Revealing the preferences of farmers for a framework to use treated effluent in irrigation: case study Western Cape, South Africa

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Outline

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1. Introduction

- Agriculture
  - Large water user (43%)
  - Water availability > limiting factor
- Strong competition for water
  - Search for alternative sources, e.g. wastewater
- Wastewater
  - Not entirely negative
  - Non-conventional water source > opportunities

2. Context of the case study

- Water-scarce region
- Agriculture: highly-dependent on rainfall
- White large scale commercial farmers > use treated effluent > municipal WWTP
- Drivers
  - lack of water
  - climate change awareness
- Vineyards, olives, fruit trees & cereals

3. Methodology

- Choice Experiment (CE) models preferences for goods
  - Goods described in terms of attributes
  - Value individual attributes of a good within a multidimensional system

- Respondents choose between alternatives
  - Alternatives differ based on attributes

3. Methodology

4. Results (LC model)

	Segment 1	Segment 2
A1	1.096*	-0.328(0.585)
	(0.658)	
A2	-0.141(0.563)	-0.684(0.431)
A3	-1.075(0.875)	0.954(0.898)
High practice restrictions (a)	-1.934**	-1.159*
	(0.853)	(0.680)
Moderate practice restrictions (b)	0.248(0.652)	-0.799(0.690)
Private scheme model	-0.474(0.346)	0.995**
		(0.459)
Private-Public Partnership scheme model	-0.407(0.383)	0.641(0.493)
Price (c)	-0.629**	-0.421***
	(0.262)	(0.125)
Model statistics		
Pseudo ρ^2	0.258	
Log likelihood	-149.91	
Segment function LCM: respondents' perceptions on irrigation with treated effluent		
Constant	8.050(5.423)	
Irrigation with treated effluent is a threat to health of farmers/workers (d)	-1.068(2.364)	
Irrigation with treated effluent is a threat to the environment (e)	-0.555(1.611)	
Use of treated effluent	-4.701(3.671)	

Significance level at 1% (***), 5% (**), 10% level (*)

A1: Water quantity up to 50 m3/day, strict quality standards, reduced nutrient content

A2: Water quantity up to 50 m3/day, general quality standards, high nutrient content

A3: Water quantity up to 2,000 m3/day, general quality standards, high nutrient content

A4: Unlimited water quantity, quality standards less than general standards, high nutrient content

(a) Strict restriction on crops (vegetables-eaten-raw not allowed); strict control on irrigation methods; strict monitoring

(b) Crops for human consumption not eaten-raw are allowed, incl. fruit trees, vineyards; moderate control over irrigation methods; regular monitoring

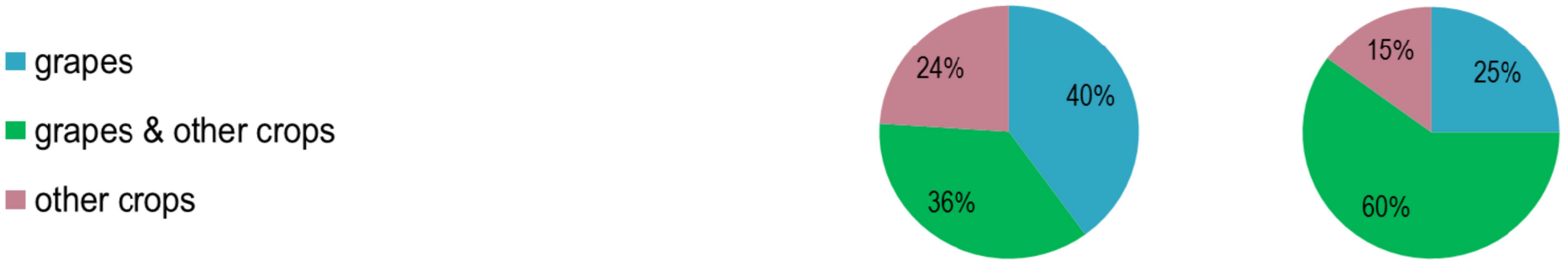
(c) 1 € = 14Rands

(d) Dummy variable for perception of irrigation with treated effluent concerning health of farmers/workers

(e) Dummy variable for perception of irrigation with treated effluent concerning the environment

4. Results (LC model)

	Segment 1 (n=26)	Segment 2 (n=20)
Male	92%	90%
Household size	3	4
Higher education	73%	79%
Fulltime farmer	81%	78%
Experienced water scarcity (past 5 yr.)	42%	40%
Household income (Rands/month)	41 381 ←	33 577
Shift to other crops if water is accessible	23% →	45%
Currently using treated effluent	~4% →	80%



5. Conclusions

- Farmers preferences
  - Strict water quality standards (+)
    - Despite that it implies reduced water quantity & reduce nutrient content
  - High practice restrictions (-)
    - Strict restriction on crops; control on irrigation methods; strict monitoring
  - Privately-managed scheme (+)
    - Trust in management & water quality monitoring

Thank you.

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Descriptive statistics of the sample and profiles of the segments

	Mean (St. Dev.)	Min.	Max.	Seg.1 (n=26)	Seg.2 (n=20)
Gender (% male)	91.3			92.31	90.00
Household size (number) (a)	3.22 (1.37)	1	7	2.96 (1.22)	3.59 (1.50)
Dependent children (number) (b)	1.60 (1.09)	0	4	1.50 (1.00)	1.73 (1.22)
Household income (Rands/month)	38 397 (22 375)	4500	100 000	41 381 (24 440)	33 577 (18 453)
Education (%) (c)					
Higher	75.6			73.08	78.95
Basic	24.4			26.92	21.05
Occupation (% full time farmer) (d)	79.5			80.77	77.78
Crops cultivated (%) (e)					
Grapes	33.3			40.00	25.00
Grapes & others	46.7			36.00	60.00
Other crops	20.0			24.00	15.00
Would shift to other crops if water is accessible (% yes)	32.6			23.08	45.00
Currently using treated effluent for irrigation*** (%)	37.0			3.85	80.00
Water scarcity in past 5 years (% did experience)	41.3			42.31	40.00
Water conflicts in past 5 years (% did experience)	10.9			11.54	10.00
Willing to exchange water entitlements for treated effluent (% yes) (f)	15.0			16.00	13.33
Wealth and Pearson Chi-Square Tests show					

T-tests and Pearson Chi-Square Tests show significant differences at (*) 10% (**) 5% and (***) 1% level.

Note: For frequencies only valid percent is reported.

a. For segment 1 the n° of respondents is n=23; for segment 2 is n=17
b. For segment 1 the n° of respondents is n=20; for segment 2 is n=15
c. For segment 2 the n° of respondents is n=19
d. For segment 2 the n° of respondents is n=18
e. For segment 1 the n° of respondents is n=25
f. For segment 1 the n° of respondents is n=25; for segment 2 is n=15.

Respondents' perceptions

Perceptions on the use of treated effluent (average score)[a]	Mean (St. Dev.)	Min.	Max.	Seg.1 (n=26)	Seg.2 (n=20)
Irrigation with treated effluent:					
is a threat to the health of farmers and workers	3.9 (0.9)	1	5	3.62(0.98)	4.25(0.64)
is a threat to the health of consumers of the produce**	3.8 (1.0)	1	5	3.46(1.1)	4.30(0.66)
is a threat to the environment	3.9 (0.9)	2	5	3.58(0.86)	4.35(0.75)
can damage the soils***	3.2 (1.0)	1	5	2.96(0.82)	3.45(1.23)
can pollute groundwater	3.3 (1.1)	1	5	2.92(0.89)	3.75(1.12)
enhances agricultural production	2.5 (1.0)	1	5	2.81(0.8)	2.15(1.18)
reduces the quantities of nutrients to be applied in the soil	2.9 (1.1)	1	5	2.62(0.98)	3.25(1.07)
should be encouraged by the authorities	1.7 (0.9)	1	4	1.69(0.88)	1.80(0.83)
Treated effluent is an alternative source to fight water scarcity	1.5 (0.6)	1	4	1.62(0.7)	1.45(0.51)
Regulations for reuse of treated effluent in agriculture are poor [b]	3.2 (1.0)	1	5	3.00(0.96)	3.40(1.05)
Regulations for reuse of treated effluent in agriculture are comprehensive and encourage reuse [b]	2.9 (1.0)	2	5	3.08(0.91)	2.70(1.08)
Water quality standards for agricultural use of treated effluent are poor and put public health and the environment at risk [b]	3.7 (0.97)	1	5	3.48(1.01)	3.95(0.89)
Water quality standards for agricultural use of treated effluent are too stringent to comply with [b]	3.6 (0.9)	1	5	3.64(0.81)	3.60(0.94)
Institutions responsible for implementing reuse of treated effluent are not supportive [b]	2.7 (0.9)	1	4	2.72(0.94)	2.75(0.97)
Infrastructure required to convey treated effluent to fields is too costly, which impedes the use of treated effluent for agricultural irrigation [b]	2.8 (1.0)	1	4	2.60(1.0)	3.00(0.97)
Process of registration of water use licenses, permits or authorizations for treated effluent, is too bureaucratic and discouraging [b]	2.6 (1.2)	1	4	2.68(1.18)	2.55(1.19)
Authorities don't support the use of treated effluent in agricultural irrigation; as a consequence there aren't enough incentives to take this option [b]	2.7(1.0)	1	4	2.80(0.91)	2.55(1.05)

Theoretical framework