Economic Appraisal of roads using agricultural potential to determine economic feasibility of rural unpaved roads

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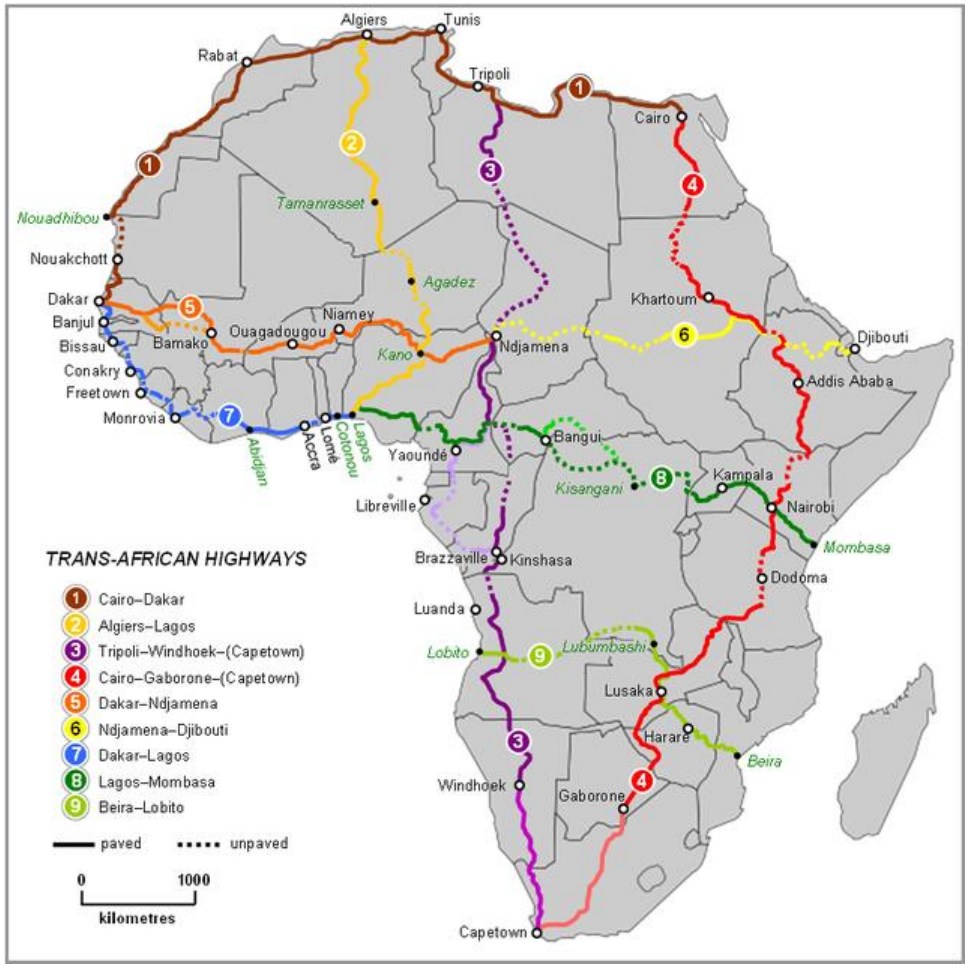
TRANS AFRICAN HIGHWAYS

Agricultural productivity requires:

- Good road infrastructure
- Reliable energy supply
- Appropriate food storage facilities
- Efficient social and financial infrastructure
- Enabling government policies
- Good Governance



- Nearly 60% of Africa's population live in rural areas.
- 60% subsistence farmers
- 80% of Sub Saharan Africa made up of small holder agricultural plots.
- Agricultural productivity – on average 40% of potential

Highways with high traffic volume

Dual Carriageway in South Africa

Typical Single Carriageway road in Africa

Comparison of road access

- Road linking major cities

- Road linking villages to markets

Zimbabwe road network

21 500km Primary feeder roads and 3500km of secondary roads identified

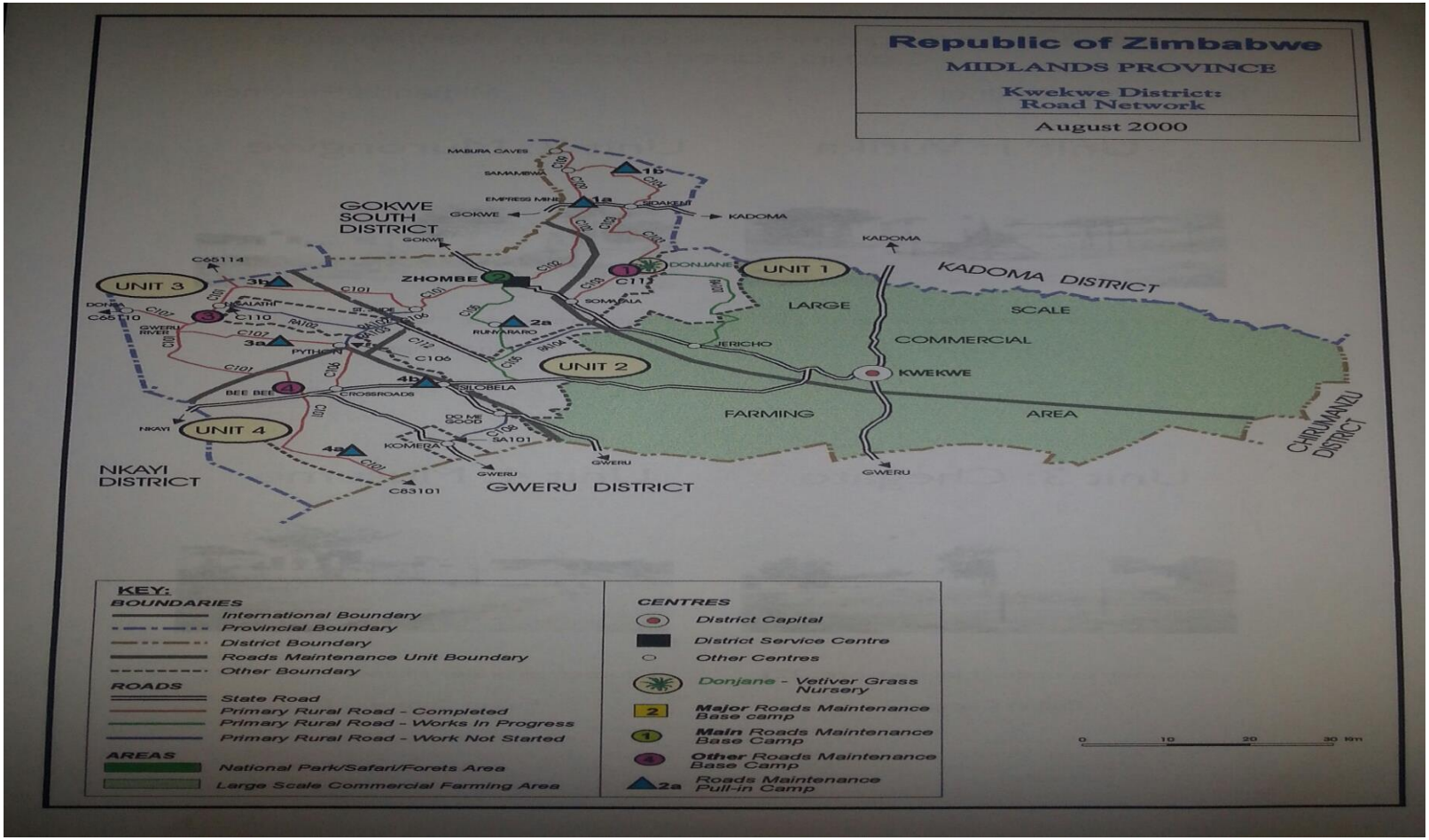
Planning process

Planning criteria

- Flat and rolling terrain – 10km Primary roads
- Hilly terrain – 3km
- Secondary roads in flat and rolling – 5km
- No secondary roads in hilly terrain

Planning procedure

- Road selected and submitted by community through local representatives
- Simplified economic evaluation
- Priority ranking derived from economic significance


Republic of Zimbabwe
MIDLANDS PROVINCE
Kwekwe District:
Road Network
August 2000
GOKWE SOUTH DISTRICT
KADOMA DISTRICT
NKAYI DISTRICT
GWERU DISTRICT
CHIRUMANZU DISTRICT
UNIT 1
UNIT 2
UNIT 3
UNIT 4
LARGE SCALE COMMERCIAL FARMING AREA
KWEKWE
ZHOMBE
KADOMA
GOKWE
GWERU
NKAYI
JERICHO
SILOBELA
KOMERA
DONJANE
RUNYARARO
KEY:
BOUNDARIES
International Boundary
Provincial Boundary
District Boundary
Roads Maintenance Unit Boundary
Other Boundary
ROADS
State Road
Primary Rural Road - Completed
Primary Rural Road - Works In Progress
Primary Rural Road - Work Not Started
AREAS
National Park/Safari/Forets Area
Large Scale Commercial Farming Area
CENTRES
District Capital
District Service Centre
Other Centres
Donjane - Vetiver Grass Nursery
Major Roads Maintenance Base camp
Main Roads Maintenance Base Camp
Other Roads Maintenance Base Camp
Roads Maintenance Pull-in Camp
0 10 20 30 Km

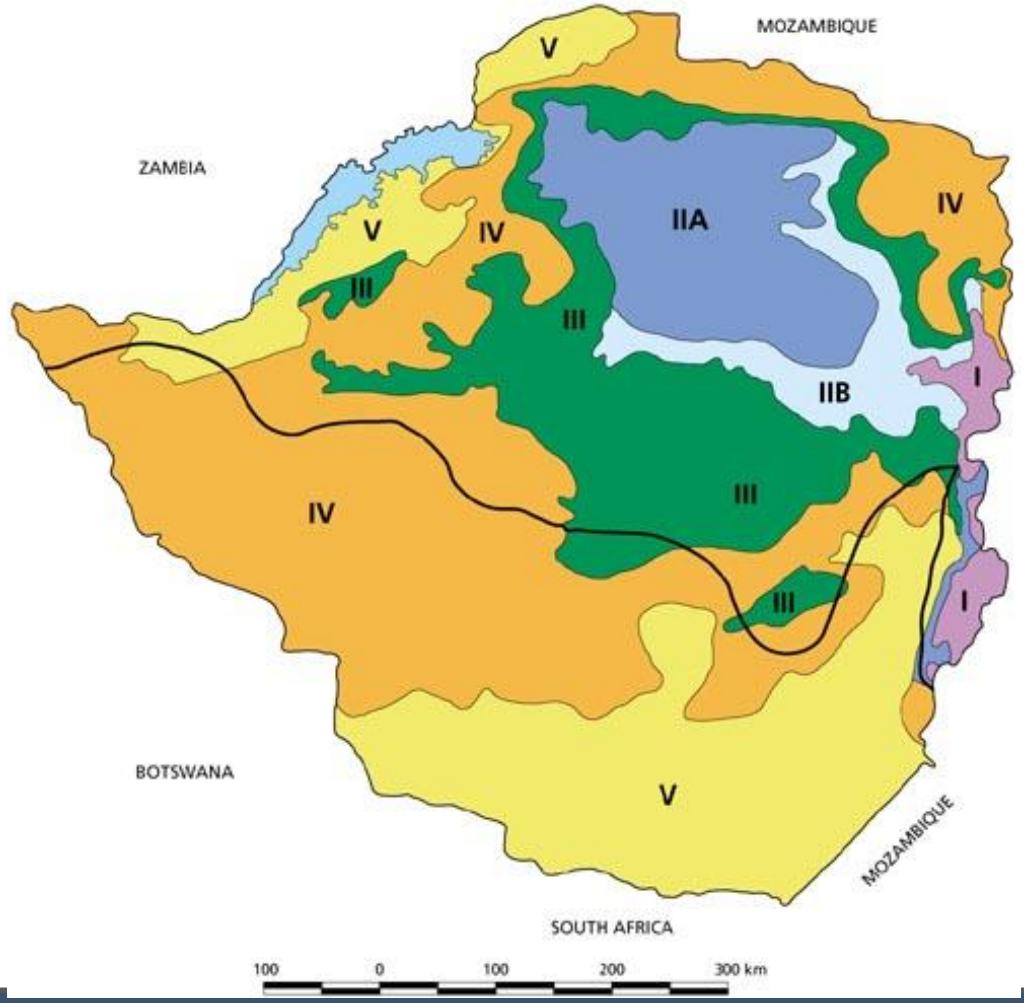
Rural unpaved road

Rural road through agricultural land

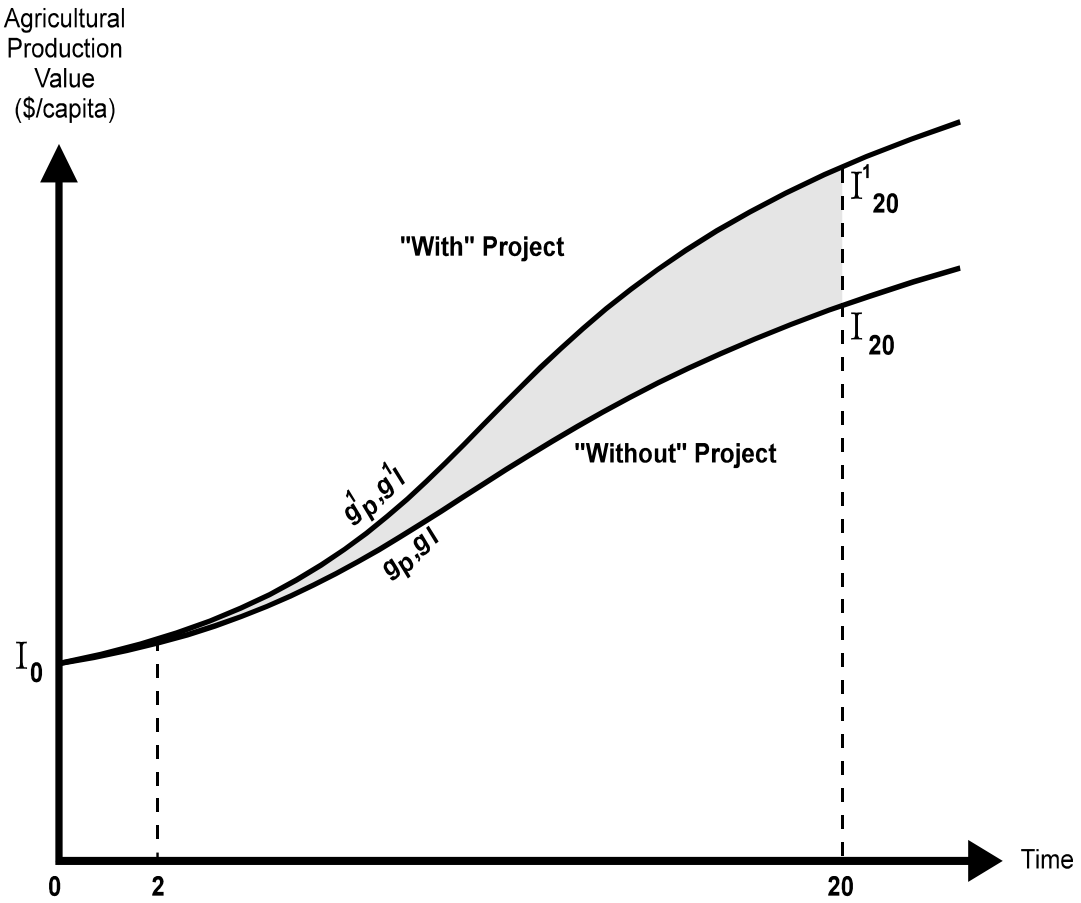
Agro ecological regions

NATURAL REGION	RAINFALL	SURFACE AREA
I	**SPECIALISED AND DIVERSIFIED FARMING** **Rainfall**:900 - 1000mm per annum.	7000sq km **(**less than 2% of the total area of Zimbabwe)
II	**INTENSIVE FARMING** **Rainfall**: 750-1000mm per annum	58600sq km(15% of the total area of Zimbabwe)
III	**SEMI-INTENSIVE FARMING** **Rainfall**: 650-800mm per annum **Production**	72900sq km **(**19% of the total area of Zimbabwe.)
IV	**SEMI-EXTENSIVE FARMING** **Rainfall**: 450-650mm per annum	147 800sq km(38% of the total area of Zimbabwe)
V	**EXTENSIVE FARMING** **Rainfall**: Too low and erratic for production of drought resistant fodder and grain crops.	104 400sq km **(**27.5% of the total area of Zimbabwe)

Agro – ecological regions of Zimbabwe



Incremental Agricultural Benefits



INH/sq.km	STANDARD BENEFITS FROM CROP PRODUCTION PER REGION/PERSON						
	II Flat	III Flat	1V Flat No cattle	IV With cattle	I Very hilly	II Hilly	III Very hilly
2.5 -5.0	-	-	-	158	-		
5.1 -7.5	-	-	-	433	-		
7.6 -10.	-	-	-	452	-		
10.1-15	504	388	193	560	-		
15.1-20	484	372	182	562	-	587	208
20.1-30	504	388	168	511	-	459	197
30.1-40	322	248	109	415	-	296	153
40.1-50	141	108	61	-	455	186	94
50.1-60	97	75	46	-	321	124	47
60.1-70	-	-	37	-	215	76	
70.1-80	-	-	-	-	150	59	
80.1-90	-	-	-	-	96		
90.1-100	-	-	-	-	60		
> 100							

15x100km²x504 =756000

40x100km²x141 =564000

Cattle Benefits/km²per head

Cattle density /km²	Region IV $/Head	Region V |$/Head
0 -4.0	492	424
4.1 – 8.0	264	246
8.1 -12.0	260	243
12.1 – 16.0	254	240
16.1 – 20.0	254	239
20.1 -24.0	248	223
24.1 – 28.0	206	199
28.1 -32.0	142	132
32.1 - 36.0	127	107
36.1 -40.0	91	64
≥ 40	82	61

20X100km ²x254 =$50800

32x100km²x127 =$406400

Economic standard construction cost/km

TYPE OF TERRAIN	TYPE OF ROAD		
	PRIMARY A	PRIMARY B	SECONDARY
FLAT	8932	5419	3844
ROLLING	9590	6077	4403
HILLY	13156	10622	8179
VERY HILLY	30893	29247	21466
KALAHARI SANDS	16983	14482	10098

Economic standard periodic maintenance costs/km

TYPE OF TERRAIN	TYPE OF ROAD		
	PRIMARY A	PRIMARY B	SECONDARY
FLAT	5319	1806	728
ROLLING	5319	2784	728
HILLY	5319	2784	728
VERY HILLY	9883	8237	3586
KALAHARI SANDS	13365	10804	6927

Summary of costs

Total economic construction cost	**= X**
Total economic routine maintenance cost	**= Y**
Total economic Periodic maintenance cost	**= Z**
TOTAL COSTS	**= X+Y+Z**

Summary of benefits

Natural region	Standard benefits/region cropping & livestock	Total benefits
I,II,II,IV &V		
Total benefits	Population x benefits per= head	

Benefit cost ratio

Total benefits/total costs = BCR

Conclusion

- The approach assumes that all benefits after construction of roads are a result of the improvement.
- The system is viable when you have reliable agricultural data
- The approach needs to be complemented by using other non transport benefits
- Where new areas are being opened the producer surplus approach is suitable