESOURCES BEING USED?

Note: "**Economic**" is the conversion of inputs (funds, expertise, natural resources, time, etc.) into outputs, outcomes and impacts, in the most cost-effective way possible, as compared to feasible alternatives in the context. "**Timely**" delivery is within the intended timeframe, or a timeframe reasonably adjusted to the demands of the evolving context. This may include assessing operational efficiency (how well the intervention was managed).

Economic efficiency is used here to refer to the absence of waste and the conversion of inputs into results in the most cost-efficient way possible. (…) This also involves evaluating the extent to which **appropriate choices** were made, and trade-offs addressed in the design stage and during implementation. These choices include the way that resources were allocated between target groups and time periods, as well as the options that were available for purchasing inputs according to market conditions.

Source: OECD-DAC principle

EFFICIENCY: DEFINITION

Efficiency considers the resources used by intervention for the given changes generated by the intervention (which may be positive or negative).

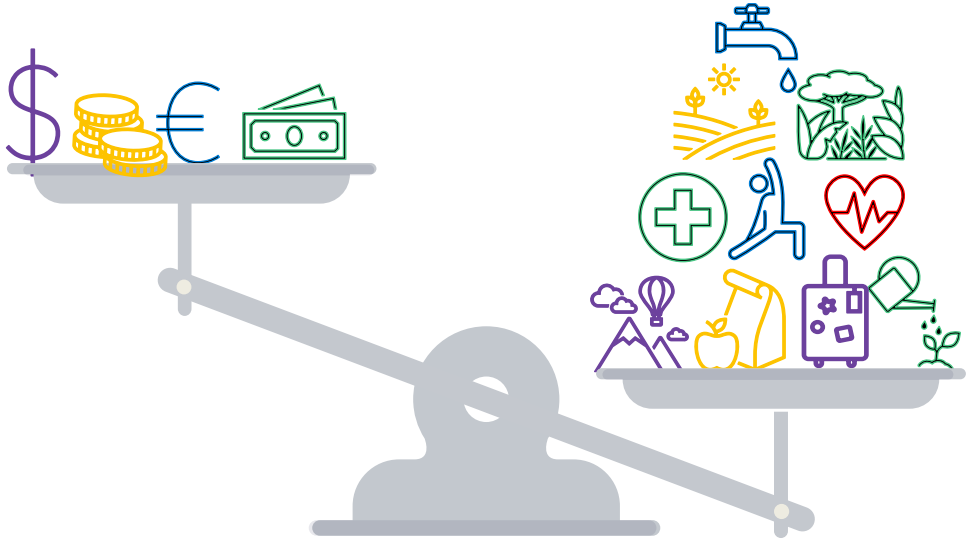
Differences in the way an intervention is approached and conducted can have a significant influence on the effects, making it interesting to consider whether other **choices** (e.g. as demonstrated by different Member States) achieved **the same benefits at less cost** (or greater benefits at the same costs).

Source: Better Regulation Toolbox, 2021

KEY ELEMENTS

Efficiency is about **choices** between feasible alternatives that can deliver similar results within the given resources. Before comparisons can be made, alternatives must be identified that are genuinely **feasible** and **comparable** in terms of quality and results.

A proper comparison requires a **common numeraire or base value**



Most of them -ESPECIALLY BENEFITS- are **INTANGIBLE in nature**

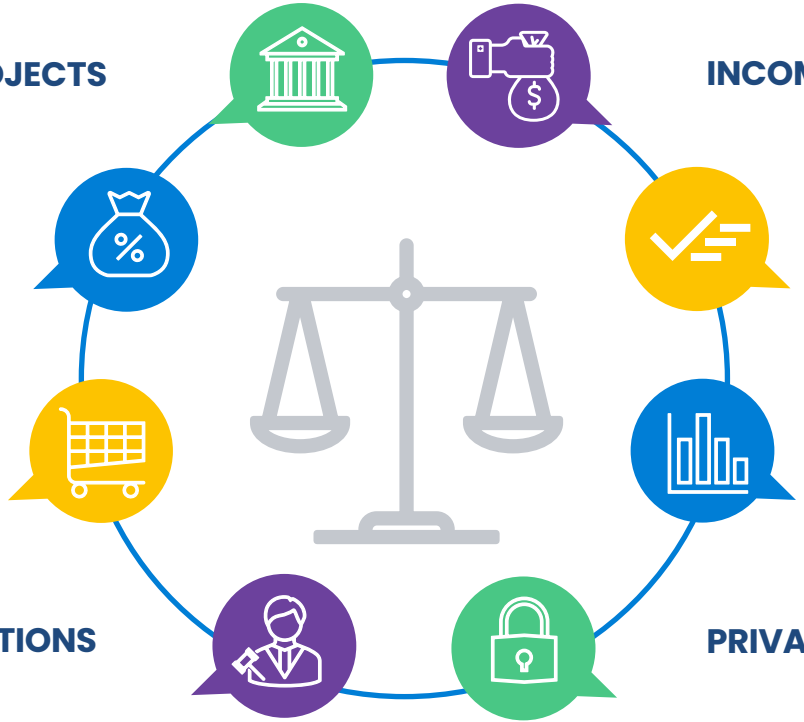
MAY COST-BENEFIT ANALYSIS OFFER A SOLUTION?

The purpose of CBA is to provide a consistent procedure for evaluating decisions in terms of their consequences

Dréze and Stern, 1987
in Auerbach and Feldstein,
"Handbook of Public Economics",
North-Holland.

- CBA is an analytical tool to appraise an investment decision in order to assess the welfare change attributable to it
- Desirability is achieved when the total benefits of an intervention, to whomsoever they occur, exceed the total costs of that intervention.
- The purpose of CBA is to inform and support the decision-making on resource allocation, calculating the convenience for society of a particular intervention against possible alternatives.

CAN BE APPLIED IN DIFFERENT FIELDS



In principle, **any change in the world can be discussed in terms of CBA**

A LONG HISTORY AND MANY TRADITIONS

1850s, France

Annales des ponts et chausseès
(starting in 1831)
On the measurement of the utility of public works by Jules Dupuit (1844)

USA, 1930s

Flood Control Act (1936)
First practical guidelines

1950s, USA

Attempts to codify the Benefit-Cost rules
U.S. Army Corps of Engineers, Department of Agriculture, Bureau of Reclamation, Federal Power Commission
Proposed practices for economic analysis of river basin projects - Green book (1950)

UNIDO, OECD, World Bank, 1970s

Guidelines for project evaluation, UNIDO (1972)
Project appraisal and planning for developing countries by I.M.D. Little and J.A. Mirrlees, OECD (1974)
Economic analysis of projects by L. Squire and H.G. van der Tak, World Bank (1975)

1990s, European Commission

Regulatory requirement to carry out CBA for major infrastructure projects co-financed with Structural and Cohesion Fund until 2020

CBA IN A NUTSHELL

1. Enumerate all direct costs and benefits to society (directly experienced, **first-order effects**) of a particular public intervention along a given time-horizon
2. Costs and benefits must be **incremental,** use a proper counterfactual
3. Assigns to direct costs and benefits a **monetary equivalent (shadow prices)**
4. Discount future values and capitalise past values to a Net Present Value
5. Compare costs and benefit flows
6. If the net result is positive, the intervention is desirable

SHADOW PRICES: DEFINITIONS

"Shadow prices are prices indicating the **intrinsic or true value** of a factor or product in the sense of equilibrium prices. These prices may be different for different time periods as well as geographically separate areas and various occupations (in the case of labour). **They may deviate from market prices**."

J. Tinbergen

*"A shadow or accounting price.... is the price the economist attributes to a good or factor on the argument that it **is more appropriate for the purposes of economic calculation** than its existing price if any."*

E.J. Mishan

SHADOW PRICES

- Reflect true values (marginal social value of a good) of input and output

- Market prices do not correctly reflect relative scarcities, benefits, and costs in some circumstances (e.g. market failures, asymmetry of information, externalities, public goods, etc.)

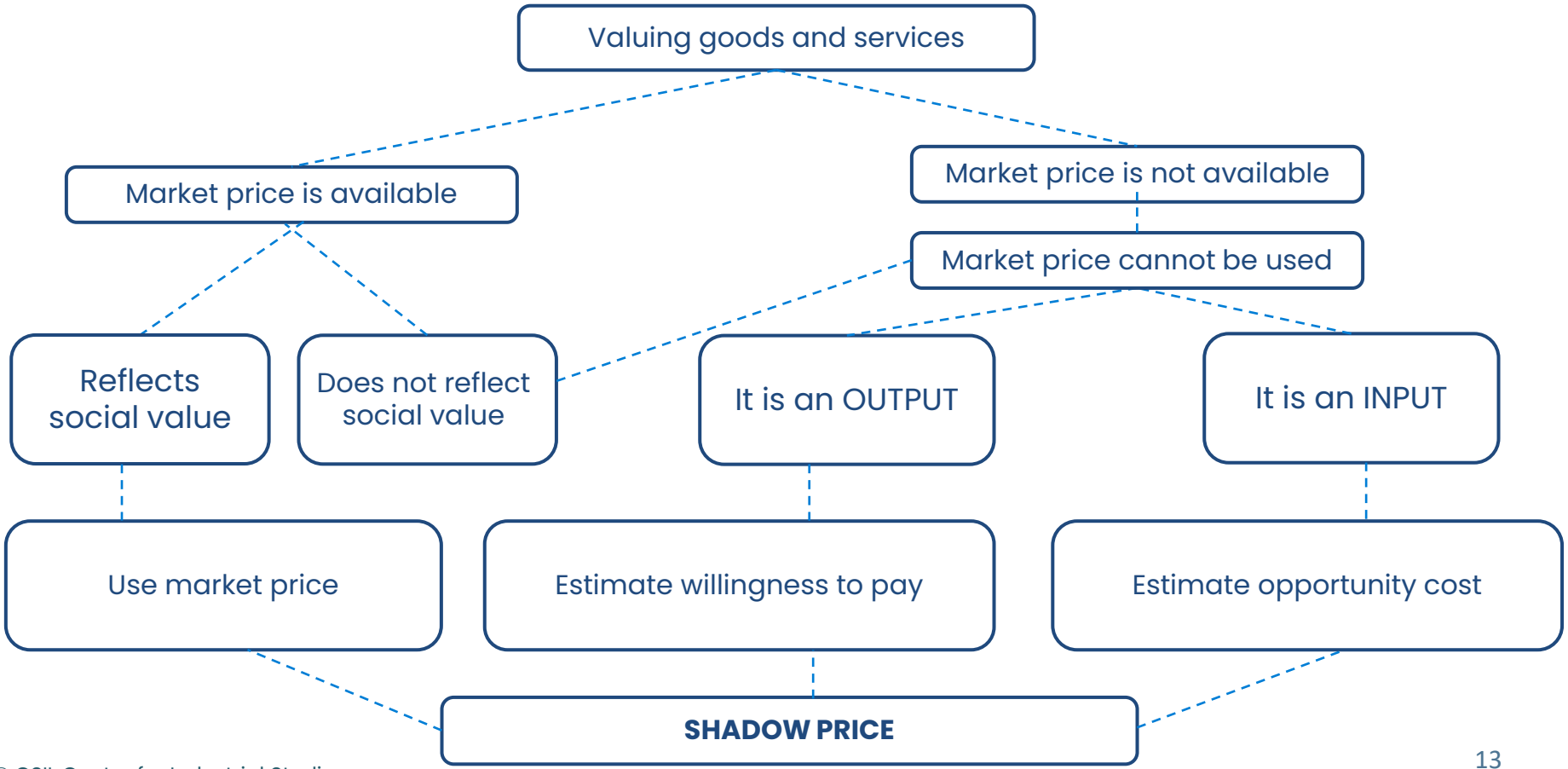
- Empirically, shadow prices can be proxied either by **opportunity cost** or **willingness to pay** or a combination of these two concepts

OPPORTUNITY COST AND WILLINGNESS TO PAY

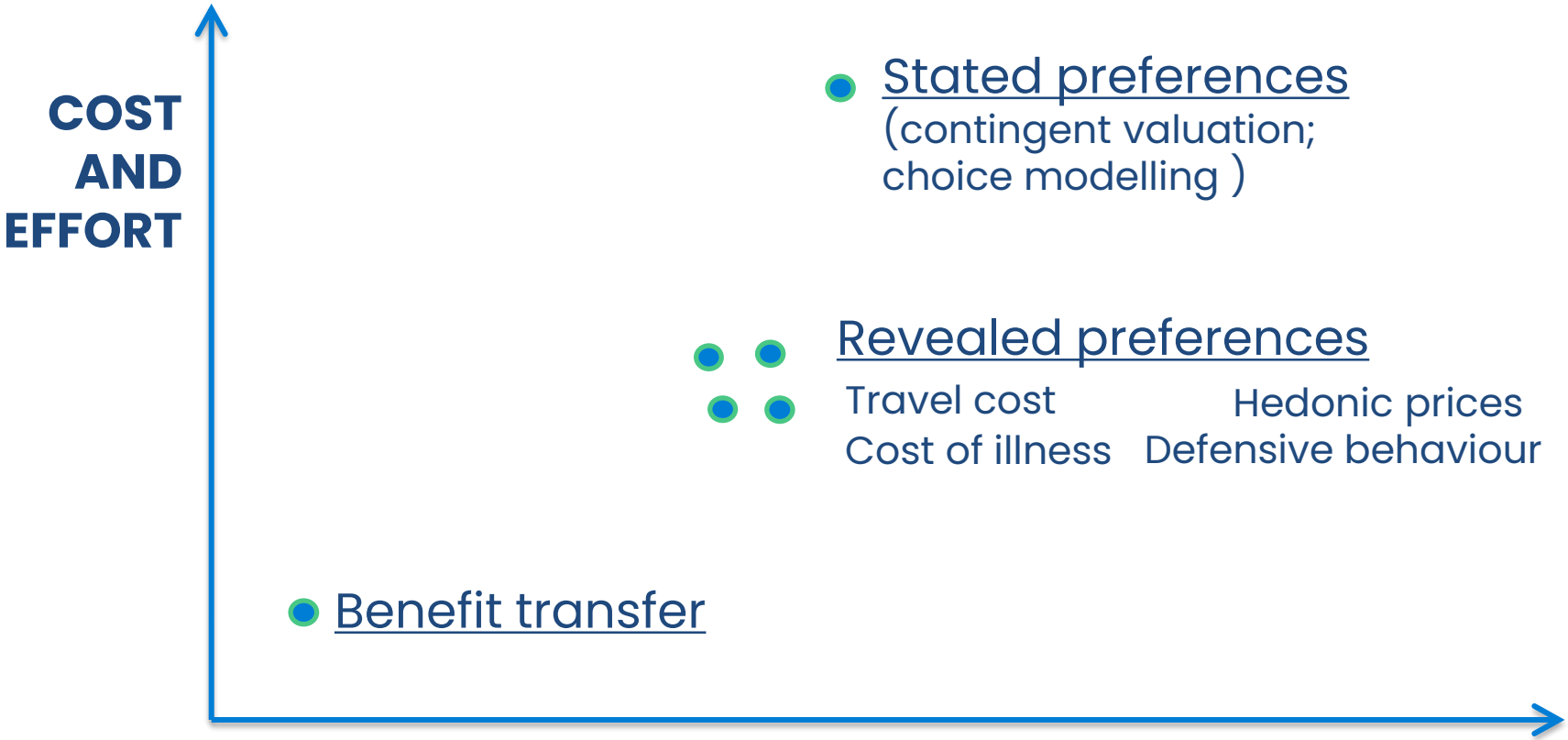
- The **opportunity cost** of a good or service is defined as the potential gain from the best alternative forgone when a choice needs to be made between several mutually exclusive alternatives. Commonly used for **INPUTS**

- **Willingness to pay** (WTP) is the maximum amount people would be willing to pay for a given outcome they view as desirable. Commonly used for **OUTPUTS**

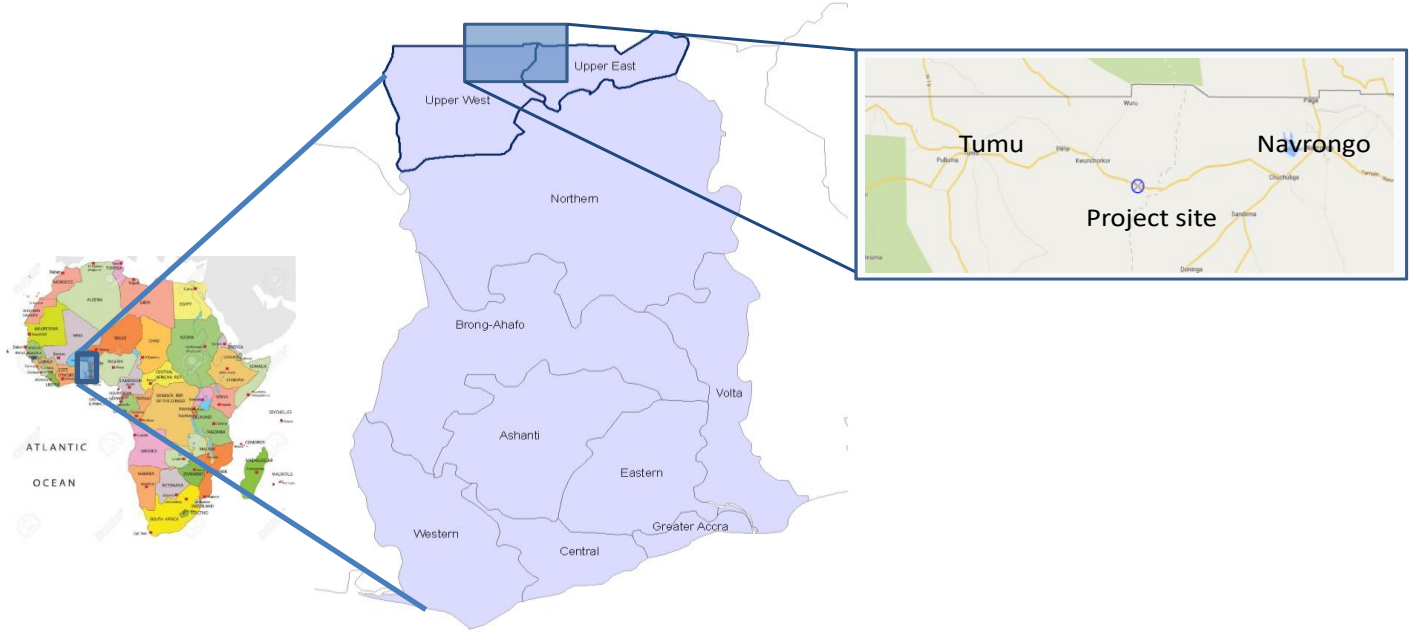
SHADOW PRICES



TECHNIQUES FOR SHADOW PRICE ESTIMATION



ONE EXAMPLE: CBA OF THE NAVRONGO-TUMU ROAD



WHERE

Ghana

WHEN

2011-2014

WHAT

Reconstruction of a 25 km section of a road, upgraded to a 2-lane single carriageway with shoulders and a double bituminous surface dressing

CONTEXT AND BACKGROUND

WHO

Implemented by the Ghana Highway Authority costing approx. 30 MGHC

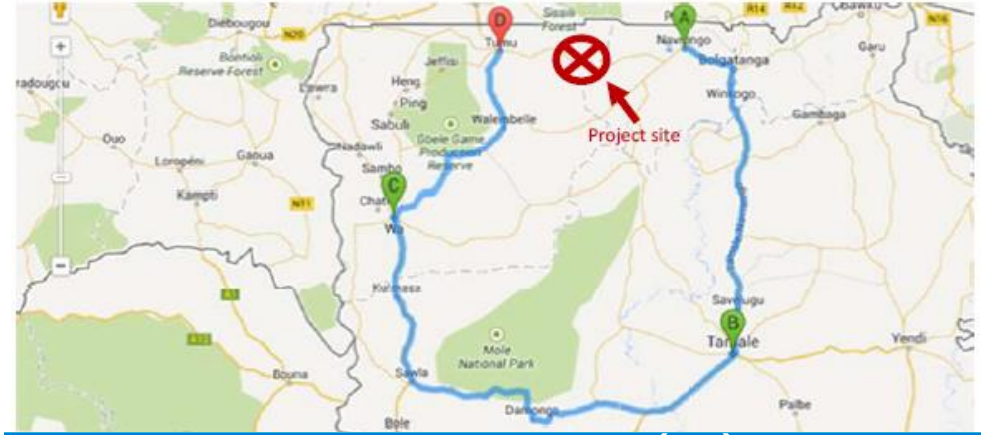
WHY

Improve the poor conditions of the road which worsened during the rainy season, with holes and stones interrupting it in many spots and causing severe accessibility problems to the local community

BENEFITS FOR WHO?

A large share of local people, especially the poorest, children and women, use the road to access primary public infrastructure and services

VEHICLES DEMAND



Using national roads

TRAFFIC DATA

- 85,500 total passengers in 2015, of which 90% existing traffic, 6% generated, 4% diverted
- 135,455 total passengers in 2035, of which 88.5% existing traffic, 7% generated, 4.5% diverted

	AADT (2011)	AADT (2015)	AADT (2025)	AADT (2035)
Cars	31.2	35.2	47.2	54.8
Taxis	0.8	-	-	-
Pick-ups/Van	114.8	129.2	173.7	201.5
Small bu	13.7	15.4	20.7	24.0
Medium bus/Mummy Wagon	5.3	6.0	8.0	9.3
Large bus	3.9	4.4	5.9	6.9
Light Truck	13.0	14.6	19.7	22.8
Medium Truck	0.7	0.8	1.1	1.3
Heavy Truck	3.1	3.5	4.6	5.4
Semi-Trailer (Light)	0.7	0.8	1.1	1.3
Semi-Trailer (Heavy)	-	-	-	-
Truck Trailer	-	-	-	-
Others	0.8	0.9	1.3	1.5
Total	**188.2**	**210.8**	**283.3**	**328.8**

NON-VEHICLES DEMAND

AADT EXISTING PEDESTRIAN, CYCLES AND MOTORBIKES

	AADT (2011)
Pedestrian	364
Cycles	354
Motor bikes	87

AADT FOR GENERATED NON-VEHICLE TRAFFIC

	AADT (2015)
Pedestrian	20
Cycles	77
Motor bikes	19

NON-VEHICLE TRAFFIC GROWTH RATES

PEDESTRIAN, CYCLES AND MOTORBIKES	
2015-2025	3.0%
2026-2035	1.5%

COSTS AND BENEFITS

Social benefits

- **Vehicle operating costs** (VoC) savings: the costs borne by owners of road vehicles to operate them, including fuel consumption, lubricants consumption, tires deterioration, repair and maintenance costs, insurance, overheads, administration
- **Time savings:** the reconstruction of 25 km of road is expected to produce a time saving for each existing and additional trip

Social costs

- **Increase in emissions**: vehicle emissions will increase, producing negative encironmental effects
- **Accidents**: all road projects imply a risk for the users of suffering an accident, it includes both direct and indirect costs

TRAVEL TIME SAVINGS

TRAVEL TIME AND TIME SAVINGS (MINUTES)

Traffic time	WITH	WITHOUT	SAVING
Existing vehicles	29	50	21
Generated vehicles	29	50	21
Diverted vehicles	70	190	120
Existing pedestrians	302	320	18
Generated pedestrians	302	320	18
Existing cycles	246	270	24
Generated cycles	246	270	24
Existing motorbikes	159	180	21
Generated motorbikes	158	180	21

BREAKDOWN OF BENEFITS OF TIME SAVINGS BY CATEGORIES OF TRAFFIC

	% OVER TOTAL VoT SAVING
Existing pedestrian	18.56
Generated pedestrian	0.45
Existing cycles	18.79
Generated cycles	1.82
Existing vehicles	41.99
Generated vehicles	2.15
Diverted vehicles	9.54
Existing motorbikes	6.09
Generated motorbikes	0.59

VEHICLE OPERATING COST SAVINGS

VoC (GHC/km)

	WITH	WITHOUT	SAVING
VoC vehicles	0.68	1.05	0.37
VoC motorbikes	0.47	0.73	0.26

BREAKDOWN OF BENEFITS OF VoC SAVINGS BY CATEGORIES OF TRAFFIC

	% OVER TOTAL VoC SAVING
Existing vehicles	48,26
Generated vehicles	1.64
Diverted vehicles	32.82
Existing motorbikes	15.75
Generated motorbikes	1.53

BREAKDOWN OF BENEFITS OF VOC AND VOT SAVINGS BY CATEGORIES OF TRAFFIC

BENEFITS	TOTAL NPV (GHC)	SHARE ON TOTAL BENEFITS*
Time savings	**10,171,686.70**	**48.6%**
-of which vehicles	5,460,375.24	**53.8%**
-of which non-vehicles	4,711,31245	**46.2%**
VoC saving	**10,607,527.54**	**50.7%**
-of which vehicles	8,774,104.51	**82.72%**
-of which non-vehicles	1,335,423.03	**17.28%**

*Total benefits include also residual value which accounts for 0.6 of total benefits.

RESULTS-BASELINE SCENARIO

BENEFITS	NPV (GHC)	%
Time savings	10,171,686.7	50.7
Reduction of VOCs	10,607,527.5	48.6
Residual value	131,762.0	0.6
COSTS	**NPV (GHC)**	**%**
Investment costs	19,654,561.5	97.2
Accident increase	544,817.5	2,7
Increase of GHG emissions	24,548.7	0.1

RESULTS

CBA results: baseline, worst and best-case scenarios

BENEFITS	ENPV* (GHC)	ERR
Worst case	-8,662,634.86	5.44%
Baseline	687,048.54	10.39%
Best case	18,607,447.46	15.65%

*social discount rate = 10%

FINAL REMARKS

- CBA is a **data-intensive activity** that needs time, competences and resources
- CBA needs to be embedded in an **appropriate institutional and regulatory framework** to:
  - maximising its informative power
  - reducing the risk of misrepresentation
- The true value of CBA is **not about getting the 'right'** number but the **process of looking for it**

For more info:
vignetti@csilmilano.com
www.csilmilano.com

THANK YOU!

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@CSIL_Dev

@CSIL, Development and Evaluation Unit