TOWARDS SUSTAINABLE AGRI-FOOD SYSTEMS:
BALANCING BETWEEN MARKETS AND SOCIETY

Attitudes Toward the Use of Treated Wastewater: A Survey of the Rural Population in Egypt

Fadi Abdelradi[1], Mohamed Ewiss[2], Bouali Guesmi[3]

[1] Faculty of Agriculture – Cairo University, fadi.abdelradi@agr.cu.edu.eg

[2] Faculty of Science – Cairo University, mzewiss@yahoo.com

[3] CREDA-UPC-IRTA, bouali.guesmi83@gmail.com

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Abstract

Treated WasteWater (TWW) projects can fail if the factors controlling their implementation are not considered. This paper analyze the findings of a survey (966 participants) conducted to investigate the attitudes of the Egyptian rural public towards TWW use for non-potable applications using a conceptual framework elaborated based on the literature estimated using Structural Equation Modeling (SEM). Results indicate that the factors considered in the analysis of the conceptual framework were found to be relevant in explaining the participants' behavior towards WasteWater Reuse (WWR). Our findings suggest considering these factor when developing new policies and campaigns for WWR prior to implementation.

Keywords: wastewater, structural equation modelling, attitudes, theory of planned behavior

1. Introduction

Water scarceness in numerous countries of the world nowadays is sparked through the rapid development in population, urbanization, agriculture, industrial development and natural events like drought. This induces the need for other water supplies. Water resources planners are on a continuous search for additional sources of water to supplement the current limited levels (Adewumi et al., 2014). WWR is nowadays regarded as an additional alternative for available water supplies. Benefits at the public and individual levels are savings in water bills; cancelling development of new water sources; Water treatment: energy savings, chemicals savings. The current situation in Egypt is the availability of a fixed amount of water supply accounting for 57 Billion Cubic Meters (BCM) per year, 97% of this amount coming from the River Nile and the rest coming from precipitation and underground water. On the demand side, it is estimated at the amount of 72 BCM per year with 80% going for agriculture (Misheloff, 2010). If Egypt sustains the present high level of population growth rate, and the same cropping patterns and per capita consumption, the gap will keep growing between requirements and sustainable supply. The issue of accommodating the increase in demand became more problematic by pollution from agricultural, domestic and industrial sewage which put limits on how both fresh and wastewater can be used without causing adverse economic, environmental, and health consequences (Misheloff, 2010).

At the policy level, Egypt has directed investments regarding WWR by expanding wastewater treatment facilities and upgrading existing ones, which has increased the dung six-folds during the last two decades, reaching 385 in 2014 compared with 121 plants in 2000. Egypt has restricted the use of TWW for growing crops. According to the Egyptian code for the use of TWW in agriculture, wastewater is classified into three grades A, B and C depending on the level of treatment received and the crops that can and cannot be irrigated with each grade (Misheloff, 2010). TWW grade A used to irrigate plants and trees for greenery for residential areas and touristic villages. TWW grade B used to irrigate feed crops, fruits for processing purposes and trees for green belts, cut flowers and roses, fiber crops. TWW grade C used for irrigating industrial oil crops and wood trees. In 2014, the amount of grade C reached 59% compared with 41% grade B of the total of 12 Million Cubic Meters (MCM) with expectations to reach 17 MCM in 2017 (CAPMASS report, 2015).

Given that TWW is an attractive option, the importance of citizens' perceptual experience in the execution of a recycle project has been acknowledged as a major reason that could guide to the success or failure of the project (Jeffrey and Temple, 1999). Ashley et al. (2001) suggests that advertisements, education and participation of stakeholders like politicians and public in the policymaking process is key to successfully develop and implement of water or wastewater schemes. Hartling (2001) pointed out three main factors that can contribute to the increase of public acceptance of WWR systems; first, transparency about the project; Second, using non-professional terminology; third, public participation in the decision-making process. Shaalan (2003) has indicated several problems that may affect water reuse and negatively influencing both health and environment like poor infrastructure, low sewage connections of urban and rural populations and the poor maintained existing wastewater treatment facilities. Several studies (Nancarrow et al., 2008 and 2010; Adewumi et al., 2014) advocate that public acceptance of reuse is a function of attitude, subjective norms, knowledge about the scheme, associated risks, trust in the implementing authority, physical quality satisfaction, specific use, cost and socio-demographic factors. These factors were studied individually or collectively in many countries where TWW use systems are planned or implemented.

The literature on attitudes towards WWR can be classified into two lines of research. The first group is studies interest in understanding public attitudes in general to the idea of WWR without relating it to ongoing schemes. The Second group is studies that are interested in attitudes towards actual or under development WWR systems. One major conclusion of these two lines of research is that public support to WWR decline if the level of contact increases (Bruvold, 1984; Denlay and Dowsett, 1994; Sydney Water, 1999; Jeffrey and Jefferson, 2003; Crook, 2003; Toze, 2006; Mojid et al., 2010). Crook (2003) showed that in the United States, the public, in general, supports non-potable reuse; however, acceptance of potable reuse is problematic. Sydney Water (1999) showed that 92% of the surveyed sample agreed with the statement "people will worry about the safety of recycled for their children". Toze (2006) indicated a number of risk factors that depends on time of exposure (short and long-term) and severity (level of contact with TWW). For example, long time exposure of TWW in agriculture may cause saline effects on soils. While severity depends on the level of contact with microbial pathogens. Carr et al. (2011) conducted a semi-structured survey with 39 farmers in Jordon who uses TWW. Results showed that farmers' perceptions are that reclaimed water is a function of its quality and farmers' capacity to face the risks related to using the reclaimed water like salinity and produce marketing. Po et al. (2005) studied the factors affecting the decision of people of whether to use recycled water for different uses based on the theory of planned behavior (TPB) following Ajzan (1985) with other factors considered in the literature. Additionally they conducted a social experiment where a sample of participants were asked whether they are willing to drink recycled water and consume horticultural products irrigated with recycled water. Results showed that emotions and trust are important factors affecting the decisions of the participants and the outcome of the experiment showed that the closer the personal contact, the less the acceptable use.

The present work is part of a research project entitled "localization of low cost on-site decentralized waste water treatment in Egypt for different reuse options" to address the problem of finding alternative sources of water to minimize the gap between fixed supply and growing demand. The aim of this work is to define the factors that influence citizens' intentions towards using WWR in rural areas and villages in Egypt. First, a conceptual framework is developed based on the TPB following Ajzen (2005) and the recent literature to study the factors affecting the intentions towards WWR for non-potable applications in Egypt using SEM. The paper is organized as follows; next section undertakes the development of the conceptual framework. Section 3 will discuss the methodology adopted. Section 4 presents the empirical results. Section 5 will discuss concluding remarks and policy implications.

2. Conceptual framework: WWR

Ajzen (2005) has showed that TPB behaviors can be predicted with high accuracy from attitudes towards the behavior, subjective norms and perceived behavioral control. Additionally we consider additional factors following the recent literature (for example, Po et al., 2003; Fielding et al. 2009; Adewumi et al., 2014) like trust in authorities, quality of wastewater and knowledge. The conceptual framework model in figure 1 will be tested using the SEM technique with the following hypothesis

- H1: Respondents' positive attitude for TWW use will have a positive effect on the intention to use TWW for non-potable requirements. Ajzen (2005) has showed that several indicators can influence people' attitudes like personality traits, emotion and mood.
- H2: Respondents' perceived control regarding water source has a positive effect on the intention to use TWW for non-potable requirements. When consumers perceive more behavioral control over the source and applications of water, the intention to use will increase. Perceived behavioral control is the awareness to the degree to which the behavior is manageable. Furthermore, Verbeke and Vackiere (2005) showed that perceived behavioral control is more relevant than actual control as it represents the degree of simplicity of doing a behavior of particular interest.
- H3: positive subjective norms towards TWW use for non-potable requirements will have a positive effect on intention to use. Subjective norms constitute the perceived social pressure to engage in a behavior, which is influenced by a set of normative beliefs.
- H4: The physical quality of TWW (color and purity) will have a positive effect on respondents' trust in the government to accept WWR for non-potable water requirements. Hurlimann and McKay (2007) showed that recycled watercolor was an important attribute for consumers to use recycled water to wash clothes.
- H5: Respondents' knowledge of the benefits of WWR will increase trust in the government which will influence the intentions to use.
- H6: Respondents' trust in the government has a positive effect on respondents' attitudes towards the WWR for non-potable requirements. Po et al. (2005) and Fielding et al. (2009) have showed that trust in the government is considered a key determinant of the acceptance of WWR.

3. Methodology

3.1. The sample

To test the hypotheses mentioned above, we conducted a survey in the rural areas and some villages of Giza and Dakahlia governorates (Egypt) from July to September 2016. Cross-sectional data were collected through the distribution of 1100 questionnaires to individuals. Individuals who did not respond to questions or did not reported their demographic and socioeconomic information were dropped from the sample. Therefore, the sample size used in the analysis was 996 (see Table 1). [1] The sample size under consideration should be large to comply with the criteria of the SEM model. The sample focuses on the rural villages, which lack the existence of centralized facilities to treat wastewater.

[1] The sample error is ±3 % (97%).

3.2. Measures

The questionnaires were physically administered, participants were individually approached and encouraged to participate in the survey. The questionnaire was categorized into three parts: First part, introduction that stated the goals of the project, which was to identify perceptions on WWR for non-potable purposes and the willingness to buy a low cost decentralized wastewater treatment system. Second part, asks the participants about reuse options of TWW, the third part is about behavioral intention questions (developed to test hypotheses H1–H6) and demographics (gender, age, marital status, employment, education, household size and level of income).

3.3. The SEM technique

The SEM approach was adopted in our study to evaluate the WWR behavior model while testing the causal links specified in the theoretical model (see Figure 4). Lisrel 8.8 software has been used. SEM is a widely applied technique in consumer research, since it allows modeling simultaneously many relationships that uses latent variables in the analysis as dependent or explanatory variables. Lobb et al. (2007) have indicated that SEM allows for a multivariate analysis of consumers' behaviors that cannot be estimated directly like attitudes, social pressure and lifestyles. Jöreskov and Sörbomm (1996) have indicated that SEM constitutes three forms interactions; First, a measurement model is identified where the specification of latent variables by a series of questions using a confirmatory factor analysis (CFA) as shown in equation (1):

$$x = \Lambda_x \xi + \delta \tag{1}$$

where x is a q×1 vector of observed exogenous variable; Λ_x is a q×n matrix of coefficients of the regressions, ξ is n×1 random vector of latent independent variables, and δ is a q×1 vector of error terms. Furthermore, it is assumed that δ is uncorrelated with ξ. Second, relating the observed indicators with exogenous latent variables as shown in equation (2)

$$y = \Lambda_y \eta + \varepsilon \tag{2}$$

where y is a p×1 vector of observed indicators, Λ_y is a p×m matrix of coefficients of the regressions, η is m×1 random vector of latent dependent variables; and ε is a p×1 vector of error terms in y. Furthermore, it is assumed that ε is uncorrelated with η. Third, describe the causal relations that exist among both exogenous and endogenous latent constructs in equation (3),

$$\eta = \beta\eta + \Gamma\xi + \zeta \tag{3}$$

where β is an m×m matrix of coefficients of the η vector of dependent variables in the structural relationships, Γ is an m×n matrix of coefficients of the ξ vector of independent variables in the structural relationship, and ζ is a m×1 vector of errors. The full model will be estimated using Unweighted Least Squares (ULS) due to potential non-normality. ULS estimates are consistent and has the advantage of no distributional assumptions, which solves the problem of non-normal distribution in our data.

To test the goodness of fit for the estimated SEM model, we use three approaches, first the statistical significance of individual parameter estimates in the model; Second the direction of the parameters according to the theory. Third different fit criteria for the model as a whole will be used following the literature (Arbuckle, 2005; Batista and Coenders, 2000; Schumacker and Lomax, 2004). Chi- square ($\mathcal{X}^2$) test and the root-mean-square error of approximation (RMSEA) values, which are global fit measures, Goodness-of-Fit Index (GFI); the Adjusted Goodness of Fit Index (AGFI); the Comparative-Fit-Index (CFI); the Normed-Fit-Index (NFI) and the Non-Normed-Fit-Index (NNFI).

4. Results

4.1. Descriptive results

A description of the results will be presented in this section to provide a baseline on the respondents' current situation regarding the WWR decision-making process. Respondents were asked what is the source of drinking water they have, to determine the distribution of homes that are served with government-centralized water supply or homes that had their own water wells. Results indicate that 96.2% of the respondents are on government services. While the remaining 3.8% are from wells. The respondents as well were asked about whether are connected with government centralized wastewater disposal system. Results show that 3.6% are on government services and the remaining 96.4% have their own septic system. Figure 2 show the level of respondents familiarity to terms that are regularly used by experts in the field of water and wastewater systems development. Familiarity with these terms is considered an indicator of the type and amount of outreach that will be required.

With respect to reuse options for TWW, nineteen-reuse option were considered in the survey. These options were classified into three groups; First group represent low contact reuse options that have indirect link to the population. Second group represent medium contact reuse options, which are in close proximity with the population. Third group includes high contact reuse options, which are intensive contact with the population. Figure 3 shows that as the level of contact increases with TWW the lower the support to choose that option, this could be a reason for perceived health risks, cultural and local issues, our results are compatible with Crook et al. (1994). The high support for medium contact options is in line with the results of Marks (2004). Additionally, we correlate between demographic characteristics (income level, age, education) and reuse categories (low, medium and high). Results show the presence of correlation between education, high income and age with different reuse options.[2]

We ask the respondents their willingness to buy for a low cost decentralized wastewater treatment unit that was developed in the Faculty of Science - Cairo University. A picture of system was included in the questionnaire and its characteristics were briefly introduced. Results indicate that 44.9% agreed and 19% have indicated that it would be possible to buy the wastewater treatment unit. A follow up question was about how much they are willing to pay on monthly basis for this unit. Results showed that 57.5%, of those who answered yes and possible are willing to pay for 100 Egyptian pounds (EGP) and 4.4% are willing to pay 300 EGP taking into account that the unit costs 4000EGP.

4.2. Measurement model results

The constructs are measured with multiple statements (see table 2); we assess the correlation among these statements to check their internal consistencies with one another. To do so, Cronbach's alpha (α) value was estimated for multiple statements measuring a construct is used to check the internal consistencies. Cronbach's alpha has a value varies from zero to one, according to Vicente & Reis (2008) Cronbach's alpha value above 0.70 indicates good internal consistency among items. Average Variance Extracted (AVE) value above 0.5 represent an acceptable amount

[2] Results are available upon request

of common variance among latent construct indicators. Exploratory Factor Analysis (EFA) is performed to check the factor loadings, which is the correlation between the statements and the constructs. A factor loading higher than 0.7 is considered excellent while less than 0.34 is considered very poor (Yongminga et al., 2006).

In order to validate the measurement model CFA for the six constructs is performed (see table 3). According to Hair, et al. (1998), CFA is performed to check identification problems like high correlation among coefficients and large standard errors. As shown in Table 3, the Satorra-Bentler scaled Chi-Square is 357.78 with 110 degrees of freedom which indicates that the null hypothesis is rejected which is the proposed model fit results in differences between S (the covariance matrix of the observed indicators) and $\widehat{\Sigma}$ (the implied matrix). Normed Chi-square (NC= $\chi 2$/df) instead of the Satorra-Bentler scaled Chi-Square. In our case, the NC value is 3.25 while a good indicator for goodness-of-fit is in a range between 1 and 5. The model meets the accepted goodness of fit measure recommended values following (Arbuckle, 2005; Kline 2011). The CFA results suggest that the proposed measurement model to provide a reasonable goodness-of-fit to continue to the next step of estimating the SEM.

4.3. Structural model results

Once the measurement model is identified that includes the endogenous constructs that are intentions, attitudes and trust and the exogenous constructs that are subjective norms, behavioral control, quality and knowledge. The next step is estimating the structural model (see Figure 4). The results of the SEM for the direct and indirect relationships that investigates factors affecting respondents' intentions towards WWR are presented in table 4. As indicated by Po et al (2005) and Fielding et al (2009), a strong contribution is characterized by coefficient estimate values greater than 0.40, moderate contribution ranges from 0.20 to 0.40, and a weak contribution represents values below 0.20. Results show that subjective norms and attitudes are found to have strong contribution to respondents' intentions, while behavioral control has a weak contribution, these results supports hypotheses 1, 2, and 3.

TWW physical quality and knowledge are found to have a strong contribution in explaining trust in water service providers, which affects indirectly respondents' intentions. Overall, the results suggest that the analyzed variables are found to be statistically significant in explaining the use of the TWW behavior. These variables explain 84% of the variance for the case of the model. Specifically, our results indicate that the more control on water source and its applications will increase respondents' intentions towards TWW reuse. The model meets the accepted goodness of fit measure recommended values following the literature.

5. Conclusions

This paper investigates a hypothesized model based on the TPB and the recent literature to identify the factors affecting the intentions the use of the TWW non-potable purposes in the rural areas of two Egyptian governorates Giza and Cairo. Results showed that for the consumers surveyed for a sample size of 992 respondents, attitude towards WWR, the degree of control over the source of water and its application, the social pressure are found to have a direct effect on intention to accept WWR. While knowledge of the advantages of reuse and physical quality of the TWW are found to indirectly affect intentions to accept WWR through the increase in trust in the service provider. The survey as well shows there is a considerable support for the idea of WWR schemes. More specifically, the options that were defined as medium contact received very high support. Higher contact options have received much lower support. Correlation between demographic characteristics and the contact levels are found to be statistically significant.

Hence, our results suggest that it would be relevant when designing new policies and campaigns that would focus on the benefits of using TWW from economic and environmental point of view and targeting illiterate and low-income people through developing new low cost WWR projects.

6. References

Adewumi, J.R., Llemobde, A.A. and Van Zyl, J.E. (2014). Factors predicting the intention to accept treated wastewater reuse for non-potable uses amongst domestic and non-domestic respondents. *Journal of the South African Institution of Civil Engineering*, 56: 11-19.

Ajzen, I. (1985). *From intentions to actions: A theory of planned behaviour*. In Kuhl, J., and Beckmann, J., (eds.) Action control : from cognition to behaviour. Springer, Berlin.

Ajzen, I., 2005. *Attitude, personality and behavior (Second edition)*. Bershire, England: Open University press.

Arbuckle, J.L. (2005). *AmosTM 6.0 user's guide*. Spring House, PA, USA.

Ashley, R.M., Souter, N. and Hendry, S. (2001). *The importance of public attitudes and behavior for the management of urban water systems. Frontiers in Urban Water Management: Deadlock or Hope?* In: Proceedings of the International Symposium organized by UNESCO, Marseille, France, June 2001, pp. 318–326.

Batista F., J.M. and Coenders, G. (2000). *Modelos de ecuaciones estructurales : modelos para el análisis de relaciones causales*. Hespérides, Villares de la Reina, Salamanca.

Bollen, K.A. (1989). *Structural equations with latent variables*. Wiley Series in Probability and Mathematical Statistics.

Bruvold, W.H. (1984). *Obtaining public support for innovative reuse projects*. In Proceedings of the Water Reuse Symposium, vol. 3, San Diego Ca, pp. 122–132.

Carr, G., Potter, P.B. and Nortcliff, S. (2011). Water reuse for irrigation in Jordan: Perceptions of water quality among farmers. *Agricultural Water Management*, 98 (5): 847-854.

Central Agency for Public Mobilization and Statistics (CAPMASS) report, *yearly statistics bulletin for drinking and wastewater*, 2014. Available at: (http://www.capmas.gov.eg/Pages/Publications.aspx?page_id=5104&Year=21872).

Crook, J. (2003). *An overview of water reuse*. Keynote lecture at International Seminar on Wastewater Reclamation and Reuse. Organized by MED-REUNET (Mediterranean Network of Water Reclamation and Reuse). Sponsored by EU Research Directorates General, Agbar Foundation (Spain) and Ege University, Izmir, Turkey (http://www.med-reunet.com/02medr1/03_seminar.asp).

Denlay, J. and Dowsett, B. (1994). *Water Reuse the most reliable water supply available*. Report prepared as part of the Sydney Water Project, Friends of the Earth Inc, Sydney, Australia, 57p.

Fielding, K. S., Price, J. and Leviston, Z. (2009). *Community perceptions and acceptance of the indirect potable recycling scheme in South East Queensland*. Proceedings. 7th IWA World Congress on Water Reclamation and Reuse, Brisbane, Australia, 20–25 September.

Hair, J.F., Anderson, R.E., Tatham, R.L. and Black, W.C. (1998). *Multivariate Data Analysis*. (5th Edition). Upper Saddle River, NJ: Prentice Hall.

Hartling, E.C. (2001). Laymanization—an engineer's guide to public relations. *Water Enviroment and Technology*, 45–48.

Hurlimann, A. and McKay, J. (2007). Urban Australia using recycled water for domestic non-potable use – An evaluation of the attributes price, saltiness, colour and odour using conjoint analysis. *Journal of Environmental Management*, 83 (1): 93–104.

Jeffrey, P. and Jefferson, B. (2003). Public receptivity regarding in-house water recycling: results from a UK survey. *Water Science and Technology—Water Supply*, 3 (3): 109–116.

Jeffrey, P. and Temple, C. (1999). Sustainable water management: some technological and social dimensions of water recycling. *Sustainable Development International*, 1: 63–66.

Jöreskov, K. and Sörbom, D. (1996). *Lisrel 8: User's Reference Guide*. Scientific Software.

Kline, R.B. (2011). Principles and practice of structural equation modeling, Methodology in the social sciences. Guilford Press.

Lobb, A.E., Mazzocchi, M. and Traill, W.B. (2007). Modelling risk perception and trust in food safety information within the theory of planned behaviour. *Food Quality and Preferences* 18 (2): 384–395.

Marks, J. (2004). *Back to the future: reviewing the findings on acceptance of reclaimed water*. Conference Proceedings, Enviro 04, Australian Water Association, 28–31 March 2004, Sydney, Australia.

Misheloff, R. (2010). *Integrated water resources management II, feasibility of wastewater reuse*. Report no.14, USAID. Available at: (http://www.mwri.gov.eg/project/report/IWRMII/Report14 Feasibility_of_WW_Reuse.pdf).

Mojid, M.A., Wyseure, G.C.L., Biswas, S.K. and Hossain, A.B.M.Z. (2010). Farmers' perceptions and knowledge in using wastewater for irrigation at twelve peri-urban areas and two sugar mill areas in Bangladesh. *Agricultural Water Management*, 98 (1): 79-86.

Nancarrow, B.E., Leviston, Z., Po, M. Porter, N.B., and Tucker, D.I. (2008). What drives communities' decisions and behaviours in the reuse of wastewater. *Water Science and Technology*, 57 (4): 485–491.

Nancarrow, B.E., Leviston, Z., and Tucker, D.I. (2009). Measuring the predictors of communities' behavioural decisions for potable reuse of wastewater. *Water Science and Technology*, 60 (2): 3199–3209.

Schumacker, R.E. and Lomax, R.G. (2004). *A Beginner's Guide to Structural Equation Modeling*, Volume 2.

Shaalan, N.S. (2003). *Egypt country paper*. Proceedings of the expert consultation for launching the regional network on wastewater re-use in the Near East.

Sydney Water (1999). *Community views on re-cycled water*. Sydney Water Research Report.

Po, M., Nancarrow, B.E., Leviston Z., Porter, N.B., Syme, G.J. and Kaercher, J.D. (2005). *Predicting community behaviour in relation to wastewater reuse: What drives decisions to accept or reject?* Water for a Healthy Country National Research Flagship. Perth: CSIRO Land and Water.

Simon T. (2006). Reuse of effluent water – benefits and risks. *Agricultural water management*, 80: 147-159.

Vicente, P. and Reis, E. (2008). Factors influencing households' participation in recycling. *Waste Management Research*, 26: 140–146.

Verbeke, W. and Vackiere, I. (2005). Individuals determinants of fish consumption: application of the theory of planned behavior. *Appetite*, 44: 67-82.

Yongminga, H., Peixuana, D., Junji, C. and Posmentier, E, S. (2006). Multivariate analysis of heavy metal contamination in urban dusts of Xi'an, Central China. *Science of the Total Environment*, 355 (1-3): 176–186.

Figure 1. Theoretical framework for the use of the treated wastewater

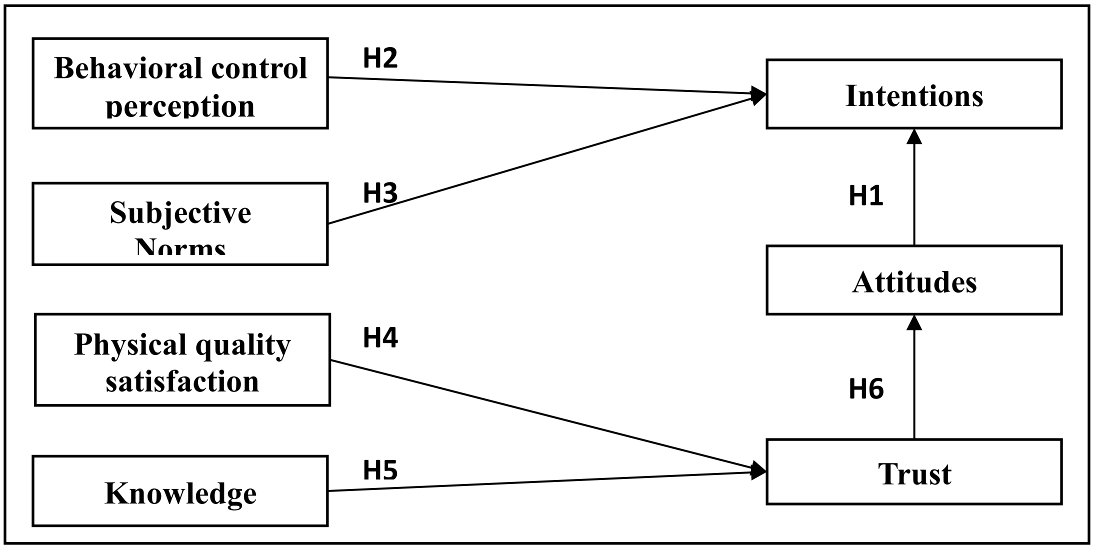


Figure 2. Familiarity with different terminologies

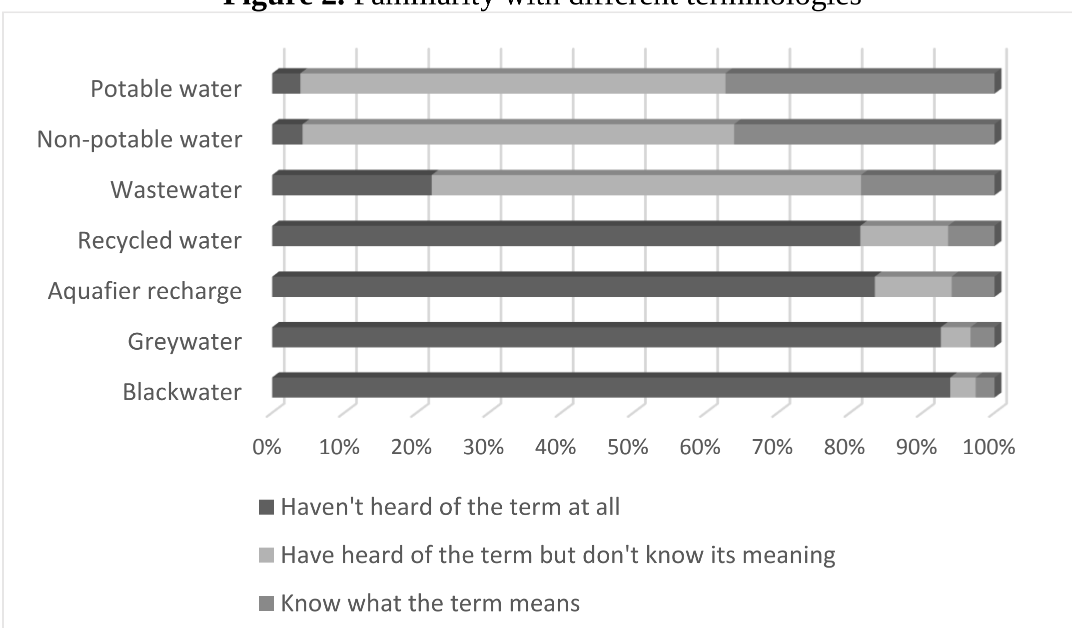


Figure 3. Treated wastewater contact level

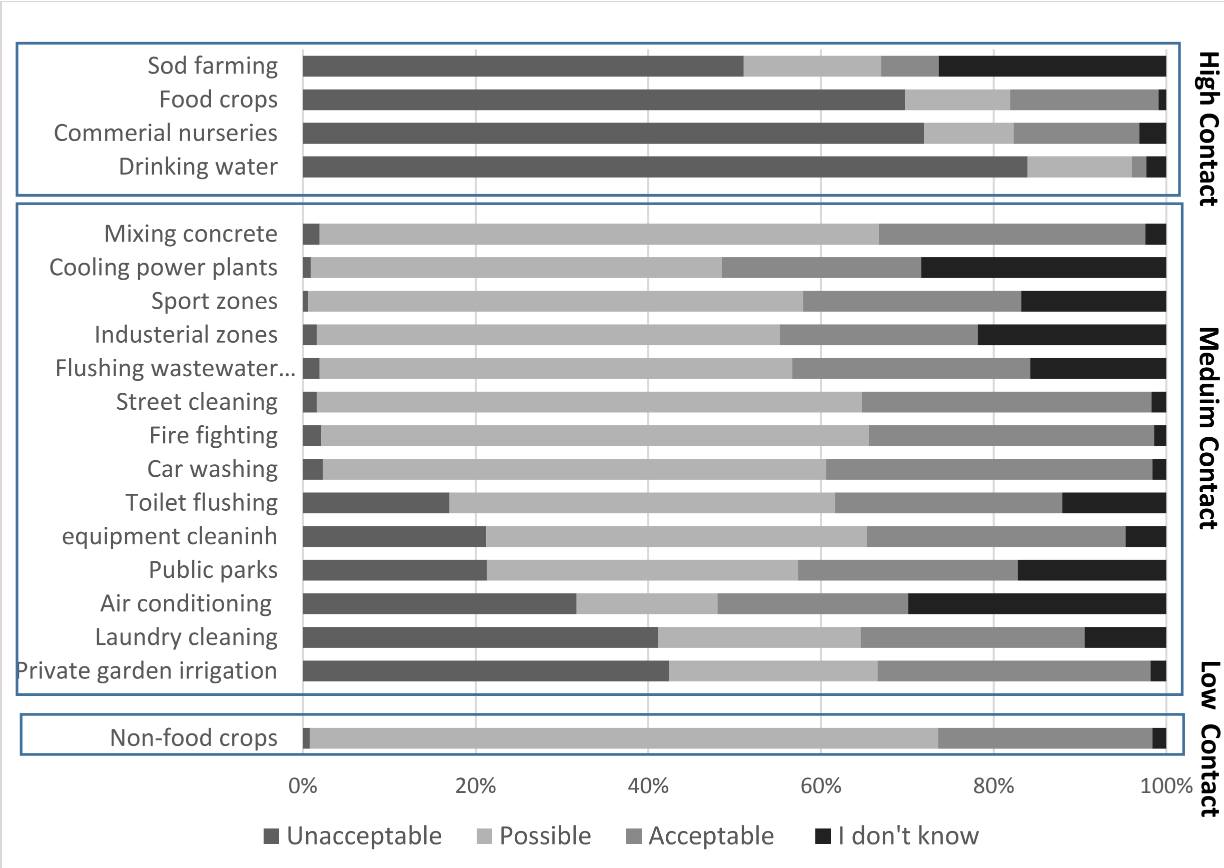
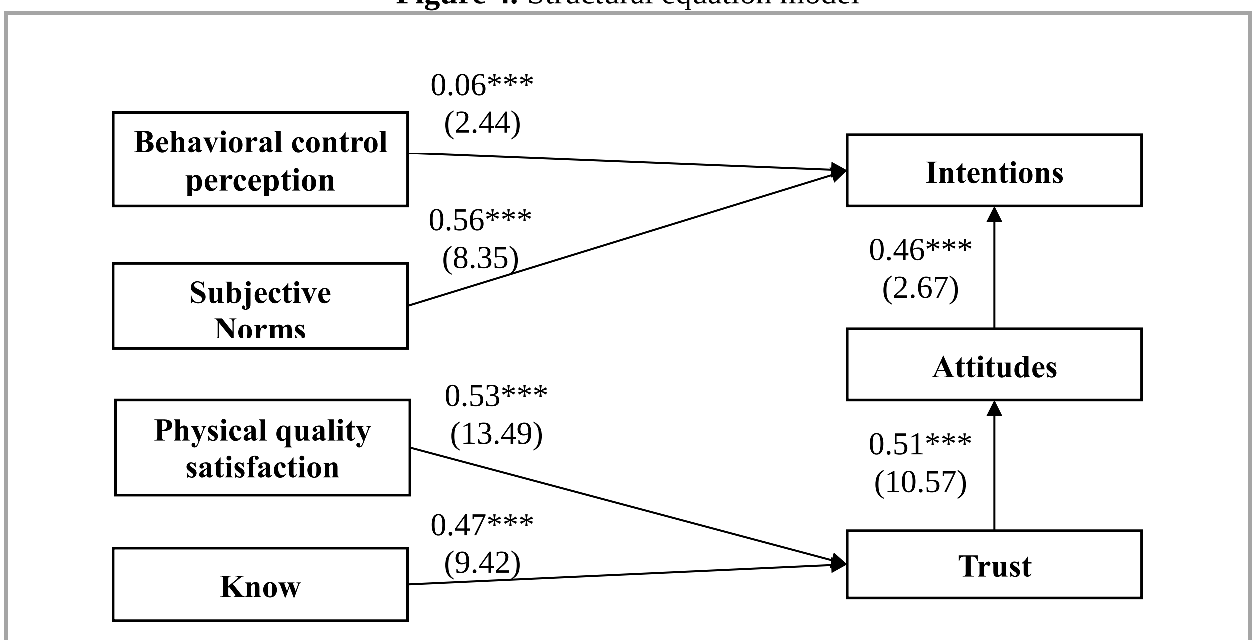


Figure 4. Structural equation model



*,**,*** indicates significance level at 10%, 5% and 1%
t-values in parenthesis

Table 1. Characteristics of the sample

N=996	Sample %		Sample %
Gender		**Work status**	
Male	86.2%	Employed	83.9%
Female	13.8%	Unemployed	16.1%
Income level		**Education level**	
Less than 1000 EGP	42.9%	Illitrate	44.3%
From 1000 to 3000 EGP	40.1%	intermediate	39.5%
From 3000 to 5000 EGP	17.1%	University degree	16.2%
Age		**Household Size**	
18-25	13.6%	3 – 5	75.2%
26-44	42.7%	6 – 7	19.2%
45-55	41.7%	8 – 9	4.9%
More than 55	2.10%	More than 9	0.7%

Table 2. Survey statement used to measure each model construct

Constructs		Items
Intentions (int)	Int1	I intend to use treated wastewater for non-potable uses
	Int2	I plan to use treated wastewater in times of shortage
	Int3	I am willing to use treated wastewater in any time
Attitudes (att)	Att1	I am personally obligated to do what I can to save water
	Att2	Water is a very important resource that should be recycled
	Att3	The government is responsible for water shortage
Subjective norms (subnorm)	Subnorm1	I will use treated wastewater if I find others using it
	Subnorm2	People who are close to me support me to use treated wastewater
	Subnorm3	Using treated wastewater is a choice for the poor
Behavioural control (behctrl)	Behctrl1	I have the right to know if the fruits and vegetables are irrigated with treated wastewater
	Behctrl2	Fruits and vegetables irrigated with treated wastewater should be labelled in the supermarket
	Behctrl3	I have the right to have an adequate supply of potable water
Knowledge of advantages (Know)	Benef1	Using treated wastewater minimize the amount of water discharged to the environment
	Benef2	Using treated wastewater minimize the reduction of groundwater and surface water resources
	Benef3	A significant savings in fertilizers for farms using treated wastewater for irrigation
	Benef4	Using wastewater can help in minimizing the need to expand or build new central sewage systems
Trust	Trust1	I will use treated wastewater if the quality is proven to be satisfactory
	Trust2	I will use treated wastewater if it is not disgusting or irritating
	Trust3	I will use treated wastewater if it doesn't stain the cloth during washing
Quality	Quality1	I will use treated wastewater if it is completely clear
	Quality2	I will use treated wastewater if it is colourless

Table 3. Validation of the Confirmatory factor analysis of the measurement model

Constructs	Indicators	Standardized loadings	t-values	Cronbach's Alpha	Composite Reliability	Extracted Validity
Intention	Int1	0.85	28.95	0.85	0.89	0.72
	Int2	0.88	24.19			
	Int3	0.82	32.83			
Attitudes	Att1	0.48	10.28	0.66	0.60	0.36
	Att2	0.86	15.16			
	Att3	0.34	7.40			
Subnorm	Subnorm1	0.98	78.12	0.80	0.88	0.73
	Subnorm2	0.99	99.90			
	Subnorm3	0.49	12.30			
Behctrl	Behctrl1	0.91	54.77	0.76	0.96	0.90
	Behctrl2	0.99	49.74			
	Behctrl3	0.95	78.12			
Know	Know1	0.83	30.70	0.93	0.96	0.85
	Know 2	0.95	55.70			
	Know 3	0.96	54.47			
	Know 4	0.95	55.51			
Trust	Trust1	0.93	47.27	0.94	0.96	0.87
	Trust2	0.98	82.78			
	Trust3	0.90	49.39			
Quality	Quality1	0.96	73.86	0.95	0.97	0.92
	Quality2	0.96	73.08			

Goodness of fit measures	Recommended values according to the literature		Estimated fit measures
NC = χ^2 /df	Schumacker and Lomax (2004)	1 - 5	357.78 / 110 = 3.25
RMSEA	Batista and Coenders (2000)	< 0,08	0.023
NFI	Arbuckle (2005); Kline (2011)	≥ 0,9	0.99
NNFI	Arbuckle (2005); Kline (2011)	≥ 0,9	0.99
CFI	Arbuckle (2005); Kline (2011)	≥ 0,9	1.00
CN	Arbuckle (2005); Kline (2011)	≥ 200	410.96
GFI	Arbuckle (2005); Kline (2011)	≥ 0,9	1.00
AGFI	Arbuckle (2005); Kline (2011)	≥ 0,9	1.00

Table 4. Direct and indirect estimated SEM parameters (standardized solution)

Equation		Errorvar	R^2
Trust = 0.53***quality + 0.47***Know		0.09	0.90
Att = 0.51***Trust		0.09	0.72
Int = 0.46***Att + 0.06***Behctrl + 0.56***Subnorm		0.12	0.84
Goodness of fit measures	**Recommended values according to the literature**		**Estimated fit measures**
$NC = \chi^2/df$	Schumacker and Lomax (2004)	1 - 5	546.69 / 132 = 4.1
RMSEA	Batista and Coenders (2000)	< 0,08	0.037
NFI	Arbuckle (2005); Kline (2011)	≥ 0,9	0.99
NNFI	Arbuckle (2005); Kline (2011)	≥ 0,9	0.99
CFI	Arbuckle (2005); Kline (2011)	≥ 0,9	0.99
CN	Arbuckle (2005); Kline (2011)	≥ 200	315.34
GFI	Arbuckle (2005); Kline (2011)	≥ 0,9	0.99
AGFI	Arbuckle (2005); Kline (2011)	≥ 0,9	0.99

*,**,*** indicates significance level at 10%, 5% and 1%