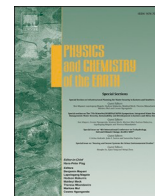




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Water conservation by managers at the workplace: Examination of attitudes and behaviour using the theory of planned behaviour

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ABSTRACT

Understanding the behavioural drivers of water conservation in public spaces is essential for enhancing the effectiveness of water resources management and water use especially in water scarce environments. This study used the Theory of Planned Behaviour to determine the contributing factors of water conservation attitude and behaviour among managers at work. Data were collected from 72 managers at North-West University – Mahikeng, South Africa through self-administered survey questionnaire. Results showed that behaviour practices of reporting water leakages and closing taps were prevalent among the managers. Furthermore, positive correlations including length of service ($r = 0.791$); training on water issues ($r = 0.542$); gender ($r = 0.509$) and speaking about water conservation ($r = 0.091$) emerged as significant predictors of a water conservation attitude and behaviour. Promotion of water conservation attitude and behaviour through education and training would have a greater tendency among managers to conserve water at work.

1. Introduction

This research determines the prevalence of a water conservation attitude and behaviour among managers in the workplace. Water is a crucial resource that drives all aspects of life (World Water Forum, 2018). Water is one of the natural resources which sustains socio-economic development as well as maintain environmental integrity (Cosgrove and Loucks, 2015). The major global water users being agriculture, industrial and domestic sectors. Shortages and compromised water availability are causes of concern to food security (agricultural sector), performance of businesses, and economic growth among others. The conservation of water is thus essential for socio-economic development.

According to the Department of Water and Sanitation (DWS, 2015), South Africa is classified as a semi-arid country which experiences variations in terms of precipitation associated with droughts, dry spells and occasional flooding which contribute to the acute water shortages. These water shortages are exacerbated by an increase in population growth, resulting in a water demand that exceeds supply (DWS, 2018; He et al., 2021; Morante-Carballo et al., 2022) and inefficient water use or management practices (DWS, 2015). Worsening the situation is the demand from various activities in quest for economic development in

South Africa that have led to the contamination of water sources, thus threatening the security of water resources. Being considered as a water scarce country (Che et al., 2021; DWS, 2022), South Africa has declared, through the Department of Water of water and sanitation that 'water resources must be shared equitably and managed judiciously by all water users in an utmost discretion manner' (DWS, 2015; DWS, 2022). The recognised central guiding principles in the protection, management, use, conservation, development, and control of water resources are sustainability, efficiency, and equity (Kotir et al., 2017; Rasmussen et al., 2017; Bajzelj et al., 2016).

In Higher Education Institutions (HEIs), Managers are concerned with the articulation of the institution's mission, strategic planning, evaluation, and commercial marketing, to ensure that their organizations become more entrepreneurial, adaptive, and commercially responsive (Meek et al., 2010). While the academic managers focus on teaching and research; the non-academic managers, in other words those managers who function in support departments such as human resources, finance and central administration are concerned with infrastructure maintenance and renovations as well as recruitment and selection, monitoring and controlling employees and interpreting policies to employees (Bainbridge, 2015). Managers are accountable for all resources within an institution, whether operational or technical. In the

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context of water conservation, prevalent attitudes and intentions that define the organisation's position and practices do not only afford guidelines as to how managers should respond to water scarcity, but they also provide a structure for action to reduce inefficient usage of water in the workplace. As a result, determining why managers may or may not choose to engage in water conservation practices and not necessarily how managers conserve water in the workplace is critical for water resources management.

Given the importance of environmental behaviours and the need to gain insight to a deeper understanding of the root causes of unusual behaviours of humans towards water conservation measures in the workplace by using the Theory of Planned Behaviour (TPB). This is important in two-fold; (i) to provide an insight into researchers who have focused on deeper understanding of the root cause if unusual behaviour to water conservation and (ii) to deduce from existing Theory of Planned Behaviour and literature, contextual and behavioural factors that might influence the exhibition of pro-environmental behaviours in higher educational milieu. The TPB was developed by Ajzen (1991) and has generated strong debate in the context of predicting the intentions of individuals to engage in water conservation behaviour. According to the TPB, the proximal determinants of a given behaviour is behavioural intention (BI). The TPB proposes that behaviour is determined by a cognitive-intention-behaviour framework. In other words, cognition (attitude, subjective norms (SN), and perceived behavioural control (PBC)) influences intention, and intention influences behaviour (Li et al., 2023). Attitude comprises of feelings, beliefs, and behaviours which are always directed towards a target (person, object, or event) and represent the degree to which that target is perceived favourable or unfavourable (Woods and West, 2015). According to Fishbein and Ajzen (2010), attitude is formed by the beliefs about the likely outcomes of the behaviour (salient beliefs) and the evaluations of these outcomes.

The subjective norm is the perceived social pressure to perform or not to perform the behaviour and is constructed by beliefs about the perceived expectations of others to carry out the behaviour (normative beliefs) and the motivation to comply with these expectations. Perceived behavioural control reflects the extent to which the individual feels he or she is able to actually carry out the behaviour, which is based on beliefs about factors that may facilitate or impede performance of the behaviour (control beliefs) and the perceived power of these factors (Ajzen, 1991). According to Barber and Legge (2017), perception is about receiving, selecting, acquiring, transforming, and organizing the information supplied through one's senses. The three TPB constructs; the attitude toward the behaviour, the subjective norms, and the perception of behavioural control, lead to the formation of a behavioural intention, which in turn leads to the performance of the behaviour (Ajzen, 1991). Building on the basis of this theory, water conservation depicts changes in the behaviour of managers in response to the situation of water availability, demand, and supply.

Besides, TPB is being increasingly applied in a broad range of fields, such as recycling intentions (Arli et al., 2020), academic higher education (Bornschlegl et al., 2021), irrigation practices (Chaudhary et al., 2017), self-care in patients with hypertension (Pourmand et al., 2020), food-safety production behaviours (Nickell and Hinsz, 2023), agricultural water consumption (Mahdavi, 2021), banking intentions (Tucker et al., 2020), and waste separation behaviour (Razali et al., 2020). Yuriev et al. (2018) from a systematic review of the empirical literature on pro-environmental behaviours in the workplace concluded that workers in any organisation can voluntarily perform numerous environmental behaviours such as recycling, carpooling, or willingness to conserve water as an initiative to natural resources management. In Iran, Gholamrezai et al. (2021) sought to investigate the role of social norms, personal norms, and perceived behavioural control on pro-environmental behaviour among farmers producing organic products (green poultry) based on the theory of planned behaviour. Using a sample of 420 farmers taken by multi-stage cluster sampling, results revealed that personal norms, social norms, and perceived behavioural

control had a significant effect on the pro-environmental behaviours of the farmers. Furthermore, Ataei et al. (2022), investigated the socio-cognitive analysis of the water conservation behaviours of Iranian farmers drawn from 351 participants by using a confirmatory factor analysis and structural equation modelling (SEM). The authors found that water conservation intention and behaviour were significantly influenced by their socio-cognitive level resulting from social pressures. From this review, it can be inferred that people's attitudes, social norms and perceived behavioural controls are highly influenced by geographical region, cultures and are subjective to their ability to engaged in conservative behaviours. It also indicates that only few of the reviewed studies have looked at managers perception within the TPB theoretical framework in the context of water conservation and water efficiency usage in tertiary institutions of higher learning. This itself highlight the loops and the need for further research in this field particularly in countries facing water crisis. The perusal of literature also suggests that most and if not all of the empirical studies that have incorporated behaviour, psychological and social aspects of water conservations measures have achieved significant milestone in the field of water usage.

In accordance with the TPB, managers can integrate water conservation attitudes and behaviours which could set environmental sustainability norms and perceptions within the workplaces. Such setting of norms and perceptions could generate environmental conduct and awareness, which could eventually build environmental consciousness towards sustainable utilisation of resources. Based on the TPB, it is expected that perceived positive change of attitude has a positive relation with the intention to act pro-environmentally (Bhattacharyya et al., 2020), in the case of the study, to conserve water. The National Water and Sanitation Master Plan of South Africa (DWS, 2018) stipulates the need to reduce water use through measures such as efficient water usage and improved technology, and water conservation in accordance with applicable rules and regulations. Vickers (2001) describes water efficiency as the minimisation of the amount of water used to accomplish a function, or task. Accordingly, water efficiency relies on well-engineered products and fixtures like reduced water use dishwashers, or low-flow toilets and showerheads. Coupled with water efficiency is user behaviour related to the adoption of behavioural change to reduce wastage by choosing efficient technologies (Viera et al., 2017). The technological efficiency is associated with the performance of the water use devices in terms of the amount of water used in relation to the minimum amount of water needed to satisfy the intended needs. On the other hand, water conservation includes all of the policies, programs and practices designed to help people change their behaviours and use less water (Vickers, 2001). While both water efficiency and water conservation aim at using less water and support people with water usage, the approach to water saving is different. Water conservation practices are coupled with behavioural change which is critical to help reduce the amount of water used. In addition, 'conservation' is a psychological construct that underpins one's personal distinguishable attitudes, beliefs, and values (Schein, 2015). In the current water scarcity conditions, the most essential way of meeting global water needs is optimal management of the resource by every sector, including public institutions. Water conservation behaviour at the workplace should encompass behavioural aspects of the management of the resource through modified consumption as well as prevention of loss (Ataei et al., 2022). As such, a water conservation behaviour will influence one's "everyday" attitudes, intuitions and actions towards water saving and water efficient usage even in a workplace environment.

Numerous studies have investigated determinants of water conservation, and a significant body of works exists. Previous conversations pertaining to water conservation would have been understood as consequences of water availability, water shortages and/or water consumption due to natural forces as well as reticulation or lack of service delivery (McKenzie-Mohr et al., 1995). However, current views of natural resources conservation are interaction between availability and pro-environmental behaviour (Forster and Pereira, 2015). Adams

(2014) investigated the links between pro-environmental behaviour and water conservation attitude using the 2010 General Social Survey (GSS) in the United States focusing on the relationship between socio-economic characteristics and pro-environmental behaviour, and the relationship between pro-environmental behaviour and water conservation attitudes. Results revealed that individuals who have a greater measure of willingness to sacrifice for the environment also have the tendency to engage in water conservation behaviour. While education and income (socio-demographic variables) did not show significant influence on the dependent variable, pro-environmental behaviour turned out to be a significant predictor of water conservation behaviour. Using relationships between environmental and water conservation attitudes and a domestic water end use, Willis et al. (2011) concluded that residents in the Gold Coast city, Australia with very positive environmental and water conservation attitudes, consumed significantly less water in total and across the behaviourally influenced end uses of showering, clothes washing, irrigation and tap, than those with moderately positive attitudinal concern. Those water users with positive attitudes towards environmental sustainability would tend to be more cautious when using water than those who do not highly value or consider the environment.

Normative inclinations as well as perception of risk are found to be important for intention as well as actual water conservation behaviour (Yazdanpanah et al., 2015). Boland and Whittington (2000) noted that for water conservation to be implemented, understanding of the multi-dimensional facet of the water problem and the acceptance of the need for water conservation is necessary. Attempts to promote voluntary action will require an understanding of existing behaviour, and also an understanding of how behavioural change can be influenced (Yazdanpanah et al., 2015). Gilbertson et al. (2011), investigated whether individual attitudes to water conservation, and reported participation in water conservation behaviour, differ between two Australian locations that vary significantly in their physical water situation. Results of the study revealed that there are significant differences in attitude and participation between the two areas. More people from the water-scarce location are supportive of most water conservation behaviour, and they are significantly more likely to state that they participate in water conservation behaviour (Gilbertson et al., 2011).

Besides water scarcity and pro-environmental behaviour as drivers of water conservation, some of the studies have reported significant relationships between the level and form of water prices and the adoption of water conservation behaviour by households (Aprile and Fiorillo, 2017; Dupont and Renzetti, 2013). Socio-demographic characteristics (age, education, gender, and income) showed that water conservation did not have an asserted relationship with a person's income, age, or level of education (Zietlowa and Michalscheck, 2016). However, a correlation analysis showed that only income and education were linearly related. Clarke and Brown (2006); Klein et al. (2006); Campbell et al. (2004) noted that demographic characteristics had an impact on the ability and capability of individuals to acquire and apply household water saving and water recycling measures. From these studies, it is noticeable that demographic and socio-economic factors are good predictors of conservation behaviour.

The above-mentioned studies, among many others, represent important contributions to the literature. Although there are abundant studies on attitudes toward water conservation at household level, it is not well established that the same factors explain water conservation attitudes and behaviour at the workplace (Wesselink et al., 2017; Foster et al., 2022). In addition, Khan and Terason (2022) noted that the higher education sector is rarely explored in the areas of resource use and conservation. The authors of this paper believe that a serious research gap exists necessitating further theoretical development and empirical testing of factors that promote managers' engagement in water conservation behaviours in the workplace. This research seeks to fill the following gap: there is little theoretical understanding regarding how an organizations' environmental management practices promote

managers' involvement in water conservation behaviours including how frequently the Managers speak about water conservation, the degree to which they promote workplace environmental practices (e.g., closing leaking taps, reporting faults), and whether they are trained about water issues in the workplace.

Additionally, previous workplace studies focusing on employee's personal environmental attitudes, habits, personal norms, and intention are the most widely conducted (Norton et al., 2015). The scanty literature available reveal that Managers are in an influential position to make decisions that can impact on their employees. Robertson and Barling (2012) found that Managers' environmental descriptive norms, leadership and pro-environmental behaviour played an important role in the greening of organizations. Their study showed that the managers influence their employees in the workplace by sharing values, inspirational motivation, intellectual stimulation, and establishing a relationship with their employees. Thus, this study contributes to and extends growing literature on the Managers' involvement in promoting pro-environmental behaviour in organizations and its activities as well as the employees of the organizations.

A conservation attitude and behaviour occur when an individual in this instance, the manager, holds a greater environmental concern and the need to preserve natural resources for future generations. Broadly understood as a behavioural construct, conservation is driven by either organisational or individual attitudes, perceptions, or intentions. The aim of this paper is to determine the prevalence of water conservation and factors contributing to water conservation attitude and behaviour of managers at the workplace. Specifically, the study sought to investigate the relationship between water conservation attitudes, behaviour, and intentions of managers towards water conservation practices at North-West University, Mahikeng Campus in South Africa.

2. Materials and methods

The main purpose of this study was to determine the prevalence of and factors contributing to a water conservation attitude and behaviour among managers at the North-West University – Mahikeng Campus. The study explored if manager's perceptions and intuitions about water conservation are based on socio-demographic factors and general attitudes towards this scarce resource. In this study, a quantitative cross-sectional design was adopted through a survey questionnaire with selected senior management in their capacity as high-level decision makers. The attitudes and behaviours of managers were tested to determine the prevalence of and contributing factors of water conservation behaviour in the workplace. A correlational research design using Spearman's correlation analysis was used to describe the relationships between water conservation attitudes and behaviour among managers at NWU-Mahikeng and the socio-demographic variables such as awareness, gender, and length of service. The following hypothesis was tested in this study.

H1. There exists water conservation attitudes and behaviour among the managers of the NWU-Mahikeng.

2.1. Data collection

For this study, Directors, Deputy Directors, Supervisors and Managers in key academic and support sections at NWU-Mahikeng were purposively chosen as respondents. The key support sections included: People and Culture (employee relations section), Finance and Facilities, and Research Support. Academic top-level managers included Deans, Deputy Deans, Directors, Deputy Directors, and Subject Chairs from the six faculties of the NWU-Mahikeng and the Directors and Deputy Directors of research entities at the Mahikeng Campus. Survey questionnaire was distributed using Survey Monkey, an online data collection tool. Altogether 83 emails were sent to respondents. The survey took approximately ten to 15 min to complete. The respondents also received

a reminder two weeks after the initial survey distribution. Of the 83 managers who were targeted, 72 responded representing a total response rate of 87%. The total number of respondents that participated in the survey were 8 managers from the support cluster and 64 managers from the academic cluster.

2.2. The study questionnaire

The survey instrument comprised only close-ended questions because such questions enhance comparability of answers, making it easier to show relationships between variables (Bryman and Bell, 2017). Efforts were made to guarantee that the response categories provided are comprehensive and mutually exclusive. Table 1 shows items of the attitude scale used to evaluate the three TPB constructs.

The behaviour of interest (dependent variable) in this study is self-reported past water conservation behaviour, which was measured using the four questions that were included in the Likert scale focusing on the four domains (i) water usage attitudes (ii) water consumption attitudes (iii) water conservation behaviour and (iv) water conservation involvement. The Likert scale format had responses of 1–4, namely: 1 = Strongly disagree, 2 = Disagree, 3 = Agree and 4 = Strongly agree. The dichotomous scale had yes or no questions which focused on the practical subjective behavioural attributes of the respondents. Two questions required multiple responses about the respondents' perceived intention; to conserve water or not and respondents marked their preferred choice with 'X'.

2.3. Data analysis

2.3.1. Reliability of measuring instrument

Reliability in research is a measure of quality in quantitative studies to assess the accuracy of the instrument. In other words, the extent to which a research instrument consistently has the same results if it is used in the same situation on repeated occasions (Heale and Twycross, 2015). In this study, reliability and internal consistency have been tested by using Cronbach's Alpha, an arithmetic operation which is used to assess the reliability or internal consistency of a set of test items (Cronbach, 1951). Some scholars have documented that an Alpha coefficient of possibly at least 0.7 is equally reliable (Vaus de, 2002; Yong and Pearce, 2013). In this study, the Cronbach Alpha coefficient for the subscales were reported as 0.76 for water conservation attitudes.

Table 1

Items of the attitude scale to evaluate the three TPB constructs.

Attitude (salient beliefs)	The best solution to constant water problems on campus is: to use more ground water to apply water conservation mechanisms to introduce water tariffs to enforce water usage restriction to install water conservation tools on campus to promote water savings
Subjective norms (normative beliefs)	<ul style="list-style-type: none"> • I report leaking water pipes or toilet sink to relevant authority • I make sure that the taps do not drip • I have a responsibility to conserve water at the workplace • I use minimal water for washing hands • I will address someone if I see them wasting water • I participate in activities that conserve water • I think I contribute to conserving water on campus
Perceived behavioural control (control beliefs)	<ul style="list-style-type: none"> • Training programs to help employees take responsibility of water resources are available • Speaking to staff and colleagues about water issues is encouraged • Water conservation education is offered to staff under me

2.3.2. Descriptive and correlation analysis

In this study, description of the data involved univariate analysis. Data from questionnaires were coded by giving each response a numerical value using Microsoft excel software. Thereafter, the data were transferred into Statistical Package for Social Scientists (SPSS) software version 25.0 for further analysis. The data were analysed by using descriptive statistics, which included mean, percentages and standard deviation (SD). Frequency tables were drawn and further cross tabulated to describe and estimate the relationships between water conservation and behavioural attributes (awareness, perceptions/intuitions, and attitudes). Furthermore, cross tabulations were done to determine the association between a water conservation mindset and the demographic factors as well as association with behavioural factors (awareness, attitude, and motivations) that might contribute to water conservation among managers at NWU-Mahikeng. To explore relationships between variables, Spearman's rank-order correlations were utilised to test the statistical significance of any observed relationships at *p-value* 0.05 and 0.01. Only cases that fulfilled the additional assumption concerning the 'minimum expected cell frequency', which should be 5 or greater (Pallant, 2005; Saunders et al., 2007), were included in the analysis.

3. Results

3.1. Characteristics of the respondents

Most of the respondents (61.1%) were male, while 38.9% were females; the majority were Subject Chairs or Heads of Departments (43.1%), whereas only 9.7% were Deans and Deputy Deans. In terms of the post level category, more than 88.9% of the respondents were from the academic sector, with only 11.1% respondents occupying a position in the support sector of the university. With regard to the number of service years on the Mahikeng Campus, the majority (50.0%) of the respondents served in management for a period of 5 years and longer, holding different portfolios. Only 11.1% had been involved in management for about one year.

3.2. Determinants of water conservation in the workplace

3.2.1. Salient beliefs towards water conservation

Based on the experiences of respondents, the study sought to identify the possible solutions to the prevalence of water shortage. Half of the respondents (50%) perceived that water conservation mechanisms offer the best solution to water shortages. About 38.9% of the respondents held the opinion that using more groundwater would help to alleviate the problem. Finally, 11.1% indicated that imposing water restrictions as a driver of behavioural change would be the best solution to the persistence of water shortages on Campus.

3.2.2. Manager's perceived subjective norms towards water conservation in the workplace

The descriptive statistics shown in Table 2 depict respondents perceived subjective norms towards water conservation in the workplace. The results in Table 2 reveal that 100% of the respondents agreed

Table 2

Respondent's perceived subjective norms towards water conservation (N = 72).

Scale and items	Mean	SD	Agree	Disagree
I make sure that the taps do not drip	3.72	0.45	100	0
I have a responsibility to conserve water at the workplace	3.67	0.48	100	0
I use minimal water for washing hands	3.44	0.77	94.5	5.5
I will address someone if I see them wasting water	3.33	0.75	94.4	5.6
I report leaking water pipes or toilet sink to relevant authority	3.39	0.83	88.8	11.2
Overall mean	3.51			

that they ‘make sure that the taps do not drip’ (M = 3.72, SD = 0.45), and they also believed that they have a responsibility to conserve water at the workplace (M = 3.67; SD = 0.48). The combined responses further reveal that 94.5% of the respondents agreed that they would ‘use minimal water for washing hands’ (M = 3.44; SD = 0.77). In addition, a more positive subjective norm was associated ‘addressing someone if I see them wasting water’ (M = 3.33; SD = 0.75; 94.4%); meaning that managers encourage each other to conserve water in the workplace. 88.8% of the respondents agreed that they ‘report leaking water pipes or toilet sink to relevant authority’ (M = 3.39; SD = 0.83).

The overall mean score shows that the attitude of respondents towards water conservation is positive. This means that positive outcomes are associated with carrying out the behaviour. Fewer managers encounter less factors which impede water conservation than factors which enable water conservation in the workplace. Thus, based on the overall mean, there is a prevalence of water conservation attitude and behaviour among managers at NWU-Mahikeng.

3.2.3. Manager’s perceived behavioural control and water conservation in the workplace

Survey results indicated that 33.3% of the respondents never speak about water conservation. Additionally, combined responses for ‘occasionally’ and ‘sometimes’ (61.1%) revealed that the majority of the managers held the opinion that there are infrequent conversations about water issues. Only 5.6% of the managers indicated that they speak to their staff/colleagues about water issues (supply, quality). In terms providing awareness on Campus, only 5.6% and 16.7% of the Managers reported that there are training and educational programs in water resources conservation respectively.

3.3. Relationships between gender, length of service and water conservation behaviour

3.3.1. Gender and water conservation

The Spearman’s rho correlation analysis in Table 3 reveals that the correlations between gender and the attitude of ‘reporting leaking water pipes or toilet sink to relevant authority’ are perfect, which shows a strong significant relationship.

Although the number of males and females was not proportional, it is interesting to note the behavioural differences presented by the different genders. A moderate positive statistically significant relationship between gender (both females and males) and the attitude of ‘taking responsibility to conserve water at the workplace’ ($r = 0.509^{**}$, $P = 0.006$; $r = 0.319^*$, $P = 0.035$ respectively). Spearman’s rank-order correlation results indicate that male respondents are significantly different from females regarding the attitude of using minimal water for washing hands ($r = 0.444^{**}$; $P = 0.003$). In other words, males are more likely to use less water than females.

Table 3
Spearman’s rank-order correlation analysis between gender and attitude.

Variable	Gender	Correlation	Sig. (2-tailed)
I report leaking water pipes or toilet sink to relevant authority	Female	28 1.000	–
	Male	44 1.000	–
I make sure that the taps do not drip	Female	28 –0.255	0.191
	Male	44 0.198	0.197
I have a responsibility to conserve water at the workplace	Female	28 .509 ^b	0.006
	Male	44 .319 ^a	0.035
I will address someone if I see them wasting water	Female	28 0.000	1.000
	Male	44 .592 ^b	0.000
I use minimal water for washing hands	Female	28 0.197	0.314
	Male	44 .444 ^b	0.003

^a Correlation is significant at the 0.05 level (2-tailed).

^b Correlation is significant at the 0.01 level (2-tailed).

3.3.2. Length of service and water conservation

The positive correlation between length of service above 5 years and managers’ attitude of ‘making sure that the taps do not drip’ shows a statistically significant effect ($r = 0.791^{**}$; $P = 0.000$) which could be interpreted as a strong relationship (Table 4).

The relationship between the attitude of using minimal water for washing hands and managers’ who have been in service for 2–5 years and >5 years shows a statistically significant positive effect ($r = 0.452^*$, $P = 0.16$; $r = 0.550^{**}$, $P = 0.001$) indicating a moderate relationship. The relationships between the attitude of making sure that the taps do not drip and managers’ who have been in service for 2–5 years shows a statistically negative effect ($r = -0.529^{**}$, $P = 0.004$).

3.3.3. Awareness and water conservation

Awareness about water conservation was measured based on whether respondents’ have access to information and/or if they provide awareness to their subordinates through speaking about water conservation, training programmes and education. Results of the Spearman’s rank-order correlations are presented in Table 5.

Table 5 depicts a statistically significant correlation between speaking about water conservation and reporting ‘leaking water pipes or toilet sink to relevant authority’ ($r = 0.302^*$, $P = 0.010$), indicating a weak positive association. Statistically significant negative correlations are reported between training on water issues ($r = -0.263^*$, $P = 0.026$), water conservation education ($r = -0.392^{**}$, $P = 0.001$) and perceived attitudes.

4. Discussion

This study first investigated the prevailing factors that influence manager’s behaviour to support water conservation in the workplace. Second, it explored the relationships between socio-demographic characteristics of managers, and attitudes and behaviours towards water conservation. The findings of this study suggest that in response to water shortages, practical solutions to bridge the intention and action gap must be implemented to address the water issues. This process should include on site water conservation which is critical as it helps to reduce the amount of water used and contributes to the sustainable use of this resource. This finding demonstrates consistency with what other scholars found in the United States of America where persistent dry climate conditions increased water concerned individuals, and most active water conservers (Garcia-Cuerva et al., 2016). This means that the degree to which water conservation is perceived favourable in the workplace is influenced by the salient belief that water is scarce. In other words, water conservation mechanisms could be employed at all levels in the organisation (top to bottom) to ensure the conventional use of

Table 4
Spearman’s rank-order correlation analysis between length of service and attitude.

Variable	Length of Service (yrs)	Correlation	Sig. (2-tailed)
(Q1) I report leaking water pipes or toilet sink to relevant authority	0–1	–	–
	2–5	1.000	–
	>5	1.000	–
(Q2) I make sure that the taps do not drip	0–1	1.000	–
	2–5	–.529 ^{**}	0.004
	>5	.791 ^{**}	0.000
(Q3) I have a responsibility to conserve water at the workplace	0–1	–	–
	2–5	0.000	1.000
	>5	1.00 ^{**}	–
(Q4) I will address someone if I see them wasting water	0–1	–1.00 ^{**}	–
	2–5	.733 ^{**}	0.000
	>5	0.550 ^{**}	0.001
(Q5) I use minimal water for washing hands	0–1	–	–
	2–5	.452 [*]	0.016
	>5	.550 ^{**}	0.001

Table 5
Spearman's rank-order correlation analysis between awareness and water conservation.

Variable		Attitude Q1	Attitude Q2	Attitude Q3	Attitude Q4	Attitude Q5
Speaking about water conservation	Correlation	0.302 ^a	0.201	-0.060	-0.051	-0.161
	Sig. (2-tailed)	0.010	0.91	0.619	0.669	0.177
Training on water issues	Correlation	-0.210	-0.150	-0.171	-.263 ^a	-0.213
	Sig. (2-tailed)	0.077	0.207	0.067	0.026	0.073
Water conservation education	Correlation	-0.129	0.055	0.000	-0.210	-.392**
	Sig. (2-tailed)	0.280	0.644	1.000	0.076	0.001

^a Correlation is significant at the 0.05 level (2-tailed).

water during drought and other times when water is in short supply. Generally, Fishbein and Aizen (2010) noted that the more favourable the attitude and subjective norm, the greater the perceived behavioural control, which could result into a stronger individual's intention to perform the behaviour.

The results of the analysis in this study indicate a significant difference in the social and personal norms between men (61.1%) and women (38.9%). Other studies have identified barriers in individuality responsibility and practicality due to demographic disparities in that gender is a predictor of water conservation behaviour (Singhirunnusorn et al., 2012). Likewise, Diakité et al. (2020) found that water conservation consciousness i.e. practice of water conservation is more prevalent among women than men, though the amount of water consumed by these women was more twice greater than of men. This component is also influenced by past experiences, general women hygiene, and memories of hard times of water shortage and inconvenience of collecting water. These barriers are referred to as situational, cultural, and social constraints that encourages a particular gender to take certain responsibility of resources conservation in the workplace (Allen and Hawkins, 1999). In other words, the results in this study agree with findings on gender differences in environmental valuation and responsibility reported by Khandker et al. (2020).

The results in this study reveal that personal norms in the workplace can influence feelings of moral commitment and responsibility for managers to apply water conservation measures. Other studies have shown that personal norms reinforce the perception of water conservation intentions of people, which is consistent with this study (Abadi and Kelboro, 2022). This implies that proper water conservation implementation measures should take into cognisance of peoples' social and normative status which strongly influence their conservation perceptions. Additionally, other studies have shown that behavioural intention (BI) affects the attitude that can improve the intention encapsulated in the psychological dimension and the thought-based attitude which reveals how people see their environment, process institutional management things and entities that they face in their institutions (Abadi, 2018; Abadi and Kelboro, 2022). This is because when managers have a favourable attitude and tendencies of engaging in pro-environmental behaviours, according to Lede et al. (2019), they turn to generate a favourable cognitive framework by which they perceive and internalise the necessity to adopt environmental behaviours effectively and efficiently. In other words, as revealed in the findings of this study, behavioural intentions have the potential to predict the behaviour of individuals, that is, if managers intend to adopt water conservation measures in their institutions, they are more likely to even perform water conservation behaviours outside the said institution.

The results of this study reveal that managers have perceived behavioural control which is driven by existing situational and internal factors to inhibit or facilitate the performance of water conservation behaviour. The internal factors relate to programs that provide knowledge about water conservation through awareness platforms such as conversations and training about water issues. The results reveal that awareness about water conservation was measured in the workplace and is an important attribute for the managers' subordinates to emulate through given directives of water conservation, training programmes and education. However, the negative correlations depict that managers

appeared to have superficial understanding of water, low awareness of saving water, and limited knowledge of water conservation which could inhibit behavioural change. This finding confirms that conversations about water issues could influence and promote people's attitudes, behaviour and increase awareness of water conservation (Çoban et al., 2011). Koop et al. (2019) asserted that providing information is a frequently applied technique to raise awareness, change attitudes and enhance water conservation behaviour. Likewise, Aprile and Fiorillo (2017) presented the view that water conservation education promotes awareness and has effects on general environmental concerns as well as water conservation behaviour. Thus, the more people know about water shortage issues and water conservation, the more likely it is that their attitude towards water conservation will be positive. Conversely, the research findings also revealed that training about water issues ($r = -0.263^*$, $P = 0.026$) and water conservation education ($(r = -0.392^*$, $P = 0.001$), indicated a more likely inverse statistically significant relationship with several attitude variables. Based on the findings of this study, the lack of training and education programs about water conservation exhibits negative water saving behaviour.

The perceived behavioural control revealed that managers encounter factors which enable water conservation as well as those that hinder it. Other scholars have argued that the feeling of control at work is an important attribute of behaviour change through which effort to design and implement any intervention measures demonstrates a sense of empowerment and control (Russell and Knoeri, 2020; Murwirapachena, 2021). Similarly, awareness of water conservations can also be seen in the lens of the Managers' exhibiting habits of influencing situations (van den Broek et al., 2019; Fang et al., 2021). When behaviour is regularly repeated, over time, it may turn into a habit and become automatic and thus influencing a vast niche within the workplace. Although other scholars are of the view that habits are not consistent behavioural patterns that are performed everywhere and all the time, however, behaviours that are performed relatively in a set environment under particular conditions may have an influence on shaping other personal norms towards water conservation in the workplace. This may be due to the positive influence of others on an individual's sense of ability and the expectation from the individual as revealed by Gholamrezaei et al. (2021).

The results showed that there is a positive significant relationship between length of service and the Managers' positive environmental attitudes and concerns towards water conservation. Vaske and Kobrin (2001), argued that there is an assumption that individuals develop a sense of belonging and an emotional attachment with a place having stayed for a period of time which could influence environmentally responsible behaviour (e.g., water conservation, energy saving, recycling etc) in a person's everyday life. This may explain the significant effect of subjective norm on the behavioural intention of water conservation among managers who have been at the institution for more than five years.

The voluntary behaviour for water conservation at the local level, can play a significant role in African economy whose leading sector relies immensely on water withdrawals (Mugagga and Nabaasa, 2016). The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future

(United Nations, 2015). The SDG number 6 seek to ensure that everyone has access to equitable safe and affordable drinking water as well as adequate and equitable sanitation and hygiene. Under Target 6.4, much emphasis is put on substantial increase in water use across all sections and ensuring sustainable supply of water to address water scarcity (United Nations World Water Assessment Programme, 2018). Accordingly, the efficient use of water in different institutions of higher learning, through behavioural change, provides opportunities for water savings for other purposes such as agriculture intensification and mechanisation, and industrial development which will enhance the attainment of SDG 2 (ending hunger), SDG 1, (no poverty) and SDG 3 (good health and wellbeing). Water conservation strategies intended by policy initiatives to change the behaviour of water users can bring about the development of sustainable cities and communities (SDG 11), responsible consumption (SDG 12) which will eventually lead to economic growth through diversification of the economy bringing about innovation and infrastructure development (SDG 9) and improve life on land (SDG 15).

5. Conclusion

The present paper aimed to assess the behavioural variables affecting water conservation among Managers using the theory of planned behaviour. In this study, three components of attitude (salient beliefs), subjective norms (normative beliefs), and perceived behavioural control (control beliefs) were analysed as variables explaining managers' environmental behaviour. According to the findings, results showed that there is a prevalence of water conservation behaviours and attitudes at the NWU-Mahikeng Campus. Managers at the institution are aware of the water scarcity problems in Mahikeng and on the Campus.

Based on the findings, it can be concluded that the contributing factors towards a water conservation attitude are to a large extent dependent on gender, length of service and water conservation awareness (training and education). Water conservation behaviours and behavioural intentions among managers at NWU-Mahikeng can be explained more clearly in the context of TPB. In this case, behaviour is strongly impacted by behavioural intention which is significantly affected by subjective norm, perceived behavioural control and attitude. Empirical evidence from the findings of this study shows that the lack of awareness in terms of educational programs and training are barriers to a water conservation attitude. It should be pointed out that the absence of critical platforms (such as training and education about water conservation) presents barriers to trigger commitment to behavioural change. According to Dieu-Hang et al. (2017), information and educational campaigns are expected to change attitudes towards conservation. However, Mills and Schleich (2010) noted that only campaigns focusing on direct and specific targets are likely to promote water conservation behaviour.

5.1. Implications, limitations, and recommendations

The results of this study hold several implications for public and private institutions that are interested in promoting water conservation at the workplace. Given the threat of water scarcity associated with climate change and unsustainable water resources, institutions have to promote water conservation behaviour among employees. This study contributes to and extends our understanding of the water conservation behaviour in the workplace and identified the justifications of conservation. From a managerial viewpoint, the findings provide support for pro-environmental decisions that address the importance of an individual's personal attitude, subjective norm and perceived behavioural control on interpreting and applying the organization's environmental sustainability objectives.

Additionally, the research illustrates how an existing behavioural theory, i.e., TPB, can successfully be modified and adopted to explain behaviour in the field of water resources management. This study has

demonstrated the existence of relationships between gender, length of service, awareness and behaviour pertaining to water conservation. This study contributes to the TPB literature by extending it to include organisational citizenship behaviours like pro-environmentalism and psycho-socialisation such as subjective norms, attitudes, and intentions. The individual drivers related to personal responsibility for environmental sustainability have revealed the necessity of providing specific water conservation messages targeting attitudinal approaches that could enable managers, and employees in general, to practice water saving in the workplace. On that basis, when implementing water conservation activities, managers should consider incorporating awareness strategies that may trigger positive attitudes, perceptions, and intentions to conserve water at the workplace. As such, the design of generic as well as tailor-made education and training programmes on water conservation could provide the necessary knowledge related to addressing behavioural change.

Although efforts have been made through this study to determine the prevalence and contributing factors towards a water conservation attitude and behaviour among managers at an institution of higher learning, the study has unearthed a number of issues that require further research. The first potential limitation of this study is that it adopted a cross-sectional research design, which means that it took a snapshot of the situation regarding behavioural change in the workplace. A longitudinal study can be done to examine behavioural change if water-efficient appliances, water conservation training and educational programmes were to be implemented in the workplace. Nonetheless, the study identified that gender, length of service and awareness are the contributing factors towards water conservation attitudes among the managers. Secondly, the constructs used to create behavioural attitude, perceptions and intentions toward water conservation are not exhaustive nor are they exclusive. Additional constructs of behavioural attitude may result in different conclusions. However, this study has made an invaluable contribution by acknowledging that proper management of water starts with management at all levels as well as other stakeholders having a water conservation attitude and behaviour in support with the UN 2030 agenda on Sustainable Development Goal number 6 (clean water and sanitation) of the United Nations are to be realised (United Nations World Water Assessment Programme, 2018).

CRedit authorship contribution statement

Lobina Gertrude Palamuleni: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Samuel Che Nde:** Writing – review & editing, Validation, Methodology, Formal analysis, Data curation. **Yvonne du Plessis:** Visualization, Supervision, Funding acquisition, Formal analysis, Data curation. **Rhoda Cynthia Bakuwa:** Writing – review & editing, Writing – original draft, Visualization, Resources, Formal analysis, Data curation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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References

- Abadi, B., Kelboro, G., 2022. Farmers' contributions to achieving water sustainability: a meta-analytic path analysis of predicting water conservation behaviour. *Sustainability* 14 (1), 279. <https://doi.org/10.3390/su14010279>.
- Abadi, B., 2018. The determinants of cucumber farmers' pesticide use behaviour in central Iran: implications for the pesticide use management. *J. Clean. Prod.* 205, 1069–1081.
- Adams, E.A., 2014. Behavioural attitudes towards water conservation and Re-use among the United States public. *Resour. Environ.* 4 (3), 162–167.
- Ajzen, I., 1991. The theory of planned behaviour. *Organ. Behav. Hum. Decis. Process.* 50 (2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-1](https://doi.org/10.1016/0749-5978(91)90020-1).
- Allen, S.M., Hawkins, A.J., 1999. Maternal gatekeeping: mothers' beliefs and behaviours that inhibit greater father involvement in family work. *J. Marriage Fam.* 61 (1), 199–212. <https://doi.org/10.2307/353894>.
- Aprile, C.M., Fiorillo, D., 2017. Water conservation behaviour and environmental concerns: evidence from a representative sample of Italian individuals. *J. Clean. Prod.* 159, 119–129.
- Arlı, D., Badejo, A., Carlini, J., France, C., Jebarajakirthy, C., Knox, K., et al., 2020. Predicting intention to recycle on the basis of the theory of planned behaviour. *Int. J. Nonprofit Voluntary Sect. Mark.* 25, e1653 <https://doi.org/10.1002/nvsm.1653>.
- Ataei, P., Karimi, H., Es'haghi, S.R., 2022. Socio-cognitive analysis of farmers' water conservation behaviour: the case of the Kavayr plain, Iran. *Sci. Progr.* 105 (4), 1–21.
- Bainbridge, H., 2015. Devolving people management to the line: how different rationales for devolution influence people management effectiveness. *Person. Rev.* 44 (6), 847–865. <https://doi.org/10.1108/PR-10-2013-0193>.
- Bajzelj, B., Fenner, R.A., Curmi, E., Richards, K.S., 2016. Teaching sustainable and integrated resource management using an interactive nexus model. *Int. J. Sustain. High Educ.* 17 (1), 2–15.
- Barber, P.J., Legge, D., 2017. *Perception and Information*. Routledge, New York. ISBN: 978-1-315-53445-9.
- Bhattacharyya, A., Biswas, K., Moyeen, A., 2020. Determinants of pro-environmental behaviours – a cross country study of would-be managers. *Australas. Account. Bus. Finance J.* 14 (2), 51–71. <https://doi.org/10.14453/aabfj.v14i2.5>.
- Boland, J.J., Whittington, D., 2000. The political economy of water tariff design in developing countries: increasing block tariffs versus uniform price with rebate. In: Dinar, A. (Ed.), *The Political Economy of Water Pricing Reforms*. Oxford Univ. Press, New York, pp. 215–235 chap. 10.
- Bornschlegl, M., Townshend, K., Caltabiano, N., 2021. Application of the theory of planned behavior to identify variables related to academic help seeking in higher education. *Front. Educ.* 6, 738790 <https://doi.org/10.3389/feuc.2021.738790>.
- Bryman, A., Bell, E., 2017. *Research Methodology: Business and Management Contexts*. Oxford University Press: Southern Africa, ABC Press, Cape Town. ISBN 978-0-19907613-0.
- Campbell, H.E., Johnson, R.M., Larson, E.H., 2004. Prices, devices, people, or rules: the relative effectiveness of policy instruments in water conservation. *Rev. Pol. Res.* 21, 637–662.
- Chaudhary, A.K., Warner, L.A., Lamm, A.J., et al., 2017. Using the theory of planned behavior to encourage water conservation among extension clients. *J. Agric. Educ.* 58 (3), 185–202. <https://doi.org/10.5032/jae.2017.03185>.
- Che, N.S., Bett, S., Okpara, E.C., Olagbaju, P.O., Fayemi, O.E., Mathuthu, M., 2021. An assessment of land use and land cover changes and its impact on the surface water quality of the Crocodile River catchment, South Africa. In: Manning, A.J. (Ed.), *River Deltas Research-Recent Advances*. IntechOpen. <https://doi.org/10.5772/intechopen.78857>.
- Clarke, J.M., Brown, R.R., 2006. Understanding the factors that influence domestic water consumption within Melbourne. *Australas. J. Water Resour.* 10, 251–258.
- Çoban, G.Ü., Akınar, E., Küçükçankurtaran, E., Yıldız, E., Ergin, Ö., 2011. Elementary school students' water awareness. *Int. Res. Geogr. Environ. Educ.* 20 (1), 65–83.
- Cosgrove, W.J., Loucks, D.P., 2015. Water management: current and future challenges and research directions. *Water Resour. Res.* 51, 4823–4839. <https://doi.org/10.1002/2014WR016869>.
- Cronbach, L.J., 1951. Coefficient alpha and the internal structure of tests. *Psychometrika* 16, 297–334.
- Diakité, H., Gao, Y., Toure, A., 2020. Comparative study between gender bias in household water conservation and management in commune of pelengana. *J. Res. Dev. Manage.* 63 <https://doi.org/10.7176/JRDM/63-05>.
- Dieu-Hang, T., Grafton, R.Q., Martínez-Espineira, R., García-Valinas, M., 2017. Household adoption of energy and water-efficient appliances: an analysis of attitudes, labelling and complementary green behaviours in selected OECD countries. *J. Environ. Manag.* 197, 140–150.
- Dupont, D.P., Renzetti, S., 2013. Household behaviour related to water conservation. *Water Resour. Econ.* 4, 22–37.
- DWS (Department of Water and Sanitation), 2015. Revised strategic plan (Vote 36) for the Fiscal Years 2015/16 to 2019/20. Department of water and sanitation. Republic of South Africa. Available at: <https://www.treasury.gov.za/documents/national/20budget/2019/ene/Vote/2036/20Water/20and/20Sanitation.pdf>. (Accessed 14 August 2024).
- DWS (Department of Water and Sanitation), 2018. National Water and Sanitation Master Plan, vol. 1. Version 10.1, Call to Action. [https://www.dws.gov.za/National/20Water/20and/20Sanitation/20Master/20Plan/Documents/NWSMP\(Master/20Plan\)/20Call/20to/20Action/20v0.1.pdf](https://www.dws.gov.za/National/20Water/20and/20Sanitation/20Master/20Plan/Documents/NWSMP(Master/20Plan)/20Call/20to/20Action/20v0.1.pdf). (Accessed 14 August 2024).
- DWS (Department of Water and Sanitation), 2022. National state of water report 2022. Integrated water studies report number WII/IWS/NSoW 2022. Pretoria, South Africa. <https://www.dws.gov.za/Projects/National/20State/20of/20Water/20Report/Documents/National/20State/20of/20Water/20Report/202022.pdf>. (Accessed 14 August 2024).
- Fang, W.T., Huang, M.H., Cheng, B.Y., Chiu, R.J., Chiang, Y.T., Hsu, C.W., Ng, E., 2021. Applying a comprehensive action Determination model to examine the recycling behavior of Taipei city residents. *Sustainability* 13, 490. <https://doi.org/10.3390/su13020490>.
- Fishbein, M., Ajzen, I., 2010. *Predicting and Changing Behaviour: the Reasoned Action Approach*. Psychology Press, New York, NY, US.
- Forster, P., Pereira, M., 2015. The relationship between Connectedness to nature, environmental values, and pro-environmental behaviours. *Reinvention: An Inter. J. Undergrad. Res.* 8.
- Foster, B., Muhammad, Z., Yusliza, M.Y., et al., 2022. Determinants of pro-environmental behavior in the workplace. *Sustainability* 14, 4420. <https://doi.org/10.3390/su14084420>.
- García-Cuerva, L., Berglund, E.Z., Binder, A.R., 2016. Public perceptions of water shortages, conservation behaviours, and support for water reuse in the U.S. *Resour. Conserv. Recycl.* 113, 106–115. <https://doi.org/10.1016/j.resconrec.2016.06.0060921-3449>.
- Gilbertson, M., Hurlimann, A., Dolnicar, S., 2011. Does water context influence behaviour and attitudes to water conservation? *Australas. J. Environ. Manag.* 18 (1), 47–60. <https://doi.org/10.1080/14486563.2011.566160>.
- He, C., Liu, Z., Wu, J., Pan, X., Fang, Z., Li, J., Bryan, B.A., 2021. Future global urban water scarcity and potential solutions. *Nat. Commun.* 12, 4667. <https://doi.org/10.1038/s41467-021-25026-3>.
- Heale, R., Twycross, A., 2015. Validity and reliability in quantitative studies. *Evid. Base Nurs.* 18, 66–67.
- Khan, M.S., Terason, S., 2022. Encouraging pro-environmental behavior in university employees: an approach toward environmental sustainability as moderated by green organizational culture. *J. Community Psychol.* 50 (3), 1454–1469. <https://doi.org/10.1002/jcop.2272634626493>.
- Klein, B., Kenney, D., Lowery, J., Goemans, C., 2006. Factors influencing residential water demand: a review of literature. Western Water Assessment. Unpublished Paper, Colorado State.
- Khandker, V., Gandhi, V.P., Johnson, N., 2020. Gender Perspective in water management: the involvement of women in participatory water institutions of Eastern India. *Water* 12 (1), 196. <https://doi.org/10.3390/w12010196>.
- Koop, S.H.A., Van Dorssena, A.J., Brouwer, S., 2019. Enhancing domestic water conservation behaviour: a review of empirical studies on influencing tactics. *J. Environ. Manag.* 247, 867–876.
- Kotir, J.H., Brown, G., Marshall, N., Johnstone, R., 2017. Systemic feedback modelling for sustainable water resources management and agricultural development: an application of participatory modelling approach in the Volta River Basin. *Environ. Model. Software* 88, 106–118.
- Lede, E., Meleady, R., Seger, C.R., 2019. Optimizing the influence of social norms interventions: applying social identity insights to motivate residential water conservation. *J. Environ. Psychol.* 62, 105–114.
- Li, X., Dai, J., Zhu, X., et al., 2023. Mechanism of attitude, subjective norms, and perceived behavioral control influence the green development behavior of construction enterprises. *Humanit Soc Sci Commun* 10, 266. <https://doi.org/10.1057/s41599-023-01724-9>.
- Mahdavi, T., 2021. Application of the theory of planned behavior to figure out farmers' intention to accept water policy options using structural equation modeling. *Water Supply* 21, 2720–2734. <https://doi.org/10.2166/ws.2021.138>.
- McKenzie-Mohr, D., Nemiroff, L.S., Beers, L., Desmarais, S., 1995. Determinants of responsible environmental behaviour. *J. Soc. Issues* 51 (4), 139–156.
- Meek, V.L., Goedegebuure, L., Santiago, R., Carvalho, T., 2010. Introduction. In: Meek, V.L., Goedegebuure, L., Santiago, R., Carvalho, T. (Eds.), *The Changing Dynamics of Higher Education Middle Management*, High Educ. Dynamics., vol. 33. Springer, Dordrecht, pp. 1–14.
- Mills, B., Schleich, J., 2010. What's driving energy-efficient appliance label awareness and purchase propensity? *Energy Pol.* 38, 814–825.
- Morante-Carballo, F., Montalván-Burbano, N., Quinonez-Barzola, X., Jaya-Montalvo, M., Carrión-Mero, P., 2022. What do we know about water scarcity in semi-arid Zones? A global analysis and research Trends. *Water* 14 (17), 2685. <https://doi.org/10.3390/w14172685>.
- Mugaga, F., Nabaasa, B.B., 2016. The centrality of water resources to the realization of Sustainable Development Goals (SDG). A review of potentials and constraints on the African continent. *Int. Soil Water Conserv. Res.* 4 (3), 215–223.
- Murwirapachena, G., 2021. Understanding household water-use behaviour in the city of Johannesburg, South Africa. *Water Pol.* 23 (5), 1266–1283.
- Nickell, G.S., Hinsz, V.B., 2023. Applying the theory of planned behaviour to Understand workers' production of safe food. *J. Work Organ. Psychol.* 39 (2), 89–100. <https://doi.org/10.5093/jwop2023a10>.
- Norton, T.A., Parker, S.L., Zacher, H., Ashkanasy, N.M., 2015. Employee green behaviour: a theoretical framework, multilevel review, and future research agenda. *Organ. Environ.* 28 (1), 103–125.
- Pallant, J., 2005. *SPSS Survival Manual*. Open University Press, Maidenhead.
- Pourmand, G., Doshmangir, L., Ahmadi, A., et al., 2020. An application of the theory of planned behaviour to self-care in patients with hypertension. *BMC Publ. Health* 20, 1290. <https://doi.org/10.1186/s12889-020-09385-y>.
- Rasmussen, L.V., Bierbaum, R., Oldekop, J.A., Agrawal, A., 2017. Bridging the practitioner-researcher divide: Indicators to track environmental, economic, and

- sociocultural sustainability of agricultural commodity production. *Global Environ. Change* 42, 33–46.
- Razali, F., Daud, D., Weng-Wai, C., Ranga, W., Jiram, A., 2020. Waste separation at source behaviour among Malaysian households: the Theory of Planned Behaviour with moral norm. *J. Clean. Prod.* 271, 122025 <https://doi.org/10.1016/j.jclepro.2020.122025>.
- Robertson, J.L., Barling, J., 2012. Greening organizations through Leaders' influence on employees' pro-environmental behaviours. *J. Organ. Behav.* 34 (2), 176–194. <https://doi.org/10.1002/job.1820>.
- Russell, S.V., Knoeri, C., 2020. Exploring the psychosocial and behavioural determinants of household water conservation and intention. *Int. J. Water Resour. Dev.* 36 (6), 940–955.
- Saunders, M., Lewis, P., Thornhill, A., 2007. *Research Methods for Business Students*. Pearson Education Limited, Essex.
- Schein, S., 2015. *A New Psychology for Sustainability Leadership: the Hidden Power of Ecological Worldviews*. Greenleaf, Sheffield, UK.
- Singhirunusorn, W., Donlakorn, K., Kaewhanin, W., 2012. Contextual factors influencing household recycling behaviours: a case of waste bank project in Mahasarakham municipality. *Proc. Soc. Beh. Sci.* 36, 688–697.
- Tucker, M., Jubb, C., Yap, C.J., 2020. The theory of planned behaviour and student banking in Australia. *Int. J. Bank Market.* 38 (1), 113–137. <https://doi.org/10.1108/IJBM-11-2018-0324>.
- United Nations, 2015. Sustainable development goals. Available at: <https://sdgs.un.org/goals>. (Accessed 16 July 2024).
- United Nations World Water Assessment Programme, 2018. *The United Nations World Water Development Report 2018: Nature-Based Solutions*. UNESCO, Paris. (Accessed 15 March 2021).
- van den Broek, K.L., Walker, I., Klöckner, C.A., 2019. Drivers of energy saving behaviour: the relative influence of intentional, normative, situational, and habitual processes. *Energy Pol.* 132, 811–819.
- Vaske, J.J., Kobrin, K.C., 2001. Place attachment and environmentally responsible behaviour. *J. Environ. Educ.* 32 (4), 16–21. <https://doi.org/10.1080/00958960109598658>.
- Vaus de, D., 2002. *Analyzing Social Science Data: 50 Key Problems in Data Analysis*. SAGE Publications Ltd, London.
- Vickers, A., 2001. *Handbook of Water Use and Conservation*. WaterPlow Press, Amherst, MA, p. 446. ISBN 1-931579-07-5.
- Wesselink, R., Blok, V., Ringersma, J., 2017. Pro-environmental behaviour in the workplace and the role of managers and organisation. *J. Clean. Prod.* 168, 1679–1687.
- Willis, R.M., Stewart, R.A., Panuwatwanich, K., Williams, P.R., Hollingsworth, A.L., 2011. Quantifying the influence of environmental and water conservation attitudes on household end use water consumption. *J. Environ. Manag.* 92 (8), 1996–2009. <https://doi.org/10.1016/j.jenvman.2011.03.023>.
- Woods, S.A., West, M.A., 2015. *The Psychology of Work and Organisations*, second ed. Andrew Ashwin Publishers, UK.
- World Water Forum, 2018. *World water development report Brazil 19th March 2018*. www.unesco.org/water/wwap/wwdr/pdf. (Accessed 8 April 2018).
- Yazdanpanah, M., Feyzabada, F.R., Forouzanian, M., Mohammadzadeha, S., Burton, R.J.F., 2015. Predicting farmers' water conservation goals and behaviour in Iran: a test of social cognitive theory. *Land Use Pol.* 47, 401–407.
- Yuriev, A., Boiral, O., Francoeur, V., Paill, P., 2018. Overcoming the barriers to pro-environmental behaviors in the workplace: a systematic review. *J. Clean. Prod.* 182, 379–394.
- Zietlow, K.J., Michalscheck, M., 2016. *Socio-demographic and Psychological Determinants of Water Conservation Behavior*. PhD Thesis. Unpublished, Humboldt-Universität zu Berlin, Germany.