Knowledge and water conservation behaviour in the European Union: a cross-country comparison

Luiza Toma[1], Joana Ferreira[1], Bethan Thompson[1]

[1] SRUC, Edinburgh, UK

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Outline

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Background

- Increasing worldwide attention to water conservation in the context of climate change and food security.
- EU has been approaching this in a number of ways, e.g., Water Framework Directive, progressing towards an integrated approach to freshwater management, with the goal of achieving ‘good status’ for all EU waters by 2015.
- Many EU member countries have adopted River Basin Management Plans for 2009 - 2015 to improve management of water resources.
- ‘Blueprint to Safeguard Europe's Water Resources’ (EC, 2012) is EU policy response to the continuing challenge of delivering the EU's water policy goals.
- The analysis underpinning the Blueprint will drive EU water policy over the long term (2050) and focuses on a number of issues including household water consumption and waste water.

Background

- Understanding which determinants influence water conservation behaviour and perceptions towards improving the efficiency of water use has been the focus of a number of research studies over time and increasingly so during the past couple of decades
  - Nieswiadomy, 1992; Dandy et al., 1997; Renwick and Archibald, 1998; Renwick and Green, 2000; Campbell et al., 2004; Syme et al., 2004; Gilg et al., 2005

- Different types of knowledge will have a significant (direct and/or indirect) effect on perceptions and behaviour
  - Kaiser & Fuhrer, 2003

Research questions

- What are the determinants of water conservation behaviour in the European Union?
- What is the impact of each and all of these determinants on water conservation behaviour?
- Better understanding = better water policies
- This study analyses the impact that knowledge (amongst other *a priori* determinants) has on the stated water conservation perceptions and behaviour of citizens from 27 EU members.

Data

- Eurobarometer dataset ‘Attitudes of Europeans towards water-related issues’ (EC, 2012)
- 27 EU countries
- Average sample size of 945 observations

Data - questionnaire

Socio-demographics

- age
- gender
- education
- occupation
- place of living
- type of water consumed in the household

Data - questionnaire

Knowledge variables

- **Declarative knowledge**
  - Perceived level of information about problems facing groundwater, lakes, rivers and coastal waters in own country
  - Awareness about the Blueprint to Safeguard Europe's Water Resources
  - Awareness about River Basin Management Plans
  - Awareness of main threats to the water environment (algae growth; chemical pollution; water shortage; floods; change to water ecosystems; dams, canals and other physical changes; climate change)
  - Awareness of change in quality of groundwater, rivers, lakes and coastal waters over the last 10 years

Data - questionnaire

Knowledge variables

- **Procedural & effectiveness knowledge**
  - Water use efficiency (households, agriculture, industry, energy producers)
  - Effective ways of tackling water problems:
    - implementing a fair pricing policy;
    - introducing heavier fines for offenders;
    - providing more information on the environmental consequences of water use;
    - ensuring higher financial incentives (for example tax breaks, subsidies) for efficient water use;
    - ensuring better enforcement of existing water legislation;
    - introducing stricter water legislation;
    - increasing taxation on water-damaging activities.

Data - questionnaire

Perceptions of water problems

- Perceived seriousness of water problems (pollution, floods, droughts/overconsumption)
- Perceived strength of impact on the status (quality and quantity) of water:
  - households' water consumption and waste water
  - overuse of water in agriculture
  - pesticides and fertilizers in agriculture
  - energy production (hydropower, cooling water)
  - tourism
  - shipping (ports, canals, spills)

Data - questionnaire

Water efficient behaviours

(In order to reduce water problems and become more water efficient in the last two years the household have):

- limited the amount of water used (not leaving taps running, shower instead of bath, installing water saving appliances etc.)
- used eco-friendly household chemicals
- avoided the use of pesticides and fertilizers in the garden
- harvested rain water
- consumed organic farming products
- recycled household oil waste, unused pharmaceuticals, unused household chemicals, paints, solvents, batteries

Methodology

- Structural equation modelling with observed and latent variables (SEM)
  - statistical method used (in this context) as a confirmatory analysis tool
  - to test the influence of *a priori** determinants on behaviour
  - consists of two parts:
    - measurement model, which specifies relationships between latent variables and their constituent indicators (similar to factor analysis)
    - structural model, which specifies causal relationships between latent variables (similar to a system of simultaneous regressions)
  - ***takes into consideration both direct and indirect causal relationships between latent variables, which means that one causal relationship may be reinforced or counteracted by another***.

* The method is not intended to discover causes (as the idea of causality may be controversial - see Mueller, 1996), but to test and assess the soundness of causal relationships *a priori* formulated.

Methodology

The model is defined by the following system of three equations in matrix terms (Jöreskog and Sörbom, 2007):

The structural equation model: $\eta = B\eta + \Gamma\xi + \zeta$

The measurement model for y: $y = \Lambda_y \eta + \varepsilon$

The measurement model for x: $x = \Lambda_x \xi + \delta$

Where:

η is an m*1 random vector of endogenous latent variables;

ξ is an n*1 random vector of exogenous latent variables;

B is an m*m matrix of coefficients of the η variables in the structural model;

Γ is an m*n matrix of coefficients of the ξ variables in the structural model;

ζ is an m*1 vector of errors in the structural model;

y is a p*1 vector of endogenous variables;

x is a q*1 vector of predictors or exogenous variables;

Λ_y is a p*m matrix of coefficients of the regression of y on η;

Λ_x is a q*n matrix of coefficients of the regression of x on ξ;

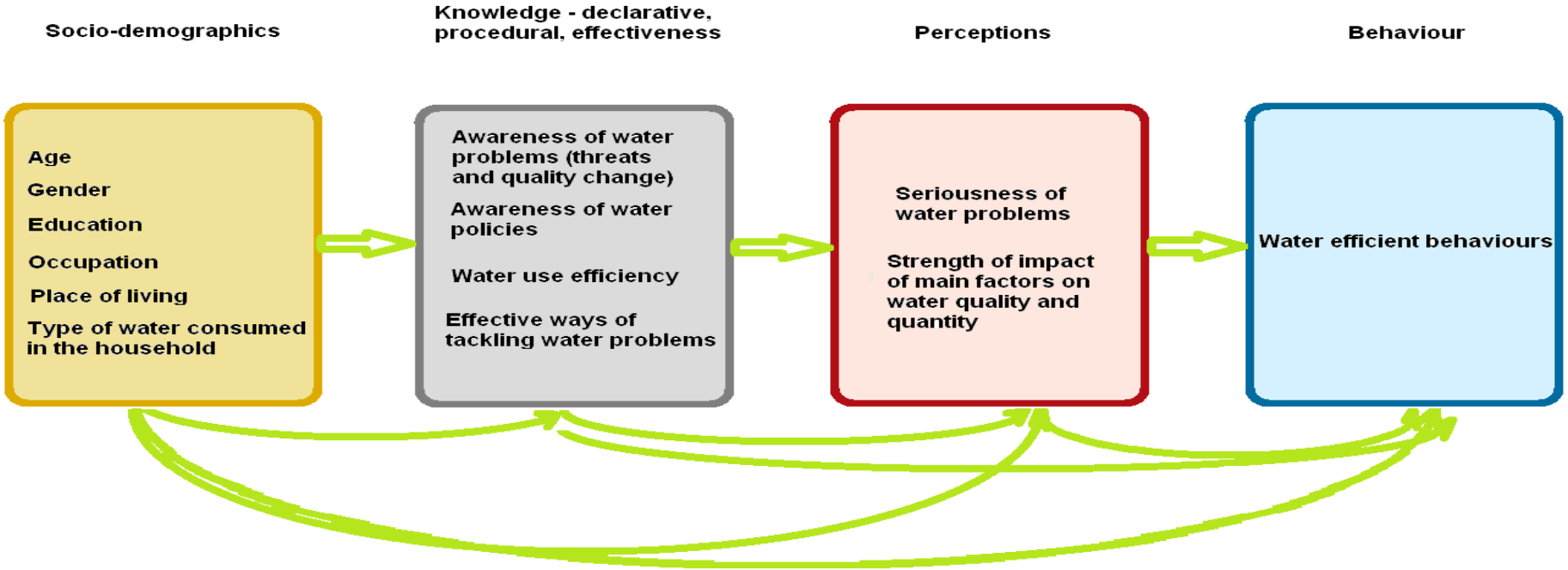
ε is a p*1 vector of measurement errors in y;

δ is a q*1 vector of measurement errors in x.

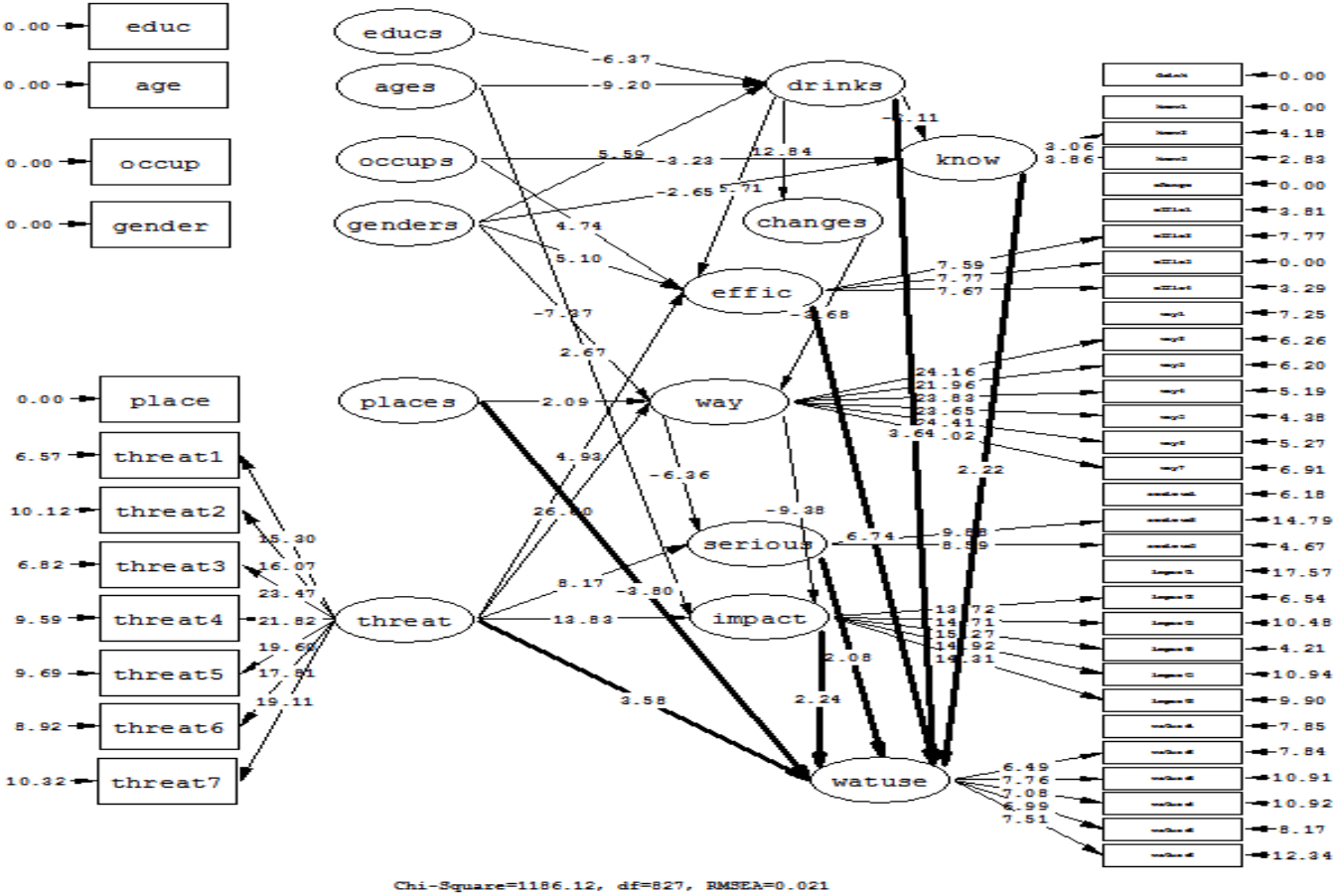
Methodology

- Model estimated with Diagonally Weighted Least Squares (DWLS) method.
- DWLS estimation method consistent with ordinal and categorical variables included in the model and significant deviation from normality in some of these variables (Finney and DiStefano, 2006).
- Statistical package Lisrel 8.80 (Jöreskog and Sörbom, 2007).

Conceptual model



UK model


educ
age
occup
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drinks
know
changes
effic
way
serious
impact
watuse
place
threat
places
threat1
threat2
threat3
threat4
threat5
threat6
threat7
Chi-Square=1186.12, df=827, RMSEA=0.021

Results – GoF indicators

GoF indicators	Estimated value	Recommended value
Normed chi-square (Chi-Square/df)	1.43	[1-3]
Root Mean Square Error of Approximation (RMSEA)	0.021	0.00-0.10
Goodness of Fit Index (GFI)	0.96	0.90-1.00
Normed Fit Index (NFI)	0.97	0.90-1.00
Non-Normed Fit Index (NNFI)	0.99	0.90-1.00
Comparative Fit Index (CFI)	0.99	0.90-1.00
Incremental Fit Index (IFI)	0.99	0.90-1.00
Relative Fit Index (RFI)	0.96	0.90-1.00
Adjusted Goodness of Fit Index (AGFI)	0.96	0.90-1.00
Standardized Root Mean Square Residual (SRMR)	0.078	0.00-0.10

Results – total effects

	Knowledge				Perceptions		Behaviour
	know	changes	effic	way	serious	impact	watuse
ages	-0.02*	0.07***	0.06***	0.01*		0.08*	
genders	-0.23*	0.03**	0.28*	-0.25***	0.18***	0.26***	0.13***
educs	0.01*	-0.05***	0.05***				0.01*
occups	0.25**		0.21**				0.03*
places				0.05*	-0.04*	-0.05*	-0.22**
threat			0.21**	0.82***	0.47***	0.53***	0.38***
drinks	-0.04*	0.17***	-0.16***	-0.02**	0.01**	0.02**	
know							0.12*
changes				-0.09**	0.07**	0.10**	0.02**
effic							0.31***
way					-0.73***	-0.11***	-0.23**
serious							0.13*
impact							0.14*
R-square	0.10	0.03	0.18	0.68	0.46	0.74	0.37

Discussion

- Comparable results of all 27 models suggest that those more likely to exhibit water efficient behaviours are:
  - Women
  - Better educated
  - With better occupational status
  - With stronger perceptions of the seriousness of water quality problems and about the strength of impact of various factors on water quality and quantity
  - With better knowledge about water policies
  - With better knowledge about sources of threat to water environment
  - More aware of deterioration in water quality over the last 10 years
  - More aware of water use efficiency issues and the ways to tackling these
- Differences between models - place of living

Acknowledgements

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