GLOBAL FUEL ECONOMY INITIATIVE

Cost Benefit Analysis (CBA)

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Outline

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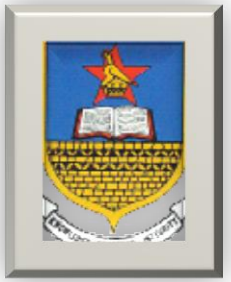
- CBA
- CBA Cost and Benefits Monetization
- CBA Evaluation
- Recommendations

Introduction

- Zimbabwe remains a net importer of gray imports mainly from Japan, United Kingdom, German America and South Africa.
- Some of the imported cars have reached their life span, but when imported to Zimbabwe they are considered to be in a usable state.
- The used gray imports have increase fuel consumption and gas emissions such as carbon dioxide (CO2).

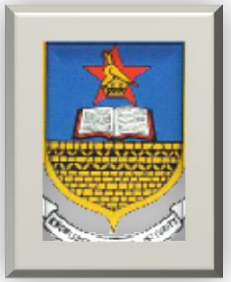
Cost benefit analysis (CBA)

- Sometimes called **benefit cost analysis** (**BCA**), is a systematic approach to estimating the strengths and weaknesses of alternatives for example in:
  - **transactions,**
  - **activities,**
  - **functional business requirements);**
- it is used to determine options that provide the best approach to achieve benefits while preserving savings



Purpose of CBA

- CBA methodology has two main purposes:
  - To determine if an investment/decision is sound (justification/feasibility) – verifying whether its benefits outweigh the costs, and by how much;
  - To provide a basis for comparing projects – which involves comparing the total expected cost of each option against its total expected benefits.



Objectives of CBA

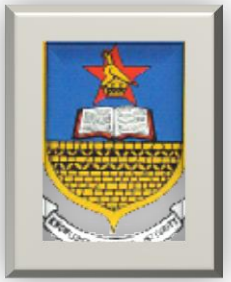
- The CBA was applied in this project to achieve three main aspects that is:
- Financial,
- Economic, and
- Social.

Specific objectives of the Study

- To determine the policy intervention that can be used for efficient fuel consumption in the country;
- To identify instruments used under the CBA framework for an effective policy intervention;
- To identify and measure the expected costs and benefits associated with the policy interventions;
- To estimate the benefits and cost indicators of policy instrument feasibility
- To use CBA decision criteria to select the feasible policy instrument.

Decision Criteria for CBA

- Three main indicators which are:
- Net Present Value (NPV),
- Internal Rate of Return (IRR), and
- Benefit Cost Ratio (BCR)



Decision Criteria

Indicator	Decision	
	Accept	Reject
Net Present Value (NPV)	NPV>0	NPV<0
Internal Rate of Return (IRR)	IRR> discount rate	IRR< discount rate
Benefit Cost Ratio (BCR)	BCR>1	BCR<1

Operationalization of the CBA

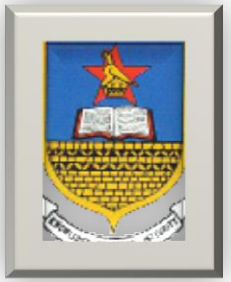
- Operationalization involves following 5 steps of CBA which are:
  - Definition of the Policy Intervention/Project
  - Identification and measurement of costs and benefits
  - Putting monetary values on costs and benefits
  - Calculation of indicators of feasibility
  - Recommend the preferred alternative

Definition of the Policy Intervention/Project

- **a) Fuel tax options**
  1. **Fuel Tax**
  2. **Fuel tax differentiation**

  b) Vehicle Options

  1. **Labeling requirement for the fleet,**
  2. **CO_2-based Vehicle acquisition,**
  3. **Ownership tax, and**
  4. **Used vehicle import restrictions**



Ministry of Transport and Infrastructure Development Management Option	Scenarios
Option 1: Fuel Tax Options	Tax and levies on fuel
	Taxation incentives on acquisition of fuel efficient vehicle
Option 2: Vehicle Options	Labeling of CO_2 emission of vehicles
	Restriction on age of imports
	CO_2 based acquisition costs
Option 3: Status Quo	Predominantly based on vehicle technology
	No enhanced enforcement of all regulations
	No inspection routines for all vehicles
	Current state of infrastructure
Option 4: All policies in Place	Fuel Regular inspection and enforced compliance to existing standards
	Improved infrastructure, high vehicle and tax options
	Increased population of hybrid vehicles

Identification of Direct Policy Effects on Fuel Efficiency and Vehicle Emissions

OPTION 1	2005	2008	2011	2013	2016
Fuel Tax Option (gCO_2/km)	182.5	190.0	184.4	184.3	178.4
(L/100km)	8.0	7.6	8.6	8.5	8.4
OPTION 2	2005	2008	2011	2013	2016
Vehicle Option (gCO_2/km)	182.5	190.0	184.4	184.3	178.4
(L/100km)	8.0	7.6	8.6	8.5	8.4
OPTION 3	2005	2008	2011	2013	2016
If Status Quo (gCO_2/km)	182.5	190.0	184.4	184.3	178.4
(L/100km)	8.0	7.6	8.6	8.5	8.4
OPTION 4	2005	2008	2011	2013	2016
All Policies Implemented (gCO_2/km)	182.5	190.0	184.4	184.3	178.4
(L/100km)	8.0	7.6	8.6	8.5	8.4

Putting monetary values on costs and benefits

Year of Vehicle Registration	Average fuel consumption by Fuel Type per 100km		Average for the two fuels
	Petrol	Diesel	
2005	8.4	7.7	8.0
2008	6.7	9.4	7.6
2011	8.2	9.6	8.6
2013	8.0	9.9	8.5
2016	7.8	9.7	8.4
Average Over Years	7.9	9.5	8.4

Average Prices of Fuel in Zimbabwe by Type

Year	Average Price by Fuel Type	
	Petrol	Diesel
2005	1.42	1.36
2008	1.55	1.42
2011	1.45	1.34
2013	1.5	1.38
2016	1.33	1.15

Annual fuel consumed in Zimbabwe by type

Year	Annual fuel Consumption by Fuel Type	
	Petrol (litres)	Diesel (litres)
2005	172 000 000	487 500 000
2008	132 000 000	357 100 000
2011	384 359 196	731 835 864
2013	544 405 645	1 050 705 466
2016	444 322 565	733 857 144

Estimations

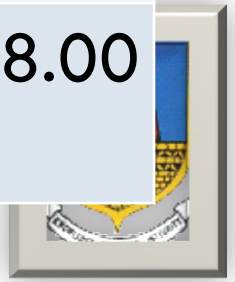
- ***Estimated Distance travelled by all cars per day = Daily fuel consumption* Average km per litre of fuel consumed***
- **Estimated Financial Cost = Annual fleet km travelled* amount in US$ per km**
- Where;
- ***Annual fleet km = average daily Km* Number of vehicles using the type of fuel*365***
- ***Amount in US$ per Km = Average fuel economy* average fuel price/100***

Estimation of Financial Cost based on total Fuel consumption and pump price – Petrol	Year				
	2005	2008	2011	2013	2016
Average Fuel economy (L/100km)	8.4	6.7	8.2	8.0	7.8
Average fuel price US$/L	1.42	1.55	1.45	1.5	1.33
Total amounts (US$/100km)	11.93	10.39	11.89	12.00	10.37
Amount in US$ per Km	0.119	0.103	0.120	0.120	0.104
Average Km per liter	11.9	14.93	12.20	12.5	12.82
Calculation of the average km travelled per day per vehicle					
Average Daily km travelled	119.875	84.7439	104.236	142.456	159.45
Average Annual KM per Vehicle	43754.38	31016.27	38046.14	51996.44	58358.70
Number of vehicles using petrol	393104	425583	515600	615172	761365
Number of vehicles newly registered	7866	11772	46108	54169	36909
Days in a Year	365	366	365	365	366
Annual Fleet km travelled	2047619047	1970149253	4687307268	6805070562	5696443141
Daily Fleet Km travelled	5609915	5382921	12841938	18644029	15564052
Estimated Financial Cost US$	243666667	202925373	562476872	816608468	592430087

Estimation of Financial Cost based on total Fuel consumption and pump price – Diesel	2005	2008	2011	2013	2016
Average fuel economy (L/100km)	7.7	9.4	9.6	9.9	9.7
Average fuel price	1.36	1.42	1.34	1.38	1.18
Total amounts (US$/100km)	11.42	9.51	10.99	11.04	9.20
Amount in US$ per Km	0.114	0.095	0.110	0.110	0.092
Calculation of the average km travelled per day per vehicle					
Total vehicle (fleet) population in Zimbabwe	66370	97765	155870	161371	164834
Average annual km travelled (per vehicle)	95392.027	38857.834	48908.001	65768.859	45897.919
Number of days in a year	365	366	365	365	366
Average daily km travelled	261.348	106.169	133.995	180.189	125.404
Total number of newly registered vehicles	12605	27913	58282	66952	46428
Daily Fleet km travelled	17345668	10379607	20885727	29077223	20670868
Annual fleet km travelled	6331168831	3798936170	7623290250	10613186525	7565537567
Estimated Financial Cost US$	721753247	360898936	838561927	1167450518	696029456

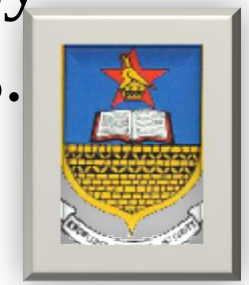
Estimation of Financial Benefit of Forgone CO_2 Emissions	Year				
	2005	2008	2011	2013	2016
Average CO_2 Carbon credit per ton USD	1.00	1.00	1.00	1.00	1.00
Average CO_2 emission gCO_2 /km	182.5	190.0	184.4	184.3	178.4
Calculation of the average km travelled per day per vehicle					
Total km travelled (national)	42382254110	23662235098.1	36062925252.9	57859549963.7	62131159277.59
Total Vehicle (fleet) population in Zimbabwe	609175	677282	829470	981458	1191889
Average annual km travelled (per vehicle)	69573.20	34937.05	43477.07	58952.65	52128.31
Number of days in a year	365	366	365	365	366
Average daily km travelled	190.599	95.4545	119.115	161.322	142.427
Total number of newly registered vehicles	12605	27913	58282	66952	46428
Annual fleet km travelled	8378787878	5769085423	12310597518	17418257087	13261980708
Daily fleet km travelled	22955583.23	15762528.47	33727664.43	47721252.29	36234919.96
Average gCO emitted	1529128787735	1096126230370	2270074182319	3210184781134	2365937358307
Conversion factor	1000000	1000000	1000000	1000000	1000000
Tons Estimated (1/1000000)	1529128.79	1096126.23	2270074.18	3210184.78	2365937.36
Average Carbon credit per ton US$	1.00	1.00	1.00	1.00	1.00
Estimated Financial Benefit US$	1529128.79	1096126.23	2270074.18	3210184.78	2365937.36

Year	Overall Benefit	Discount Factor 10%	NPV ($)
2005	59725042.79	0.9091	54296036.40
2008	148953817.23	0.7513	111909003.00
2011	127681391.26	0.5645	72076145.37
2013	285733209.36	0.4665	133294542.00
2016	148791121.35	0.3505	52151288.00



Conclusions

- Reduction in the level of CO_2 emissions and the average fuel consumed per kilometer are necessary to improve on vehicle fuel efficiency.
- Effects of some of the Policy options could not be directly realized for Zimbabwe, as this requires a specific survey study to measure the cost and benefits of the policies
- From literature it can be concluded that policy options can reduce cost and improve benefits.



Recommendations

1. Fuel Quality Standards

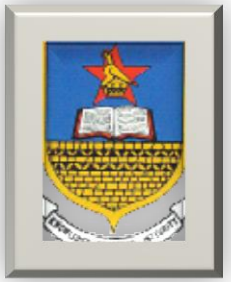
- Ministry of Transport and Infrastructure Development and ZERA should establish a framework to phase out forms of fuel that account of high pollution and fuel consumption levels for example the move to ban consumption of certain brand of diesel due to its high pollution aspect.

2. Taxes

- Carbon tax and fuel taxes have not been effective as a deterrent factor for poor fuels consumption.
- The Ministry of Finance and Economic Development, Ministry of Transport and Infrastructure Development and ZERA should establish mechanisms to develop fuel tax options / tax rebate systems in relation to CO2 emissions and fuel efficiency levels.
- These options should be targeted at really deterring consumption of poor fuels and fuels per se.

3. **Transport Demand Management Practices**

- Reduce annual kilometers travelled through travel demand management strategies, for example, spreading the times of starting work in order to reduce congestion which is one of the causes of pollution as cars will be stationery for at least 10-15 minutes, year of manufacturing for cars on the street as old cars are highly inefficient and releases a lot of carbon emissions



4. Infrastructure and transport planning

- The Ministry of Transport and Infrastructure Development should establish a framework for provision of mass transit (Bus/Train) to enhance a shift from private car dominance which is causing high emissions in the country.
- There is also need to provide for Non-Motorized Transport modes i.e. bicycles lanes eg China, Germany, etc

Thank You