

Reframing the Theory of Planned Behaviour: Proposing an adapted framework towards understanding waste management behaviour in Namibia's protected areas

Carrigan Harper¹ • Claudine Roos^{1, 2} • Reece Alberts¹ • Morgan Hauptfleisch^{1, 3}

¹ Unit for Environmental Sciences and Management, North-West University, Potchefstroom, South Africa

² School for Geo- and Spatial Sciences, North-West University, Potchefstroom, South Africa

³ Namibia Nature Foundation, Windhoek, Namibia

Correspondence: C. Harper (carriganharper162@gmail.com)

ABSTRACT The Theory of Planned Behaviour (TPB) has become a widely used model in environmental psychology, particularly for predicting and influencing pro-environmental behaviours. However, behaviours like waste management, especially in protected areas (PAs), involve complexities that may require an adaptation of this framework. Our paper proposes an adapted TPB framework to identify the factors influencing waste-related behaviours among visitors and staff in Namibian PAs, which are characterised by high tourist flows, remote landscapes, and sensitive ecosystems. Drawing from an extensive literature review, we identify four key constructs, namely awareness, situational factors, perceived moral obligation, and perceived policy effectiveness, as essential additions to the original TPB framework. These adaptations aim to provide a more comprehensive and intricate understanding of waste management behaviour in the context of Namibian PAs.

KEYWORDS Theory of Planned Behaviour (TPB); adapted framework; waste behaviour; protected area; Namibia; pro-environmental behaviour

INTRODUCTION

As global environmental pressures intensify, the psychological foundations of pro-environmental behaviour have become increasingly important to designing effective sustainability interventions. This is particularly important in protected areas (PAs), where ecosystems are susceptible to the cumulative impacts of waste-related behaviours driven by tourism and other human activities (Roos et al. 2023). In Namibia, solid waste management in its 20 state-run national parks is considered inadequate (MEFT 2020), despite the

country hosting over 1.25 million international tourists annually (MEFT 2025) and conserving nearly 42% of its land under formal protection (UNEP-WCMC & IUCN 2026). These pressures are compounded by structural and operational constraints, which limit the effectiveness of existing waste management systems and place additional strain on already vulnerable ecosystems.

Despite these challenges, there is no published research examining waste management in Namibian PAs from a behavioural perspective.

Understanding the behavioural determinants behind waste practices is essential, as infrastructure alone cannot account for variations in how visitors and staff manage waste.

To address this gap, this paper draws on the Theory of Planned Behaviour (TPB) to explore the factors shaping waste-related behaviour in Namibia's PAs. Developed by Ajzen (1985), the TPB is a widely applied socio-psychological framework used to predict human behaviour (Ajzen 1991). The framework proposes that behaviour is primarily shaped by behavioural intentions, which in turn stem from three components: attitudes toward the behaviour, subjective norms, and perceived behavioural control (Figure 1). These constructs represent underlying beliefs about behavioural outcomes, perceived expectations from significant others (e.g., family members, friends, or peers), and an individual's perceived ability to perform the behaviour (Ajzen & Schmidt 2020). When these factors are favourable, they strengthen behavioural intention, increasing the likelihood of the behaviour occurring (Ajzen 2020).

The TPB has been widely applied across multiple domains, including health behaviours (Caputo 2020, Willis et al. 2020), environmental behaviours (Ghani et al. 2013, Ioannou et al. 2013), consumer decision-making (Han & Stoel 2017, Saricam & Okur 2019), and educational practices (Lapkin et al. 2015, Wang et al. 2015), among others (Ajzen 2020, Bosnjak et al. 2020). Its conceptual flexibility has

enabled researchers to adapt the framework to different behaviours, cultural contexts and situational settings.

However, despite its broad application, the standard TPB formulation may be insufficient for capturing the complex socio-psychological dynamics that underpin waste management in PAs. Existing TPB research on waste behaviour has predominantly focused on household recycling or source-separation practices, with comparatively limited attention given to behaviours occurring within PAs (Chen & Tung, 2010, Ghani et al. 2012, Ioannou et al. 2013, Heidari et al. 2018, Razali et al. 2020, Wang et al. 2020, Esfandiar et al. 2021, Babazadeh et al. 2023, Cao et al. 2023). Yet, because of its complexity, waste management in PAs involves additional situational, contextual, and psychological factors that extend beyond the scope of the original TPB constructs.

Accordingly, our paper adapts the TPB to better capture the broader determinants of waste-related behaviour in Namibian PAs, thereby strengthening its relevance in contexts characterised by complex environmental and social dynamics.

Drivers of waste management in Namibian PAs

Waste management in Namibian PAs presents a complex challenge for environmental conservation and protection. While effective waste management is widely recognised as essential for protecting wildlife, maintaining habitat integrity, and supporting ecological sustainability (Przydatek

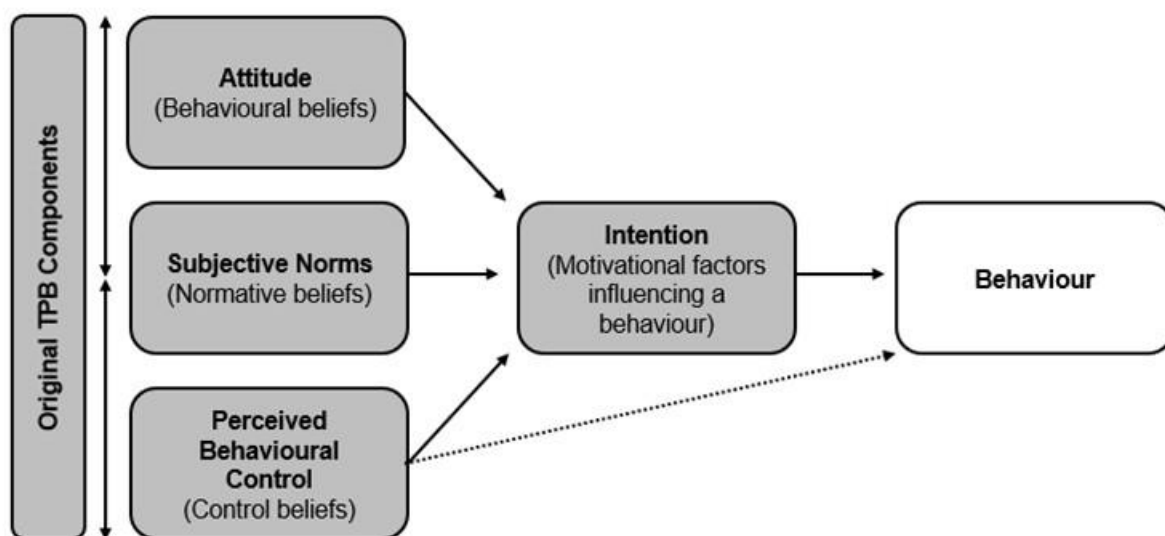


Figure 1 A schematic representation of the original Theory of Planned Behaviour (TPB) framework.

2018, Roos et al. 2025), the conditions under which waste must be managed in Namibia's PA network introduce distinct operational and behavioural constraints.

These constraints are shaped by the remoteness of many parks, limited infrastructure, irregular waste collection services, and a lack of formal recycling facilities (MCC 2014, MEFT 2020). As a result, conventional waste management systems are often difficult to implement or sustain, leading to a reliance on park-managed solutions that vary considerably in capacity and effectiveness. In addition to these structural limitations, operational and behavioural challenges further complicate waste management practices. Staff often operate with limited training, support, and resources, while visitor behaviours vary depending on factors such as nationality, length of stay, and activity type. Together, these constraints create a complex waste management environment that places additional pressure on already vulnerable ecosystems.

Similar challenges are observed globally but they are particularly pronounced in Namibia's PA network. Many PAs worldwide continue to rely on landfilling, waste mixing, and other unsustainable practices due to infrastructural and operational limitations (Dunjić et al. 2017). In Namibia, these constraints are intensified by scale, remoteness, and variability across parks.

Waste management plans exist for six Namibian PAs, including Bwabwata National Park (BNP), Khaudum National Park (KNP), Mudumu National Park (MNP), Namib Naukluft Park (NNP), Skeleton Coast National Park (SCNP), and Etosha National Park (ENP). However, these plans often fall short of addressing the distinct environmental and operational conditions of each park. Coastal parks, for example, face persistent marine debris and tourism- and fishery-related pressures, whereas desert parks contend with wind-blown litter, scarce water resources, and long transport distances that increase disposal costs and logistical barriers.

Current management plans tend to prioritise the establishment and maintenance of waste infrastructure, but place far less emphasis on behaviour-focused interventions such as staff

training, visitor education, or communication strategies. This imbalance limits the effectiveness of waste management efforts and can exacerbate environmental impacts. Sustainable waste management, however, requires more than technical or infrastructural solutions; it depends on behavioural change supported by adequate awareness, training, and engagement (Etim 2024, Wilson et al. 2025). Park-specific strategies, such as context-sensitive recycling initiatives, targeted education campaigns, and tailored communication tools, are therefore essential to address the diverse challenges across parks in Namibia. In coastal parks, these needs are amplified by high visitor numbers and the sensitivity of marine and shoreline ecosystems (Kasa et al. 2025, Rupasinghe et al. 2025). Strengthened behavioural engagement, coupled with improved waste practices, can contribute meaningfully to conservation outcomes by minimising harm to wildlife, reducing litter accumulation, and limiting pollution in ecologically important areas (Roos et al. 2023). These outcomes depend not only on the availability of infrastructure, but on the behaviours and decisions of those managing and interacting with waste in these environments.

These contextual characteristics make Namibian PAs a particularly valuable setting for examining how waste-related behaviours are shaped under conditions of infrastructural limitation, environmental variability, and diverse stakeholder interactions. In such contexts, the relationship between intention and behaviour may be disrupted, and factors such as perceived behavioural control and social norms may operate differently than in more resourced and standardised systems.

Given these gaps, it becomes clear that improving waste outcomes in PAs requires a deeper understanding of the psychological and social factors that shape behaviour. This provides a strong rationale for adapting the TPB to better explain and predict waste-related behaviour and practices in these complex settings.

Rationale for adapting the original TPB framework

To better explain waste-related behaviour in PAs, this paper adapts the original TPB framework. While TPB has been widely applied to

environmental behaviour (Kumar 2019, Si et al. 2019, Bosnjak et al. 2020, Wang et al. 2020, Fenitra et al. 2021, Jacob et al. 2021), its standard formulation may not fully capture the social, institutional, and situational drivers that shape waste management practices in Namibia's PAs. PAs present unique operational constraints, visitor dynamics, and regulatory environments that introduce behavioural complexities not adequately addressed by the original TPB constructs. This is no different in Namibia, where waste management in PAs occur under conditions characterised by remoteness, infrastructural limitations, variable waste services, and diverse visitor and staff interactions. Consequently, adapting the TPB provides a more suitable framework for examining the motivations, barriers, and social influences that drive waste-related behaviour in Namibian PAs.

Despite the conservation importance of waste management, relatively little research has examined waste-related behaviours in PAs, particularly in southern Africa. Limited South African studies have focused on waste behaviour in a marine protected area (Harper et al. 2022) and a private nature reserve (Roos et al. 2021), while no published research specifically addressing waste management behaviour in Namibia's PAs could be identified. The absence of behavioural research is particularly significant given the environmental and operational conditions characterising Namibia's PA network. This gap underscores the need for an improved theoretical framing that captures the behavioural determinants relevant to these contexts.

Environmental attitudes and pro-environmental behaviours are shaped by situational and contextual factors such as location, cultural expectations, and perceived social norms (Hines et al. 1987, Stern 2000). In some PAs, particularly those with vulnerable ecosystems, these factors are more pronounced due to policies that limit visitor activities, the presence of wildlife, and strict environmental protection regulations (Ramkissoon et al. 2013, Ramkissoon & Mavondo 2015). Consequently, waste-related behaviours may be influenced by context-specific factors not accounted for by the original TPB components of attitudes, subjective norms, and perceived behavioural control. Visitor behaviour in PAs is often influenced by a heightened sense of

environmental responsibility or stewardship. For many visitors, the visibility of natural landscapes, signs of human impact, and park communication strategies encourage environmentally responsible behaviour (Al Mamun et al. 2018, Muldoon 2020). Conservation-focused branding and the presence of charismatic wildlife may further reinforce normative expectations for pro-environmental behaviour (Chiu et al. 2023). Staff behaviour, on the other hand, may be influenced by other aspects. Staff responsibilities may include safeguarding biodiversity, complying with environmental regulations, and maintaining park standards - all of which influence their waste-related actions. Furthermore, staff behaviour acts as a behavioural cue for visitors, shaping perceptions of expected practices. Incorporating constructs that reflect stewardship, responsibility, and perceived environmental impact allows an adapted TPB to better capture these behavioural dynamics in PAs (Ramkissoon & Mavondo 2015).

These dynamics suggest that waste-related behaviour in Namibian PAs may be influenced by factors extending beyond the original TPB components. Two of the theory's constructs, namely subjective norms, and perceived behavioural control, require additional nuance to address behaviours within PAs. Subjective norms in PAs may be shaped by "park-specific" social expectations, influenced by signage, ranger presence, or peer actions (Ramkissoon et al. 2013). Perceived behavioural control may likewise be influenced by factors such as the availability and visibility of waste facilities, the quality of infrastructure, and both direct and indirect peer influence (Ardoin et al. 2013, Han 2020). By incorporating constructs related to environmental stewardship, situational constraints, and perceived environmental impact, the adapted TPB framework offers a more accurate representation of the factors driving responsible waste management behaviour in Namibian PAs.

LIMITATIONS OF THE ORIGINAL TPB FRAMEWORK

Although the TPB is widely used as a psychological model in predicting behaviour, some critiques and limitations have been identified. These are in relation to the underestimation of certain influences, and the gap between intention and behaviour.

Underestimation of contextual, cultural and emotional influences

One of the key limitations of the TPB is that it does not explicitly account for contextual, cultural, or environmental factors that may influence behavioural outcomes. Waste-related behaviour, for instance, is often influenced by conditions that fall outside of attitudes, subjective norms, and perceived behavioural control. This is reflected in empirical studies on waste behaviour, which report mixed findings regarding the relative importance of the original TPB constructs (Brown et al. 2010, Chen & Tung 2010, Strydom 2010, Ghani et al. 2012, Ioannou et al. 2013, Heidari et al. 2018, Esfandiar et al. 2021, Roos et al. 2021, Harper et al. 2022, Razali et al. 2020, Wang et al. 2020, Babazadeh et al. 2023, Cao et al. 2023).

The physical environment is frequently shown to influence waste behaviour. The presence, absence, or quality of resources and infrastructure (such as waste bins, recycling points or signage) can significantly shape how individuals manage waste (Gifford 2007). Social and demographic dynamics also play a role. For example, tourist areas attract visitors from diverse cultural backgrounds whose pro-environmental behaviours and expectations may vary (Li et al. 2019). Policy contexts similarly affect behavioural outcomes, as weak or inconsistently enforced regulations can undermine motivation to engage in responsible waste practices (Hage et al. 2009).

Beyond contextual and cultural factors, the TPB overlooks the role of emotions and unconscious cognitive processes, which research has shown to be strong predictors of behaviour (Conner et al. 2013, Sheeran et al. 2013, Sniehotta et al. 2014). In morally relevant situations, such as those involving environmental responsibility, feelings of guilt, obligation or stewardship may meaningfully influence behaviour.

The intention-behaviour gap

Although the TPB positions intention as the strongest predictor of behaviour, Ajzen (1985, 1991) acknowledges that individuals do not always act in accordance with their stated intentions. This “intention-behaviour gap” raises questions about how reliably intentions predict real-world behaviour, especially for complex actions that involve multiple constraints (Sheeran 2002).

Individuals who form positive intentions but fail to act, sometimes referred to as “inclined abstainers” (Sniehotta et al. 2014), are not accounted for in the model.

Studies specific to waste management have found that additional constructs beyond the original TPB components can exert stronger influence on behavioural outcomes, particularly in settings where actions are effortful or constrained (Bamberg & Moser 2007, Steg & Vlek 2009). Reflecting on this limitation Ajzen (1991, 2020) notes that the TPB is open to adaptation or extension, provided that additional constructs explain significant variance in behaviour and are grounded in the behavioural context being examined.

By recognising these limitations and incorporating constructs relevant to conservation settings, the adapted TPB framework proposed in this paper aims to advance theoretical understanding while offering practical insight into the drivers of waste-related behaviour in Namibian PAs.

INTEGRATIVE LITERATURE REVIEW

This study employed an integrative literature review, which facilitates the synthesis and critique of existing literature to generate new frameworks or perspectives (Torraco 2015, Snyder 2019). In this case, the review focused on theoretical and empirical studies that have extended the TPB, with the aim of identifying constructs relevant to waste-related behaviour in Namibian PAs.

The literature search covered publications from 2000 to 2024, primarily sourced from Google Scholar, Scopus and ResearchGate, and included journal articles and peer-reviewed papers. Grey literature, such as reports, conference proceedings, and policy documents, was not included in this review. Search terms included combinations of “Theory of Planned Behaviour”, “TPB”, “extended TPB”, “additional constructs”, “waste management”, and “protected areas”, along with specific constructs like “habit”, “moral norms”, and “external variables”. Eligible studies were those that proposed at least one extension to the original TPB framework in the context of environmental behaviours, with a clear rationale for the inclusion of additional constructs.

The initial, broad search generated approximately 17,800 results across multiple disciplines. Refining the search to waste-related behaviours reduced this to roughly 13,100 publications. Further limiting the search to waste behaviours in protected or vulnerable areas resulted in 545 articles. After screening the titles, abstracts and full texts for relevance, 21 studies met the criteria for inclusion. To strengthen the theoretical grounding, additional studies on waste behaviour in non-PA contexts (e.g., households, organisational settings) were also reviewed. From this combined pool, nine key papers were selected for detailed analysis based on their conceptual clarity, methodological rigour, and relevance to extending the TPB. These nine studies form the foundation for the adapted framework presented in this paper (see Table 1).

PROPOSED ADAPTATIONS TO THE FRAMEWORK

Based on the integrative literature review (summarised in Table 1), four constructs - awareness, situational factors, perceived moral obligation, and perceived policy effectiveness - were identified as conceptually and empirically relevant to explaining waste-related behaviour in Namibia's PAs (Figure 2). These constructs have frequently appeared in extended TPB studies (Table 1) and provide theoretically grounded additions that address limitations of the original framework, particularly in settings characterised by environmental sensitivity, diverse user groups, and variable infrastructure such as Namibia's PAs. The following subsections outline the rationale for each construct's inclusion.

Table 1 Adaptations to the original Theory of Planned Behaviour (TPB) framework reported in the nine key publications considered for this research.

Source reference	Adapted constructs identified in literature	Construct used in this research	Reasoning for adaptation
Chen & Tung (2010)	• Moral norms • Consequences of recycling • Situational factors	Perceived moral obligation; awareness; situational factors	Moral norms reflect personal responsibility. Awareness of consequences relates to cognitive attitudes toward recycling. Situational factors moderate other TPB constructs.
Ghani et al. (2012)	• Situational factors	Situational factors	Waste separation requires time and effort, highlighting contextual constraints.
Ioannou et al. (2013)	• Demographic factors • Past recycling behaviour • Situational factors • Consequences of recycling	Situational factors; awareness	Situational constraints and knowledge related factors influence behavioural intention.
Heidari et al. (2018)	• Environmental awareness • Moral obligation • Situational factors • Motivation	Awareness; perceived moral obligation; situational factors	Awareness and moral obligation positively influenced recycling attitudes and intentions.
Razali et al. (2020)	• Moral norm	Perceived moral obligation	Intrinsic motivation (moral norms) strongly influences behaviour.
Wang et al. (2020)	• Environmental regulation • Knowledge • Involvement • Moral obligation	Perceived policy effectiveness; awareness; perceived moral obligation	Regulations and incentives relate to perceived policy effectiveness; Knowledge contributes to awareness.
Esfandiar et al. (2021)	• Awareness of consequences • Personal norm	Awareness; perceived moral obligation	Awareness contributes to personal norms that motivate behaviour.
Cao & Morrison (2023)	• Self-identity • Moral norms	Perceived moral obligation	Moral norms influence perceived responsibility towards wise behaviour.
Babazadeh et al. (2023)	• Perceived moral obligation • Perceived policy effectiveness	Perceived moral obligation; perceived policy effectiveness	These constructs extend TPB and improve predictive power.

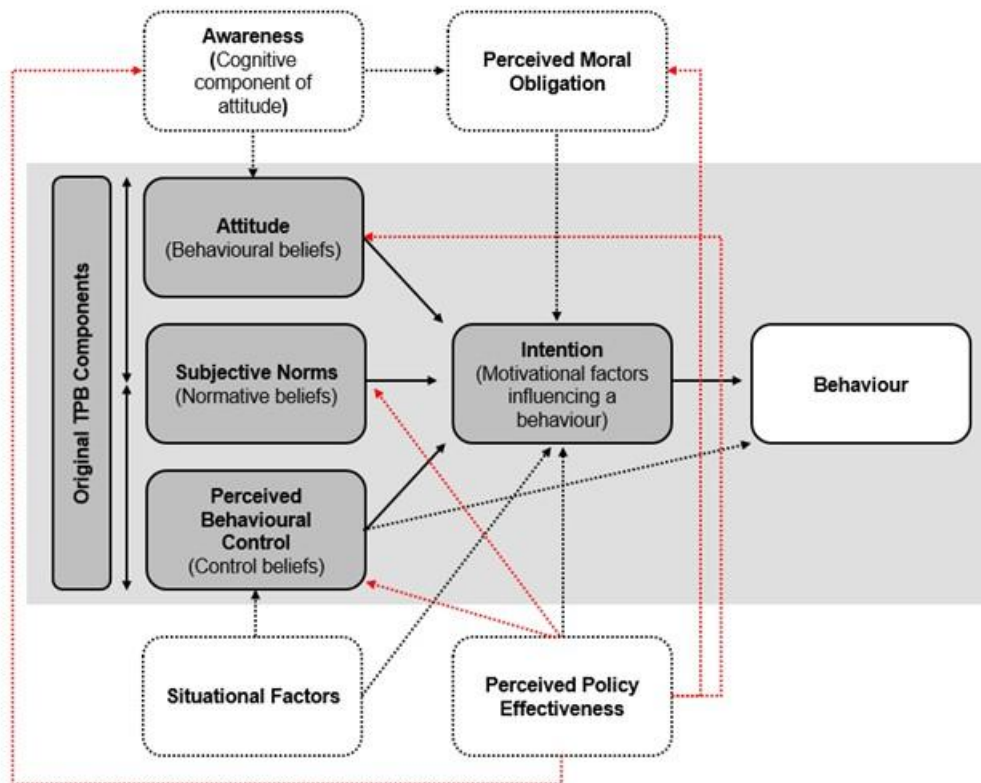


Figure 2 The adapted Theory of Planned Behaviour (TPB) framework proposed by this research. Grey boxes represent the original TPB constructs, and white dashed boxes show additional constructs proposed in this paper. Solid black arrows indicate direct relationships among original TPB constructs and intention/behaviour, dashed black arrows indicate direct relationships of additional constructs, and dashed red arrows indicate indirect relationships or moderating effects.

These constructs were identified as potentially influential in shaping waste management behaviours, particularly in the context of Namibia's PAs, where tourist behaviours, staff norms, infrastructure limitations, and policy visibility differ markedly from urban or developed-country settings. The following sections outline the rationale for each construct's inclusion, providing a theoretical basis for their role in the adapted framework.

Awareness

Some authors (Ajzen & Driver 1992, Davies et al. 2002, Tonglet et al. 2004, Chen & Tung 2023) suggest that attitude should be divided into two components: experiential (related to feelings) and instrumental (based on knowledge). Awareness refers to the cognitive component of attitude, specifically measuring the knowledge of facts and outcomes associated with performing a behaviour. Awareness not only shapes attitude but also fosters a positive attitude towards the behaviour (Fryxell & Lo 2003, Taufique et al. 2016). Increased environmental awareness has been shown to

enhance behavioural intentions by cultivating a sense of responsibility, which subsequently results in a moral obligation to act in a particular way (Section 3.1.3). Awareness influences attitude and perceived moral obligation directly and also impacts subjective norm (the perceived pressure to be knowledgeable about environmental issues) and perceived behavioural control (by increasing an individual's control over behaviour) (Moorman et al. 2004, Kim et al. 2014). Several studies have included awareness in examining waste-related behaviours (Tonglet et al. 2004, Chen & Tung 2010, Tang et al. 2011, Ioannou et al. 2013, Izagirre-Olaizola et al. 2015, Janmaimool & Denpaiboon 2016, Heidari et al. 2018, Kumar 2019, Wang et al. 2020, Esfandiar 2021, Wu et al. 2022).

However, the relevance of awareness may be particularly pronounced in Namibia's PAs, where large wilderness landscapes, ecological sensitivity, and the visibility of human impacts can make environmental consequences more immediate and observable. In remote park settings where waste infrastructure may be limited or inconsistent,

individual awareness becomes increasingly important in shaping responsible waste practices.

Awareness is also especially relevant in Namibia's PA context because visitors and staff interact directly with highly visible conservation landscapes and wildlife species that may be vulnerable to pollution and littering. Under these conditions, awareness extends beyond general environmental knowledge and may influence how individuals perceive their personal responsibility toward conservation outcomes.

In PAs, there is typically an emphasis on raising awareness of the link between waste and risks to wildlife. While such campaigns are crucial, they could be expanded to address broader waste management issues, enhancing overall waste management behaviour in these settings.

Situational factors

The inclusion of situational factors is crucial, as perceived behavioural control alone may not fully account for the resources and opportunities that influence the effective performance of a behaviour. While perceived behavioural control measures an individual's perceived ability to act, some studies suggest that it does not always accurately predict behaviour (Davies et al. 2002, Tonglet et al. 2004, Chen & Tung 2010). Even if an individual holds a positive attitude towards a behaviour, situational factors may act as barriers to action. These factors include the availability of time, space, cooperation, location, and access to necessary resources (Ghani et al. 2013, Alhassan et al. 2018, Heidari et al. 2018, Razali 2020, Roos et al. 2021).

In the context of waste-related behaviour, situational factors can include the availability of waste bins, waste management information, and access to recycling facilities, as well as the perceived time and space available for waste disposal. Studies by Ramayah et al. (2012), Ghani et al. (2013), and Ioannou et al. (2013) highlight that barriers such as inconvenience, lack of resources, and skills can hinder waste management behaviours. Moreover, location and condition of waste bins play an important role in waste separation and disposal behaviours in PAs. The absence of visible or well-maintained waste disposal infrastructure can significantly discourage effective waste management practices in these areas.

In Namibia's protected areas, the scale and remoteness of the PA network intensify infrastructural and logistical constraints. Long travel distances, irregular waste collection services, limited infrastructure, and uneven facility maintenance may reduce individuals' ability to perform environmentally responsible behaviours, even when positive attitudes or intentions are present. Under these conditions, behavioural outcomes may be influenced as much by environmental constraints as by individual motivation.

Situational factors are therefore especially important for understanding the intention-behaviour relationship in Namibia's PAs. Visitors and staff may express strong pro-environmental intentions but still encounter practical barriers that limit responsible waste disposal. In remote parks, for example, inaccessible or poorly maintained waste facilities may weaken perceived behavioural control and discourage proper waste management practices. Incorporating situational factors into the adapted TPB framework therefore allows for a more accurate representation of how infrastructural conditions interact with behavioural intentions to shape waste-related practices in Namibian protected areas.

Perceived moral obligation

The concept of perceived moral obligation has been overlooked in some applications of the TPB, despite its potential to improve the theory's predictive and interpretive capability (Ding et al. 2018, Si et al. 2019). Perceived moral obligation refers to an individual's judgement about the moral correctness or incorrectness of engaging in a particular behaviour (Babazadeh et al. 2023, Cao & Morrison 2023). A stronger sense of moral responsibility increases an individual's intention to engage in the behaviour. Perceived moral obligation has been identified as a critical determinant of waste management intentions (Ajzen 1991, Zhang et al. 2015, Xu et al. 2017, Heidari et al. 2018, Wang et al. 2020, Esfandiar et al. 2021, Babazadeh et al. 2023, Cao & Morrison 2023), with some studies suggesting it is the strongest predictor of household waste behaviours (Miafodzyeva et al. 2013, Pakpour et al. 2014, Razali et al. 2020).

The role of moral obligation in PAs may differ from other contexts due to the environmental, social, and cultural values associated with these areas. In PAs, where conservation is a central focus, there is a heightened sense of responsibility to manage waste in a way that aligns with environmental protection. While moral obligation may not always be openly expressed, it plays a subtle yet powerful role in shaping individuals' sense of responsibility and their behaviour towards waste management in these settings. In Namibia, the relevance of perceived moral obligation may be further strengthened by the country's strong conservation identity and long-standing emphasis on environmental stewardship. Namibia's national conservation narratives and community-based natural resource management (CBNRM) models reinforce stewardship values, PA settings may evoke heightened moral responsibility among staff, local communities, and visitors. Many communal conservancies adjacent to parks embrace environmental ethics, reinforcing a cultural expectation of environmental care.

Incorporating perceived moral obligation into the adapted TPB framework therefore allows for a more contextually grounded understanding of waste-related behaviour in Namibia's protected areas, particularly in settings where conservation values and environmental responsibility may shape behavioural intentions beyond the influence of the original TPB constructs alone.

Perceived policy effectiveness

Perceived policy effectiveness refers to an individual's evaluation of the coherence, sufficiency, and efficacy of policies aimed at promoting pro-environmental behaviours (Wan et al. 2014a). When individuals perceive policies as effective, they are more likely to comply with and engage in behaviours encouraged by those policies (Wang et al., 2020). Perceived policy effectiveness influences not only behaviour but also moderates the effect of other TPB constructs (MacKenzie & Spreng 1992, Fiske et al. 1994, Davis et al. 2006, Wan et al. 2014a, Babazadeh et al. 2023).

Policies can include incentive-based, regulatory, and educational measures, implemented by government bodies to encourage pro-environmental actions (Wan et al. 2014b). In the context of PAs, policies may encompass

regulations regarding waste management, waste separation, recycling initiatives, or staff training on waste management practices. In the context of Namibian PAs, the Ministry of Environment, Forestry and Tourism (MEFT) and park concession operators implement regulations on littering, campsite cleanliness, and waste handling. The inclusion of perceived policy effectiveness is particularly relevant in Namibia's protected areas because waste management responsibilities are distributed across government authorities, park management structures, concession operators, and visitors, creating variability in how policies are communicated, implemented, and enforced across different parks and facilities. The National Solid Waste Management Strategy (2017–2022) emphasises formal waste systems, environmental education, and accountability mechanisms (MET 2017). It must, however, be noted that there are no pieces of legislation or regulations that solely focus on waste management in Namibia's PAs. Even so, policy visibility and enforcement may vary between parks and facilities, influencing how visitors and staff perceive and respond to waste rules. This variability makes perceived policy effectiveness especially important in Namibia's PA context. In remote or resource-constrained parks, inconsistencies in infrastructure, staffing capacity, monitoring, or communication may influence whether visitors and staff perceive waste regulations as meaningful, visible, or enforceable. Under these conditions, individuals may be less likely to comply with waste-related practices if policies appear unclear, inconsistently applied, or weakly enforced. Conversely, visible and consistently implemented policies may strengthen perceptions of environmental responsibility and reinforce pro-environmental behavioural norms.

Studies by Steg & Vlek (2009), Wan et al. (2014a), and Xu et al. (2017) suggest that effective policy measures positively influence individuals' engagement in waste-related behaviours. However, the success of these policies is largely contingent on how visible, consistent, and enforced they are. When policies are clearly communicated and consistently applied, individuals are more likely to comply, leading to greater policy effectiveness in promoting pro-environmental behaviours in PAs. Incorporating perceived policy effectiveness into the adapted TPB framework therefore allows for a more contextually grounded

understanding of how institutional visibility, communication, and enforcement influence waste-related behaviour in Namibia's protected areas.

THEORETICAL IMPLICATIONS

Ajzen et al. (2011) acknowledges that the TPB is not a complete theory and does not provide an exhaustive explanation of behaviour. By incorporating additional constructs or components into the TPB framework, our research offers a broader perspective on waste management behaviour in protected areas, particularly in Namibia's protected areas, where remoteness, infrastructural variability, and diverse user groups shape behavioural outcomes. These adaptations help to expand the TPB by addressing limitations that arise in complex behavioural contexts such as waste management in conservation settings.

Enhanced predictive ability

Integrating constructs like perceived moral obligation, perceived policy effectiveness awareness, and situational factors into the TPB framework enhances its predictive power. These additions provide a more intricate depiction of behaviour, accounting for a wider range of motivations and constraints. In settings like PAs, where individuals are expected to act in environmentally responsible ways, the extended model offers a more accurate understanding of the factors driving waste management behaviour (Ajzen 1991, Fryxell & Lo 2003). The broader set of variables allows the model to capture context-specific influences that may not be addressed by the original TPB, improving its applicability in real-world scenarios.

Broader conceptualisation of social influence

The inclusion of perceived moral obligation expands the TPB's conceptualisation of social influence. Traditional subjective norms focus on the pressures from significant others, but by integrating perceived moral obligation, the model also incorporates personal moral values and ethical standards. This is particularly relevant in conservation contexts, such as PAs, where individuals may act out of a sense of moral duty to the environment. Research by Babazadeh et al. (2023) suggests that moral obligation is a strong predictor of waste-related behaviour, highlighting its importance in fostering environmentally

responsible actions, even when external pressures are minimal. This shift allows the TPB to account for internal, ethically-driven motivations that are crucial in pro-environmental behaviours.

Acknowledging contextual constraints and enablers

Certain external conditions or situational factors can directly influence perceived behavioural control (Ajzen 1991). Including situational factors in the model acknowledges the role of external conditions, such as the availability of waste disposal facilities, transportation access, and other logistical factors, in facilitating or inhibiting waste management behaviour. In PAs, these barriers are often more pronounced and addressing them is key for effective waste management (Ghani et al. 2013, Alhassan et al. 2018, Roos et al. 2022). For example, in settings where infrastructure is lacking or poorly maintained, individuals may feel that they have little control over their ability to manage waste. By considering situational factors as an independent variable, the model reflects the real-world constraints that shape behaviour, offering a more accurate understanding of why people may not engage in pro-environmental behaviours despite having positive attitudes or intentions.

Integration of policy influence

The addition of perceived policy effectiveness to the TPB highlights the significant role of perceptions of policy effectiveness in shaping behaviour. In PAs, where waste management policies are crucial for maintaining ecological integrity, visitors' perceptions of these policies can greatly influence their compliance (Wan et al. 2014a). In Namibia's PA governance context, policy visibility and enforcement may vary across sites, influencing how regulations are interpreted and followed. Clear and well-enforced policies are more likely to encourage individuals to align their behaviour with environmental goals. Studies by Steg & Vlek (2009) and Wan et al. (2014a) emphasise that when policies are perceived as effective, individuals are more likely to engage in pro-environmental actions. The incorporation of perceived policy effectiveness helps bridge the gap between personal motivations and external regulations, providing a more comprehensive understanding of behaviour in PAs.

Inclusion of cognitive and affective determinants through awareness

The inclusion of awareness introduces both cognitive and affective elements into the TPB framework, which enhances the theory's ability to explain environmental behaviours. Cognitive factors, such as understanding the environmental impact of waste, increase an individual's knowledge and perceptions. Affective components, like feelings of moral responsibility, work alongside this knowledge to reinforce pro-environmental intentions. As Fryxell & Lo (2003) and Taufique et al. (2016) suggest, increased awareness not only shifts attitudes but also strengthens moral obligations. This, in turn, makes individuals more likely to act responsibly by aligning their intentions with environmentally sustainable behaviour. This cognitive-affective interplay is crucial for understanding how awareness can lead to stronger pro-environmental actions, particularly in settings where behaviour is closely tied to ethical considerations (Kim et al. 2014). This is particularly relevant in Namibian PAs, where environmental messaging, wildlife visibility, and ecosystem sensitivity can strengthen behavioural focus.

Shift toward a Value-Belief-Norm orientation

The introduction of perceived moral obligation and perceived policy effectiveness aligns the adapted TPB framework with the Value-Belief-Norm (VBN) theory of environmental behaviour. The VBN theory emphasises that personal values, beliefs, and moral norms drive behaviour, particularly in the context of conservation and environmental sustainability (Stern 2000). By incorporating perceived moral obligation and perceived policy effectiveness, the adapted TPB broadens its scope to account for the ethical and moral underpinnings of behaviour. This shift not only strengthens the model's predictive power in the Namibian PA context, where conservation and ethical responsibility are central, but also creates a hybrid model that captures both personal and social determinants of waste behaviour. The fusion of these theories highlights the growing importance of moral beliefs and personal norms in shaping environmental intentions and actions, particularly in natural settings where environmental stewardship is paramount.

PRACTICAL IMPLICATIONS

The adapted TPB framework has practical relevance for guiding interventions, policy design, and waste management strategies in Namibia's PAs. The inclusion of situational factors, perceived policy effectiveness, and perceived moral obligations enables a more context-specific approach, ensuring that interventions are tailored to the contextual conditions and behavioural mechanisms shaping these environments.

Improved intervention design

Traditional TPB constructs may not fully address the complexities of environmental behaviours in natural or protected settings, especially within Namibia's vast and spatially dispersed PA network. By including situational factors and perceived policy effectiveness, the adapted framework allows for the design of interventions that target specific logistical or contextual barriers to waste management (Ghani et al. 2013). For example, situational factors can identify site-specific infrastructural weaknesses across Namibian parks, such as the lack of waste disposal bins or limited recycling facilities, which may hinder individuals from acting responsibly. With these insights, interventions can be designed to address these constraints directly, ensuring that waste management strategies are both practical and effective in Namibia's PA systems.

Enhanced policy compliance

The inclusion of perceived policy effectiveness emphasises the importance of effective policy communication and enforcement within Namibia's PA governance context in shaping behaviour. Research indicates that visitors' compliance with waste management policies is significantly influenced by how those policies are communicated and perceived (Young et al. 2015). By integrating perceived policy effectiveness into the model, PA managers in Namibia can better understand how perceptions of policy effectiveness influence behaviour, allowing them to tailor communication strategies that increase policy adherence. This is especially relevant in Namibia, where waste regulations may be interpreted differently across parks. Clear, consistent messaging about the goals and benefits of waste management policies can enhance

compliance, ensuring that visitors are well-informed and motivated to follow the rules.

Promotion of intrinsic motivation

The inclusion of perceived moral obligation opens the door for appealing to intrinsic motivations that are relevant in Namibia's conservation-oriented identity and stewardship-based environmental governance frameworks. When individuals perceive their actions as part of a moral obligation to the environment, they are more likely to engage in pro-environmental behaviours, even without external incentives or oversight. As Schwartz (1977) and Stern (2000) suggest, moral values and ethical responsibility are key drivers of pro-environmental behaviour. In PAs, where conservation is a primary goal, perceived moral obligation can encourage individuals to act out of a sense of stewardship, fostering long-term behavioural change.

Long-term behavioural change towards achieving conservation outcomes

Integrating constructs like awareness, perceived moral obligation, and perceived policy effectiveness supports sustained behavioural change within Namibia's PAs, where long-term conservation outcomes depend on both institutional capacity and individual behaviour across large, remote landscapes. Research suggests that when individuals perceive waste management as an ethical duty, and when this is reinforced by effective policies, they are more likely to maintain responsible behaviour in the long term (Stern 2000). For PAs, this means that visitors who feel morally responsible for waste management, supported by clear and effective policies, are more likely to continue practicing responsible waste disposal, even after their visit. Over time, these behaviours can lead to broader conservation outcomes, such as a culture of environmental stewardship that extends beyond the Namibian PA network.

POTENTIAL LIMITATIONS AND UNINTENDED NEGATIVE IMPLICATIONS

While the adapted TPB framework offers valuable insights, there are potential limitations and unintended negative implications that need to be considered.

Theoretical integrity and predictive power

The TPB was originally designed with three core constructs: attitude, subjective norms, and perceived behavioural control. Introducing new variables may risk diluting the simplicity and predictive power of the original model (Ajzen 1991). While these additions provide a more comprehensive understanding of behaviour, they could also complicate the analysis, making it more difficult to draw clear conclusions. As the core constructs of the TPB have been extensively studied and validated, altering them may reduce the generalisability of the model in other contexts.

Multicollinearity issues

Some of the added constructs, particularly perceived moral obligation and attitude, may overlap to some degree, leading to multicollinearity. When two constructs are highly correlated, it becomes challenging to distinguish their separate effects on behaviour, which can undermine the clarity and reliability of statistical analyses (Cunningham & Aldrich 2011). This could result in less reliable conclusions, particularly when trying to determine the unique impact of each construct on waste-related behaviour.

Context-specific findings and limited generalisability

The adaptations made to the TPB may limit the generalisability of findings. The added constructs are context-specific, and waste management behaviours in Namibian PAs are influenced by unique factors, such as cultural values, tourism-related norms, and environmental awareness. These factors may not apply in other settings, making it difficult to generalise the findings of studies using the adapted TPB to other contexts (Kollmuss & Agyeman 2002, Gifford 2007). While the modified TPB provides targeted insights for specific settings like Namibia's PA network, its applicability in broader contexts may be limited.

Despite the limitations, adapting the TPB framework for specific contexts, such as waste-related behaviour in Namibian PAs, remains highly valuable. Although these adaptations may introduce additional complexity, they offer a deeper understanding of behaviour, particularly in environments where factors like environmental awareness, cultural values, and tourism-related norms significantly influence actions. While the

findings may be less generalisable, they provide valuable, context-specific insights for developing tailored waste management strategies that respond to the specific conditions in Namibian PAs. Thus, the adapted TPB framework enhances our understanding of waste-related behaviour in Namibian PAs without undermining the utility of the original model.

CONCLUSIONS AND RECOMMENDATIONS

Our research aimed to adapt the Theory of Planned Behaviour (TPB) framework to more accurately capture psychological and contextual drivers of waste-related behaviour in Namibian PAs. For complex behaviours like waste management, particularly within PAs, the original TPB constructs were found to be insufficient. Due to the distinct physical, social, and legal contexts of Namibian PAs, it became clear that additional constructs were necessary to understand waste behaviours in these settings. To address this, an integrative literature review was conducted, focusing on waste-related studies from various contexts that provided a clear rationale for including extra constructs to ensure practical relevance. Based on this review, an adapted TPB framework was proposed, incorporating awareness, situational factors, perceived moral obligation, and perceived policy effectiveness. By extending the original TPB in this way, our research aims to enhance the explanatory power of the theory and offer a more nuanced understanding of waste-related behaviour, which can be applied to the design of targeted interventions.

While our research proposes adapting the TPB, it is essential to apply and test the adapted framework in context. Namibia's PAs present a distinct behavioural setting in which waste management is influenced by a variety of factors. Therefore, assessing the validity and reliability of the additional constructs is crucial. To test constructs such as awareness, situational factors, perceived moral obligation, and perceived policy effectiveness, it is important to examine how they influence behavioural intentions. Empirical testing could include surveys or interviews to measure self-reported behavioural intentions. The testing should also consider variations in responses based on demographic variables (age, gender, education level, etc.), as well as differences between sub-

groups that influence waste management in Namibian PAs (e.g., cultural differences, values, and beliefs). Ultimately, empirical testing is necessary to translate the theoretical framework into practical, evidence-based strategies aimed at reducing environmental damage and promoting sustainable behaviours.

By incorporating these additional constructs, the adapted TPB framework offers a more comprehensive understanding of waste management behaviour in Namibia's PA network, capturing the drivers behind both visitor and staff actions. This framework is particularly valuable in identifying clear intervention points for promoting sustainable waste practices. These may include targeted interventions, infrastructure improvements, and communication strategies that align more closely with the specific context and environment of Namibia's PAs.

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DECLARATION OF INTERESTS

Due to his position with the Namibian Journal of Environment (NJE), Morgan Hauptfleisch was not involved in the editorial handling, peer review, or decision-making process for this manuscript. The authors declare no other competing interests.

REFERENCES

- Ajzen I (1985) From intentions to actions: A Theory of Planned Behavior. In: Kuhl J, Beckmann J (eds) *Action control*. 11-39. Springer, Heidelberg.
- Ajzen I (1991) The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes* 50(2): 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Ajzen I (2011) The Theory of Planned Behavior: Reactions and reflections. *Psychology and Health* 26(9): 1113–1127. <https://doi.org/10.1080/08870446.2011.613995>
- Ajzen I (2020) The Theory of Planned Behavior: Frequently asked questions. *Human Behavior and Emerging Technologies* 2(4): 314–324. <https://doi.org/10.1002/hbe2.195>

- Ajzen I, Driver BL (1992) Application of the Theory of Planned Behavior to leisure choice. *Journal of Leisure Research* 24(3): 207–224. <https://doi.org/10.1080/00222216.1992.11969889>
- Ajzen I, Schmidt P (2020) Changing behavior using the Theory of Planned Behavior. In: Hagger MS, Cameron LD, Hamilton K, Hankonen N, Lintunen T (eds) *The Handbook of Behavior Change*. 17–31. Cambridge University Press, Cambridge. <https://psycnet.apa.org/doi/10.1017/9781108677318.002>
- Alhassan H, Asante FA, Oteng-Ababio M, Bawakyillenuo S (2018) Application of Theory of Planned Behavior to households' source separation behaviour in Ghana. *Management of Environmental Quality: An International Journal* 29(4): 704–721. <http://dx.doi.org/10.1108/MEQ-10-2017-0122>
- Al Mamun A, Mohammad M, Hatna H (2018) Pro-environmental behavior: Extended Theory of Planned Behavior applied to eco-tourism. *International Journal of Hospitality & Tourism Administration* 19(2): 189–210.
- Ardoin NM, Heimlich JE, Braus J, Merrick C (2013) Influencing conservation action: What research says about environmental literacy, behavior, and conservation results. *Monographs in Environmental Education and Environmental Studies* 3: 3–20.
- Babazadeh T, Ranjbaran S, Kouzekanani K, Abedi Nerbin S, Heizomi H, Ramazani ME (2023) Determinants of waste separation behavior Tabriz, Iran: An application of the Theory of Planned Behavior at health center. *Frontiers in Environmental Science* 11: 1–7. <https://doi.org/10.3389/fenvs.2023.985095>
- Bamberg S, Möser G (2007) Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology* 27(1): 14–25. <https://doi.org/10.1016/j.jenvp.2006.12.002>
- Boldero J (1995) The prediction of household recycling of newspapers: The role of attitudes, intentions, and situational factors. *Journal of Applied Social Psychology* 25(5): 440–462. <https://doi.org/10.1111/j.1559-1816.1995.tb01598.x>
- Bosnjak M, Ajzen I, Schmidt P (2020) The Theory of Planned Behavior: selected recent advances and applications. *Europe's Journal of Psychology* 16(3): 352–356. <https://doi.org/10.5964/ejop.v16i3.3107>
- Brown TJ, Ham SH, Hughes M (2010) Picking up litter: an application of theory-based communication to influence tourist behaviour in protected areas. *Journal of Sustainable Tourism* 18(7): 879–900. <https://doi.org/10.1080/09669581003721281>
- Canova L, Manganelli AM (2020) Energy-saving behaviours in workplaces: Application of an extended model of the theory of planned behaviour. *Europe's Journal of Psychology* 16(3): 384–400. <https://doi.org/10.5964/ejop.v16i3.1893>
- Cao J, Qiu H, Morrison AM (2023) Self-identity matters: an extended Theory of Planned Behavior to decode tourists' waste sorting intentions. *International Journal of Environmental Research and Public Health* 20(6): 1–19. <https://doi.org/10.3390/ijerph20065099>
- Caputo A (2020) Comparing theoretical models for the understanding of health-risk behaviour: Towards an integrative model of adolescent alcohol consumption. *Europe's Journal of Psychology* 16(3): 418. <https://doi.org/10.5964/ejop.v16i3.2213>
- Chen MF (2020) The impacts of perceived moral obligation and sustainability self-identity on sustainability development: A Theory of Planned Behavior purchase intention model of sustainability-labeled coffee and the moderating effect of climate change skepticism. *Business Strategy and the Environment* 29(6): 2404–2417. <https://doi.org/10.1002/bse.2510>
- Chen MF, Tung PJ (2010) The moderating effect of perceived lack of facilities on consumers' recycling intentions. *Environment and Behavior* 42(6): 824–844. <https://doi.org/10.1177/0013916509352833>
- Chiu YTH, Lee WI, Chen TH (2014). Environmentally responsible behavior in ecotourism: Antecedents and implications. *Tourism Management* 40: 21–32. <https://doi.org/10.1016/j.tourman.2013.06.013>
- Conner M, Godin G, Sheeran P, Germain M (2013) Some feelings are important: cognitive attitudes, affective attitudes, anticipated affect, and blood donation. *Health Psychology* 32(3): 264. <https://doi.org/10.1037/a0028500>
- Cunningham JB, Aldrich JO (2011) *Using SPSS: An interactive hands-on approach*. Sage Publications, California.
- Davies J, Foxall GR, Pallister J (2002) Beyond the intention-behaviour mythology: an integrated model of recycling. *Market Theory* 2(1): 29–113. <https://doi.org/10.1177/1470593102002001645>
- Davis G, Phillips PS, Read AD, Iida Y (2006) Demonstrating the need for the development of internal research capacity: Understanding recycling participation using the Theory of Planned Behaviour in West Oxfordshire, UK. *Resources, Conservation and Recycling* 46(2): 115–127. <https://doi.org/10.1016/j.resconrec.2005.07.001>
- Ding Z, Jiang X, Liu Z, Long R, Xu Z, Cao Q (2018) Factors affecting low-carbon consumption behavior of urban residents: a comprehensive review. *Resources, Conservation and Recycling* 132: 3–15. <https://doi.org/10.1016/j.resconrec.2018.01.013>
- Dunjić J, Stojanović V, Solarević M, Kicošev V (2017) Sustainable waste management in protected areas of Vojvodina. *Contemporary Trends in Tourism and Hospitality: New Spaces in Cultural Tourism, CTTH 2017* (pp. 145–152). University of Novi Sad, Faculty of Sciences, Novi Sad, Serbia.
- Esfandiar K, Dowling R, Pearce J, Goh E (2021) What a load of rubbish! The efficacy of Theory of Planned Behavior and norm activation model in predicting visitors' binning behaviour in national parks. *Journal of Hospitality and Tourism Management* 46: 304–315. <https://doi.org/10.1016/j.jhtm.2021.01.001>
- Etim E (2024) Leveraging public awareness and

- behavioural change for entrepreneurial waste management. *Heliyon* 10(21):1–11. <https://doi.org/10.1016/j.heliyon.2024.e40063>
- Fenitra RM, Tanti H, Gancar CP, Indrianawati U, Hartini S (2021) Extended Theory of Planned Behavior to explain environmentally responsible behavior in context of nature-based tourism. *Geojournal of Tourism and Geosites* 39: 1507–1516. <https://doi.org/10.30892/gtg.394spl22-795>
- Fiske CA, Luebbehusen LA, Miyazaki AD, Urbany JE (1994) The relationship between knowledge and search: It depends. *Advances in Consumer Research* 21(1): 43.
- Fryxell GE, CW (2003) The influence of environmental knowledge and values on managerial behaviours on behalf of the environment: An empirical examination of managers in China. *Journal of Business Ethics* 46: 45–69. <http://dx.doi.org/10.1023/A:1024773012398>
- Ghani WAWAK, Rusli IF, Biak DRA, Idris A (2013) An application of the Theory of Planned Behaviour to study the influencing factors of participation in source separation of food waste. *Waste Management* 33(5): 1276–1281. <https://doi.org/10.1016/j.wasman.2012.09.019>
- Gifford R (2007) *Environmental psychology: Principles and practice*. Optimal Books, Washington.
- Hage O, Söderholm P, Berglund C (2009) Norms and economic motivation in household recycling: empirical evidence from Sweden. *Resources, Conservation and Recycling* 53(3): 155–165. <https://doi.org/10.1016/j.resconrec.2008.11.003>
- Han H (2020) Theory of green purchase behavior in eco-tourism destinations. *Journal of Sustainable Tourism* 28(6): 919–939.
- Han TI, Stoel L (2017) Explaining socially responsible consumer behavior: A meta-analytic review of Theory of Planned Behavior. *Journal of International Consumer Marketing* 29(2): 91–103. <https://doi.org/10.1080/08961530.2016.1251870>
- Harper C, Roos C, Retief FP, Alberts RC, Cilliers DP (2022) Applying the Theory of Planned Behaviour to Tourism-Related Waste Behaviour in Marine Protected Areas: The Aliwal Shoal Case Study. *Journal of Environmental Management & Tourism* 13(3): 853–876. [https://doi.org/10.14505/jemt.v13.3\(59\).23](https://doi.org/10.14505/jemt.v13.3(59).23)
- Heidari A, Kolahi M, Behraves N, Ghorbanyon M, Ehsanmansh F, Hashemolhosini N, Zanganeh F (2018) Youth and sustainable waste management: a SEM approach and extended Theory of Planned Behavior. *Journal of Material Cycles and Waste Management* 20: 2041–2053. <https://doi.org/10.1007/s10163-018-0754-1>
- Hines JM, Hungerford HR, Tomera AN (1987) Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. *The Journal of Environmental Education* 18(2): 1–8. <https://doi.org/10.1080/00958964.1987.9943482>
- Ioannou T, Zampetakis LA, Lasaridi K (2013) Psychological determinants of household recycling intention in the context of the Theory of Planned Behaviour. *Fresenius Environmental Bulletin* 22(7): 2035–2041.
- Izagirre-Olaizola J, Fernandez-Sainz A, Vicente-Molina MA (2015) Internal Determinants of Recycling Behaviour by University Students: A Cross-Country Comparative Analysis. *International Journal of Consumer Studies* 39(1): 25–34. <https://doi.org/10.1111/ijcs.12147>
- Jacob J, Valois P, Tessier M (2021) Using the theory of planned behavior to predict the adoption of heat and flood adaptation behaviors by municipal authorities in the province of Quebec, Canada. *Sustainability* 13(5): 2420–2436. <https://doi.org/10.3390/su13052420>
- Janmaimool P, Denpaiboon C (2016) Evaluating determinants of rural Villagers' engagement in conservation and waste management behaviors based on integrated conceptual framework of Pro-environmental behavior. *Life Sciences, Society and Policy* 12: 12–32. <https://doi.org/10.1186/s40504-016-0045-3>
- Kaiser FG, Ranney M, Hartig T, Bowler PA (2005) Ecological behavior, environmental attitude, and feelings of responsibility for the environment. *European Psychologist* 10(2): 68–75. <http://dx.doi.org/10.1027/1016-9040.4.2.59>
- Kasa VP, Brahmandam AKS, Samal B, Cheela VRS, Dubey BK, Pathak K (2025) Assessment of coastal litter trends in tourist vs. non-tourist beaches: A case study from Indian coastal smart City. *Science of The Total Environment* 959: 178339. <https://doi.org/10.1016/j.scitotenv.2024.178339>
- Kazaure MA (2019) Extending the Theory of Planned Behavior to explain the role of awareness in accepting Islamic health insurance (takaful) by microenterprises in northwestern Nigeria. *Journal of Islamic Accounting and Business Research* 10(4): 607–620. <http://dx.doi.org/10.1108/JIABR-08-2017-0113>
- Kim Y, Yun S, Lee J (2014) Can companies induce sustainable consumption? The impact of knowledge and social embeddedness on airline sustainability programs in the US. *Sustainability* 6(6): 3338–3356. <https://doi.org/10.3390/su6063338>
- Klößner CA (2013) A comprehensive model of the psychology of environmental behavior—A meta-analysis. *Global Environmental Change* 23(5): 1028–1038. <https://doi.org/10.1016/j.gloenvcha.2013.05.014>
- Kollmuss A, Agyeman J (2002) Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior?. *Environmental Education Research* 8(3): 239–260. <http://dx.doi.org/10.1080/13504620220145401>
- Kumar A (2019) Exploring young adults' e-waste recycling behaviour using an extended Theory of Planned Behavior model: A cross-cultural study. *Resources, Conservation and Recycling* 141: 378–389. <https://doi.org/10.1016/j.resconrec.2018.10.013>
- Lapkin S, Levett-Jones T, Gilligan C (2015) Using the Theory of Planned Behaviour to examine health professional students' behavioural intentions in relation to medication safety and collaborative practice. *Nurse Education Today* 35(8): 935–940.

- <https://doi.org/10.1016/j.nedt.2015.03.018>
- Li D, Zhao L, Ma S, Shao S, Zhang L (2019) What influences an individual's pro environmental behavior? A literature review. *Resources, Conservation and Recycling* 146: 28–34. <https://doi.org/10.1016/j.resconrec.2019.03.024>
- Miafodzyeva S, Brandt N, Andersson M (2013) Recycling behaviour of householders living in multicultural urban area: a case study of Järva, Stockholm, Sweden. *Waste Management & Research* 31(5): 447–457. <https://doi.org/10.1177/0734242x13476746>
- MacKenzie SB, Spreng RA (1992) How does motivation moderate the impact of central and peripheral processing on brand attitudes and intentions?. *Journal of Consumer Research* 18(4): 519–529. <http://dx.doi.org/10.1086/209278>
- MCC (Millennium Challenge Corporation) (2014) National strategy on solid waste management in protected areas – Namibia: Baseline report. Unpublished report: Millennium Challenge Corporation, Namibia. pp. 1–20.
- MEFT (Ministry of Environment, Forestry and Tourism Namibia) (2020) Annual progress report 2019–2020. [https://www.meft.gov.na/files/downloads/853_\[MEFT\]Annual%20Progress%20Report%202019-2020LOWRES%20\(1\).pdf](https://www.meft.gov.na/files/downloads/853_[MEFT]Annual%20Progress%20Report%202019-2020LOWRES%20(1).pdf)
- MEFT (Ministry of Environment, Forestry and Tourism Namibia) (2025) Tourist statistical report 2024. <https://visitnamibia.com.na/wp-content/uploads/2025/12/Tourist-Statistical-Report-2024.pdf>
- MET (Ministry of Environment and Tourism Namibia) (2010) State of protected areas in Namibia. https://rris.biopama.org/sites/default/files/2019_03/State%20of%20the%20Protected%20Areas%20in%20Namibia%202010.pdf
- MET (Ministry of Environment and Tourism Namibia) (2017) National Solid Waste Management Strategy. https://www.oneplanetnetwork.org/sites/default/files/from-crm/94626967351dc24cb26894c1ecd0363fce_National_solid_waste_management_strategy_FINAL_DRAFT_-_3_July_2017.pdf
- Moorman C, Diehl K, Brinberg D, Kidwell B (2004) Subjective knowledge, search locations, and consumer choice. *Journal of Consumer Research* 31(3): 673–680. <https://doi.org/10.1086/425102>
- Muldoon M (2020) Environmental stewardship: Understanding visitor attitudes and behavior. *Journal of Ecotourism* 19(3): 214–229.
- Pakpour AH, Zeidi IM, Emamjomeh MM, Asefzadeh S, Pearson H (2014) Household waste behaviours among a community sample in Iran: An application of the Theory of Planned Behaviour. *Waste Management* 34(6): 980–986. <https://doi.org/10.1016/j.wasman.2013.10.028>
- Przydatek G (2019) Waste Management in Selected National Parks – A Review. *Journal of Ecological Engineering* 20(4): 14–22. <https://doi.org/10.12911/22998993/102609>
- Razali F, Daud D, Weng-Wai C, Jiram WRA (2020) Waste separation at source behaviour among Malaysian households: the Theory of Planned Behaviour with moral norm. *Journal of Cleaner Production* 271(2): 1–10. <http://dx.doi.org/10.1016/j.jclepro.2020.122025>
- Ramayah T, Lee JWC, Lim S (2012) Sustaining the environment through recycling: An empirical study. *Journal of Environmental Management* 102: 141–147. <https://doi.org/10.1016/j.jenvman.2012.02.025>
- Ramkissoon H, Mavondo FT (2015) Pro-environmental behavior: The link between place attachment and place satisfaction. *Tourism Analysis* 20(6): 679–690. <http://dx.doi.org/10.3727/108354214X14146846679286>
- Ramkissoon H, Smith LDG, Weiler B (2013) Testing the dimensionality of place attachment and its relationships with place satisfaction and pro-environmental behaviors: A structural equation modelling approach. *Tourism Management* 36: 552–566. <https://doi.org/10.1016/j.tourman.2012.09.003>
- Roos C, Alberts RC, Retief FP, Cilliers DP, Moolman HJ, Bond AJ (2025) Towards responsible waste management in protected areas: An evaluation of South African national parks management plans. *Parks Journal* 31(1):83–96. <https://doi.org/10.2305/KQNT7049>
- Roos C, Alberts RC, Retief FP, Cilliers DP, Bond AJ (2023) Proposing principles towards responsible waste management in South African protected areas. *Koedoe* 65(1): 1–10. <https://doi.org/10.4102/koedoe.v65i1.1753>
- Roos C, Alberts RC, Retief FP, Cilliers DP, Hodgson W, Olivier L (2022) Challenges and opportunities for sustainable solid waste management in private nature reserves: The case of Sabi Sand Wildtuin, South Africa. *Koedoe* 64(1), a1710. <https://doi.org/10.4102/koedoe.v64i1.1710>
- Roos C, Retief F, Alberts R, Cilliers D, Hodgson W, Olivier O (2021) Understanding waste management behaviour in private nature reserves through the Theory of Planned Behaviour. *Parks Journal* 27(2): 39–48. <http://dx.doi.org/10.2305/IUCN.CH.2021.PARKS-27-2CR.en>
- Rupasinghe HPA, Perera IJJUN, Sandaruwan RDC, Jayapala HPS, Bellanthudawa BKA, Tennakoon A (2025) Coastal beach ecosystems contaminated by marine litter: Impact on coastal biodiversity, tourism, and environmental sustainability. *Environmental Pollution* 372: 126006. <https://doi.org/10.1016/j.envpol.2025.126006>
- Saricam C, Okur N (2019) Analysing the consumer behavior regarding sustainable fashion using Theory of Planned Behavior. *Consumer Behaviour and Sustainable Fashion Consumption* 1–37. http://dx.doi.org/10.1007/978-981-13-1265-6_1
- Schwartz SH (1977) Normative influences on altruism. In: Berkowitz L (ed) *Advances in experimental social psychology*. 221–279. Academic Press, New York.
- Sheeran P (2002) Intention—behavior relations: a conceptual and empirical review. *European Review of Social Psychology* 12(1): 1–36. <http://dx.doi.org/10.1002/0470013478.ch1>

- Sheeran P, Gollwitzer PM, Bargh JA (2013) Nonconscious processes and health. *Health Psychology* 32(5): 460–473. <https://doi.org/10.1037/a0029203>
- Si H, Shi JG, Tang D, Wu G, Lan J (2019) Understanding intention and behavior toward sustainable usage of bike sharing by extending the Theory of Planned Behavior. *Resources, Conservation and Recycling* 152: 1–10. <http://dx.doi.org/10.1016/j.resconrec.2019.104513>
- Sniehotta FF, Presseau J, Araújo-Soares V (2014) Time to retire the Theory of Planned Behaviour. *Health Psychology Review* 8(1): 1–7. <https://doi.org/10.1080/17437199.2013.869710>
- Snyder H (2019) Literature review as a research methodology: An overview and guidelines. *Journal of Business Research* 104: 333–339. <https://doi.org/10.1016/j.jbusres.2019.07.039>
- Stern PC (2000) Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues* 56(3): 407–424. <https://doi.org/10.1111/0022-4537.00175>
- Strydom WF (2018) Applying the Theory of Planned Behavior to recycling behavior in South Africa. *Recycling* 3(43): 1–20. <https://doi.org/10.3390/recycling3030043>
- Tang Z, Chen X, Luo J (2011) Determining socio-psychological drivers for rural household recycling behavior in developing countries. *Environment and Behavior* 43: 848–877. <https://doi.org/10.1177/0013916510375681>
- Taufique KMR, Siwar C, Chamhuri N, Sarah FH (2016) Integrating general environmental knowledge and eco-label knowledge in understanding ecologically conscious consumer behavior. *Procedia Economics and Finance* 37: 39–45. [https://doi.org/10.1016/S2212-5671\(16\)30090-9](https://doi.org/10.1016/S2212-5671(16)30090-9)
- Tonglet M, Phillips PS, Read AD (2004) Using the Theory of Planned Behaviour to investigate the determinants of recycling behaviour: a case study from Brixworth, UK. *Resources, Conservation and Recycling* 41(3): 191–214. <https://doi.org/10.1016/j.resconrec.2003.11.001>
- Torraco RJ (2005) Writing integrative literature reviews: Guidelines and examples. *Human Resource Development Review* 4(3): 356–367. <https://doi.org/10.1177/1534484305278283>
- UNEP-WCMC, IUCN (2026). Protected planet: Namibia. Online: <https://www.protectedplanet.net/country/NAM>. Accessed: 9 March 2026.
- Wan C, Shen GQ, Yu A (2014a) The moderating effect of perceived policy effectiveness on recycling intention. *Journal of Environmental Psychology* 37: 55–60. <https://doi.org/10.1016/j.jenvp.2013.11.006>
- Wan C, Shen GQ, Yu A (2014b) The role of perceived effectiveness of policy measures in predicting recycling behaviour in Hong Kong. *Resources, Conservation and Recycling* 83: 141–151. <http://dx.doi.org/10.1016/j.resconrec.2013.12.009>
- Wang L, Wang M, Wen H (2015) Teaching practice of physical education teachers for students with special needs: An application of the Theory of Planned Behaviour. *International Journal of Disability, Development and Education* 62(6): 590–607. <http://dx.doi.org/10.1080/1034912X.2015.1077931>
- Wang S, Wang J, Yang S, Li J, Zhou K (2020) From intention to behavior: Comprehending residents' waste sorting intention and behavior formation process. *Waste Management* 113: 41–50. <https://doi.org/10.1016/j.wasman.2020.05.031>
- Willis L, Lee E, Reynolds KJ, Klik KA (2020) The Theory of Planned Behavior and the social identity approach: A new look at group processes and social norms in the context of student binge drinking. *Europe's Journal of Psychology* 16(3): 357–383. <https://doi.org/10.5964/ejop.v16i3.1900>
- Wilson BM, Delmas MA, Rajagopal D (2025). Behavioral interventions for waste reduction: A systematic review of experimental studies. *Frontiers in Psychology* 16:1–14. https://doi.org/10.3389/fpsyg.2025.1561467?urlappend=%3Futm_source%3Dresearchgate.net%26utm_medium%3Darticle
- Wu L, Zhu Y, Zhai J (2022) Understanding waste management behavior among university students in China: environmental knowledge, personal norms, and the Theory of Planned Behavior. *Frontiers in Psychology* 12: 1–13. <https://doi.org/10.3389/fpsyg.2021.771723>
- Xu L, Ling M, Lu Y, Shen M (2017) Understanding household waste separation behaviour: Testing the roles of moral, past experience, and perceived policy effectiveness within the Theory of Planned Behaviour. *Sustainability* 9(4): 1–27. <https://doi.org/10.3390/su9040625>
- Young W, Hwang K, McDonald S, Oates CJ (2015) Sustainable consumption: Green consumer behaviour when purchasing products. *Sustainable Development* 23(5): 290–301. <http://dx.doi.org/10.1002/sd.394>
- Zhang D, Huang G, Yin X, Gong Q (2015) Residents' waste separation behaviors at the source: Using SEM with the Theory of Planned Behavior in Guangzhou, China. *International Journal of Environmental Research and Public Health* 12(8): 9475–9491. <https://doi.org/10.3390/ijerph120809475>