Pol. J. Environ. Stud. Vol. 34, No. 6 (2025), 8157-8175
DOI: *10.15244/pjoes/195351* ONLINE PUBLICATION DATE: 2025-01-31

Original Research

The Perception of Port Users Regarding Pollution Management at a Port in the Western Cape, South Africa

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Received: 22 November 2023
Accepted: 28 October 2024

Abstract

Ports in South Africa face numerous environmental challenges. This study focuses on the port of Cape Town. Without understanding the port user's perception in relation to pollution, it is likely that current practices will continue, despite standards and legislation in place. The objectives of the study were to determine the perceptions of port users regarding pollution management and identify the potential barriers and opportunities for the port as it pertains to pollution management. Data was collected using questionnaires that were distributed to selected managerial and non-managerial employees of the TNPA, tenants, contractors, and waste license permit holders. This study suggests that pollution is managed differently in different parts of the Port of Cape Town, better in some parts than others. Although respondents generally perceive that fines are enforced to manage pollution issues, many still agree that pollution management is a problem at the port. As the landlord, the Ports Authority is not empowered to issue environmental fines, and there are also unpromulgated environmental legislations related to ports. Therefore, enforcement does not necessarily effectively address pollution management issues. Another concern is that many of the employees were unsure whether pollution management is a problem and whether penalties for pollution management enforcement have the desired effect. This seems to be due to certain employees not receiving the appropriate training and awareness programs at the time of this investigation. The GIS was one of the opportunities the Port of Cape Town could consider incorporating for monitoring and managing complex environmental challenges as continuous improvement.

Keywords: perception, port users, pollution management, port of Cape Town

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Introduction

Many current global challenges in the environment are the result of human practices and perceptions toward the environment [1, 2]. Solutions to environmental problems require a collective approach and a sense of individual responsibility. Up to 85% of the global population lives in developing countries where economic development is high on the agenda. The increasing populations of developing countries can also be linked to increasing human activities and pollution [3]. Economic development is tied to increasing shipping and related activities in ports. However, linked to economic development is increasing threats to the environment due to pollution resulting from, among others, port users' activities [4-6]. The natural environment is increasingly unable to accommodate the rising levels of pollution that are created due to increasing anthropogenic activities [7, 8].

During port activities, there are different types of pollution sources produced, such as the leakage of oil and liquid goods, water pollution due to vessel dumping, air pollution caused by vessels and congested trucks in the port environment, noise induced by cargo handling and vessel repairing in the dry docks, vessel spray painting, disposal after cargo loading or unloading operations, as well as pollution produced during cargo storage operations [9-12].

South African ports are not an exception when it comes to increasing economic activity and resulting pollution. According to the Environmental Management Department (EMD) of the Transnet National Ports Authority (TNPA), ports in South Africa face numerous environmental challenges, including the Port of Cape Town. Environmental pollution in the Port of Cape Town is an ongoing problem with severe implications for port operations, the future of the port, and the surrounding environment [13].

Most recent studies about port environments pay much attention to issues about sustainable development and green ports [14-19]. It has been proven that ports have, for many years, played a vital role in advancing the economies of many countries and regions globally. Nonetheless, port operational activities continue to produce pollution, which might affect ports negatively. In an attempt to solve this problem, researchers investigate methods of reducing port environmental pollution by optimizing the strategy of the port operations and adjusting the equipment used for the operations in the port [20, 21]. Research that is focused on port users' perceptions regarding environmental pollution is rarer. Understanding how humans perceive the environment is crucial to helping deal with pollution created by port activities. It is necessary to understand stakeholder perceptions concerning port operations and their impact on the environment [22]. Research on people's perceptions of environmental issues is very important [23, 24]. The success of environmental and pollution management relies on understanding people's perceptions of the environment. In order for anticipated human practice toward the environment to change, it is important to know the formation of environmental perceptions [25].

Without understanding the port industrial user's perception, it is likely that the current practice will continue despite the laws, standards, and legislation in place. In understanding human behavior's sensitivity towards the environment, the research findings are anticipated to help develop a strategy that will address the current situation and assist in formulating the best environmental management practice in the Port of Cape Town. Furthermore, recent studies consider geographic information systems (GIS) as one of the technologies that may be incorporated into strategies addressing environmental challenges related to pollution due to human activities. The instrument can analyze, determine risks, and plot maps with hot spots related to pollution [26-31]. This tool for the Port of Cape Town reveals an opportunity for continuous improvement to the port environment.

The objectives of the study were to determine the perceptions of port users regarding pollution management and to identify the potential barriers and opportunities for the port regarding pollution management.

Materials and Methods

Study Area

The Port of Cape Town (33º55′S; 18º26′E) is situated at the southern corner of Table Bay and is the second oldest port in South Africa [32]. This port's historical background can be traced back to 1652, when the Dutch East India Company established a replenishment station in Table Bay. The port has a 253 ha land area and 9163 ha water area. The services rendered span marine, container, general cargo, fresh produce, fishing industry, ship repair, offshore, and port services with hinterland connectivity [33]. The Port of Cape Town is a multi-purpose import/export seaport that mainly feeds to the Western Cape Province and accommodates cargo to and from other parts of South Africa. The port is, therefore, vital for the local economy [34].

Sampling Techniques and Size

The target groups for this study were the Port of Cape Town users (Transnet National Ports Authority [TNPA], tenants, contractors, and waste license permit holders [WLPH's]) who have worked with their organizations for at least six months. The total population size in this study from these organizations was N = 801 (100%) for both managerial and non-managerial employees of port users. A total of 165 (21%) were managerial employees, and 636 (79%) were non-managerial employees.

Sampling Procedure

Purposive sampling was used to select participating organizations [35] because it allows for selecting people who are 'typical' of a certain group and represent diverse perspectives on an issue [36]. The reason purposive sampling is used for this research is because the research focuses on a small sample with the main focus on obtaining 'rich data' [37].

Transnet National Ports Authority Sampling Procedure

The Port of Cape Town, a harbor belonging to the Transnet National Ports Authority, had 680 employees when the survey was conducted. There were 114 managerial employees (MEs) (including supervisors to the senior managers) and 430 non-managerial employees (NMEs). 136 employees were excluded from this investigation. These were office-based employees like secretaries, human resource officers, administrators, occupational nurses, labor relations officers, payroll personnel, and financial officers. All the employees falling under these identified disciplines were considered irrelevant to achieving the research objectives. In order to determine an acceptable sample size based on the population, the online Survey System sample size calculator was used [38]. This calculation resulted in an ME sample size of 89 and an NME sample size of 203 (95% confidence level and confidence interval of 5). However, due to interest from the employees, the sample size for MEs increased to 93, while that of the NMEs increased to 306.

Contractors Sampling Procedure

The contractors working in the port premises were selected during the survey. It was difficult to select the contractors in advance due to the fact that they would come and do their work only when required. More often, most of the companies relevant to this study would spend a short period of time and leave the port, depending on the scope of work. In some instances, for the dry docks, agents and/or companies would book the dry dock space for repairs and cancel the bookings. Due to this, it was challenging to provide a sampling size of the contractors in advance. However, a total of nine contractor companies participated in the survey. According to the Survey System [38], all the population members were required to be part of the sample. The total number of participants was 132 ME and NME employees. Out of these participating employees, 27 were managerial employees, while 105 were non-managerial employees.

Tenants' Sampling Procedure

The Port of Cape Town has many tenants conducting a varied range of activities. At the time of the investigation, there were approximately 121 tenant lease agreements in the Port of Cape Town. The activities were not limited to engineering works, providing a service to the shipping industries, restaurants, the import and export of dry bulk, and governmental departments offering services to the port users, including tourists. These activities attracted a diverse spectrum of people to the TNPA property. The majority of the tenants are privately owned companies. However, there are a few governmental departments that recently moved to the port due to the services that need to be rendered to the public, in particular tourists.

The purposive sampling technique was used to select the tenants for the investigation. The selected tenants were companies with a lease that was at least five years old. Furthermore, they had to be at least two years in operation before the lease expired. The selection further considered those tenants with activities that have the potential to degrade the port environment in their day-to-day tasks. Out of 121 tenants, 12 companies were selected for the study due to their operational activities being environmentally related and relevant in terms of the objectives of this study.

In the 12 selected tenant companies, the total number of MEs was 33, while the total number of NMEs was 152. The use of the Survey System [38] resulted in a sample size of 29 for MEs and 109 for NMEs (95% confidence level and confidence interval of 5). However, the employees showed an interest in being part of the study. Therefore, the sample size came to 33 MEs and 152 NMEs, which is the total population.

Waste License Permit Holders Sampling Procedure

Transnet National Ports Authority is the custodian of the National Ports Act 2005 (Act No. 12 of 2005). Section 58 of this Act deals with licenses that the port issues to the port operators. The companies that handle waste within the port premises are required to obtain this permit from the TNPA. The permit is issued according to the type of service rendered by the applicant [39]. At the time of this investigation, 19 waste license permit holder companies were registered with the Port of Cape Town. Out of 19 companies, six waste license holders were selected for the study. These selected companies were selected because of the nature of the services they rendered. They handled all types of services as per the waste license conditions. These included: (a) collection and transport; (b) provision of waste receptacles; (c) maintenance activities; (d) recycling waste oil; and (e) recycling other waste.

Due to the small population size, all the employees were included in the investigation [38]. The total number of managerial and non-managerial participants was 85. Out of these, 12 were managerial employees, while 73 were non-managerial employees.

Data Collection

The methods of data collection comprised firstly of self-administered questionnaires, which were

divided into two sections, namely the demographic information and the content-based question sections. The questionnaires were used to collect data from managerial employees (MEs) and non-managerial employees (NMEs) of all four target groups (TNPA, contractors, tenants, and WLPHs).

Data Analysis

It was an explorative descriptive study, and statistical analysis was done using SPSS 29 [36].

The dependent and independent variables are categorical variables, which violates the assumption of normality in the application of multiple regression. A Generalized Linear Model (GLzdM) for ordinal categorical data [40, 41] was utilized to determine relationships between the dependents and independents.

The GLzdM allows dependent values to be from any one of the logistic or exponential families of distributions, and the assumption of a common variance is also relaxed. The GLzdM uses a monotonic and differentiable link function. Link functions are chosen according to the data type and the context of the data to specify the type of relationship between the dependents and the independent variables. The dependent variables in this article, originally in the form of 5-point Likert scale statements, were recoded into 3-point Likert scale statements (for example, "Agree" "Unsure" "Disagree"). This transformed the dependent variables into ordinal variables, and a logit link function was selected in each case to determine the probability of a specific outcome ("Agree" "Unsure" "Disagree").

A variable denoting the position of the respondent was created from the two questions: their organization and whether they were a managerial or non-managerial employee. This variable has eight categories. Other independent variables (all categorical) included in the analyses were the demographic positions of the respondents, "age group", "population", "years working at the position", and the "nature of their position" (internship, permanent, casual, contract, or permanent).

Results and Discussion

It should be noted that the Transnet National Ports Authority (TNPA) is referred to in the results and discussion as "Transnet".

Generalized Linear Model was used to see if the position of the employees (non-managerial vs Managerial) had a significant impact on the outcome of the statement. This variable was included in the analysis with other independent variables. The result of this analysis showed that the position of the employees did not have any significant impact on the outcome of the ordinal variable: "Pollution management is a problem at the port" ($P>0.05$) (Fig. 1). However, the variables "Age", "Population", and "Years working at the position" all had a significant impact on their response (Table 1).

The employees with years of working experience in their position have the ability to influence pollution management at their workplace either by providing necessary support in implementation or by neglecting environmental requirements such as policy, environmental management plans, operating procedures,

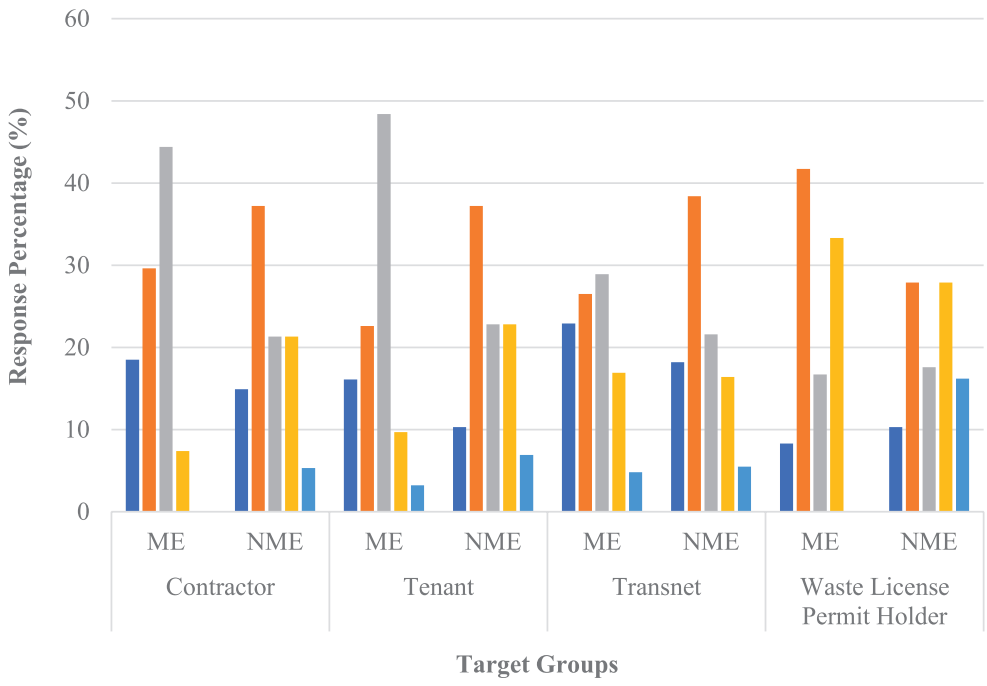

Fig. 1. Response percentages of ME's and NME's from all target groups on the statement: "Pollution management is a problem at the port".

Table 1. The Wald Chi Square results from the Generalized Linear Model for statistically significant influences of independent variables on dependent variables.

		Dependents		
		"Pollution management is a problem at the port"	"There is enforcement of waste and pollution management at the port"	"People get fines for environmental pollution"
Independents	Organisation Position		Chi-Sq = 27.11, df = 7, p<0.001 The highest impact on the dependent variable is from the Managerial Tenants in comparison to the other groups	Chi-Sq = 21.99, df = 7, p = 0.003 The highest impact on the dependent variable is a negative impact from the Non-Managerial Waste License Holders in comparison to the other groups
	Gender		Chi-Sq = 10.233, df = 1, p = 0.001 There is a positive impact from female employees on the dependent variable in comparison to the males	Chi-Sq = 15.43, df = 1, p<0.001 There is a positive impact from female employees on the dependent variable in comparison to the males
	Age	Chi-Sq = 18.54, df = 3, p<0.001 The negative impact is higher in the first age groups (up to 40) in comparison to the other groups		
	Population Group	Chi-Sq = 15.64, df = 3, p = 0.001 The 2nd and 3rd populations groups have a positive impact on the dependent in comparison to the other population groups		
	Years in this position	Chi-Sq = 6.55, df = 3, p-value = 0.088 (significant at the alpha-level of 0.1) Employees with a service length of 6 – 10 years have a positive impact on the dependent variable, in comparison to the other groups		
	Nature of the Position			Chi-Sq = 9.14, df = 3, p = 0.028 There is a negative impact of Permanent and contract employees on the dependent variable in comparison to the other employee categories
	Multinomial probability distribution, with a cumulative probit link function			
	Wald Type III analysis			

environmental legislation, awareness, and training [42-44].

Environmental pollution in seaports is the result of ship movements, ports' own activities, and land-based activities. It is, therefore, necessary to have preventative measures in place to manage pollution in the ports [45-48]. The Environmental Management Department of the Transnet National Ports Authority strives to inform all

port users and educate them on environmental issues that relate to land or sea-based pollution facing the port. Pollution is one of the major environmental challenges that face the Port of Cape Town [13]. Therefore, effective management of pollution is essential in the port. A wide range of environmental issues can affect the port environment [49], such as dredging [50, 51], noise [52, 53], water [54], sediment [55], releases into the air [56, 57], soil [58], and oil spills [59]. Most researchers recommend using *geographic information systems* **(**GIS) as one of the most effective tools to monitor and manage environmental pollution, even in complex environmental situations. This tool measures data easily and accurately. The advantage is that a smaller number of employees can be used and managed automatically, and large amounts of data can constantly be analyzed [60-62]. This is considered an opportunity for the Port of Cape Town to incorporate GIS into its complex environmental challenges for continuous improvement for monitoring and pollution management purposes. In the study conducted by the Council for Scientific and Industrial Research in 2022, it was indicated that the sampled water and sediment in all the dry docks in the Port of Cape Town had high levels of pollution, which was associated with ship repair operational activities [63]. Similar results of high levels of pollution were found in sediment samples, which were collected in the Port of Gdańsk and the Port of Gydnia, Polish ports of international significance. The cause of pollution was traced to ship-related activities where the majority of ordinary employees are active [64, 65]. In the Port of Cape Town, water and sediment quality reports are shared with the relevant stakeholders as part of environmental awareness and training programs [63, 66, 67]. In 2018, Di Vaio and Varriale suggested that it is critical for all the organizations operating within seaports to be provided with training and awareness programs in the direction of the environment to influence their practice for the benefit of a better port environment [68]. The tenants and contractors must demonstrate the best practice on how they will manage and minimize pollution in their operational activities [39]. The tenants' and contractors' environmental management plans (EMP) must demonstrate the control measures to prevent and minimize pollution due to the operational activities [67, 69]. In the EMP, it must be stated that the organization will ensure that the resources for operational activities will not be compromised so that the implementation of the EMP is achieved. The roles and responsibilities of the managers and employees must be clearly stated for accountability [70]. It is the responsibility of the tenants, contractors, and port operators, as part of their lease agreement conditions, to familiarize themselves with and comply with all pollution-related legislation relevant to the port environment, especially those that do the actual work on the operations [69-71].

The relationship between port users and the port authority is very crucial, especially in sharing information regarding the environmental impact of the port's operational activities. The port users have a role in managing their operational activities in an environmentally appropriate manner [72]. Around the globe, seaports have realized that they are faced with many environmental challenges that continue to increase daily. It is necessary to manage the current situation to reduce the negative environmental impact, focusing on operational activities adhering to legislative requirements [73-75].

In total, 51% of the NMEs and 47.1% of the MEs agreed that pollution management is a problem at the port. Various environmental policies and procedures exist in the TNPA to manage pollution issues in the port. The employees within the port environment are required to adhere to environmental policies and procedures. The Safety, Health, Environment, and Quality (SHEQ) policy of the TNPA commits that everyone in the organization should comply with all relevant environmental legislation and regulations [76]. Many seaports around the world continue to review their policies to ensure that the reduction of environmental pollution in their operational activities is realized [76-81]. The Port of Cape Town leadership has approved an Integrated Waste Management Plan (IWMP). The Environmental Specialist, having been in this position for many years, has been updating the IWMP with necessary legislation when a need arose [82]. This plan shows how Transnet employees should manage pollution. There have been a significant number of seaports outside of Europe that started drafting and implementing waste management plans. The number of seaports continues to grow in this direction. Some of these ports are in South Africa (Port of Cape Town and Durban), United Arab Emirates (Abu Dhabi Ports), British Virgin Islands ports (Cayman Island Ports), and India (Port of Mormugao) [83]. There are service providers in the Port of Cape Town that deal with pollution-related matters. It is also compulsory for these service providers to have pollution liability insurance [84-88]. In addition to these contracts, the TNPA has a dedicated pollution control team that deals with pollution issues, such as oil spills around the port, either on land or water [82]. Despite pollution-related issues such as oil spills, among others, in the port systems, China has shown tremendous improvement in capabilities in marine pollution for effective prevention and control measures. These measures, among others, include a framework, technical specifications, policies, environmental legislation, oil spill contingency plans, and a spill emergency response team [89].

Policies, strategies, and associated documents of the TNPA are evidence that pollution issues are taken seriously, at least from a governance point of view. The policies, strategies, pollution management contracts, and the pollution control team could be considered as evidence of mechanisms that exist to address an identified pollution problem in the port. However, internal and external audits, local authorities' inspection reports, and notices of possible penalties to TNPA

indicate that pollution is a problem in the Port of Cape Town [90-93]. Worldwide many ports are faced with pollution due to a variety of anthropogenic activities [94-100]. According to Advantage A.C.T., certain parts of the port environment needed more attention from the port authority as far as pollution is concerned [90]. Furthermore, the port waters are continuously covered in litter and flotsam, which creates a risk to marine life. This condition is further aggravated in the rainy season (winter) with stormwater outlets leading into the port waters [63, 101]. In a study that investigated pollution in 26 countries, all port authorities agreed that the number one environmental concern was water pollution [102]. All these factors could have influenced the perception of MEs and NMEs to "agree" with the statement that pollution is a problem in the port.

The WLPH's core business is to deal with pollution-related matters [103-105]. The administration of the contracts between WLPHs and the clients is the responsibility of the MEs. When services are required, the MEs will be knowledgeable about handling such and what services need to be rendered where. The MEs would then inform the NMEs of the clients to be serviced, in this case, the port authority. Transnet has contracts with WLPHs to manage waste and pollution in the port [84, 87]. It should be noted that Transnet is not the only organization in the port that deals with WLPHs. There are others also within the port that make use of the WLPH's to manage their pollution problems. It is possible that 50% of the WLPH MEs and 38.2% of the WLPH NMEs "agreed" that pollution management is a problem in the port because they, as service providers for pollution problems, experience and perceive the port as being ineffective or inefficient in managing these issues. Environmental perception can be influenced by individuals' years of experience and their responsibility towards the environment. Hence, it is crucial to understand people's perceptions [23-24]. In understanding the contributing factors in people's perception toward the environment lies the success of environmental and pollution management [25]. It is possible that knowledge of the types of environmental pollution shared by means of water and sediment quality reports, as well as awareness and training programs and years of experience in their positions, were contributing factors that influenced the MEs and NMEs perception that pollution management in the Port of Cape Town is a problem.

Almost 35% of the MEs and 21% of the NMEs were "unsure" whether pollution management is a problem (Fig. 1). This is a concerning result since it implies a level of ignorance among port users about pollution management and whether it is a problem at the port or not. They could be unsure because pollution management is not in the scope of their own job functions. This might have resulted in possible ignorance with regards to pollution management. Furthermore, maybe they do not have enough knowledge, did not receive the applicable training, or it is an attitude issue. Possibly, these might have influenced their perception. Numerous factors, such as knowledge and attitude, play a role in people's environmental perceptions [106]. In 2004, Gallagher defined attitude as the "perception of or belief regarding the physical environment, including factors affecting its quality" [107]. Therefore, depending on environmental factors, the individual attitude may be influenced [108]. The oversight audit reports of 2019 [109] and 2018 [110] indicate that not all tenant employees received awareness and training for oil spills, water, pollution, and legislation, while others received specific programs related to their job requirements [91, 109-112). Among other identified challenges of pollution is a lack of awareness programs and commitment [91, 113-116].

33% of the WLPH-ME and 44% of the WLPH-NME respondents felt that pollution management is not a problem in the port. They thus perceive pollution in the port as adequately managed (Fig. 1). The Safety, Health, and Environment Plan (SHEP) file and EMP require that all employees are responsible for avoiding pollution during their operational activities [117-119]. Poor housekeeping, among others, may lead to incidences of pollution. However, prevention and management of pollution through good housekeeping, strict environmental compliance, enforcement and monitoring, contingency plans, and advanced clean-up technology are key in the port environment [13, 120-123]. Furthermore, the tenants and contractors use Toolbox training sessions to discuss pollution and water issues. Toolbox training is a session where operational activities of that day, including the associated risks, are discussed by both MEs and NMEs [13, 124]. In 1999, the World Bank established guidance on EMPs [125]. This was done to provide ways to predict the impact and monitor the control measures that will mitigate the impacts identified in operational activities. In so doing, good practices can be developed in order to take care of the environment. Port users must ensure that all their staff members are made aware of the requirements of the Environmental Management Programmes (EMPs) and their implementation for their operations [68, 74, 126, 127]. It was also indicated that environmental studies should be shared on different platforms as part of awareness and training programs [63, 66, 67, 128, 129]. Transnet provides awareness and training to its employees regarding pollution [13, 66-68, 74, 130]. The more individuals are exposed to information, the more they have the potential to positively impact their personal efficacy to protect the environment, and the more they will have a positive perception of environmental-related issues and their risks [131]. The received awareness and training may have contributed to a better understanding by these respondents of pollution issues and a better understanding of how to manage it. Their training knowledge and practice may have contributed to their positive perception of pollution management. Also, pollution may be better managed in the areas of the port where these respondents work, therefore their positive perception. In most developing countries, a lack

of environmental knowledge contributes to pollution problems [132]. Awareness and educational campaigns are steps to change people's perceptions [133]. SHE representatives of the TNPA and port users conduct inspections at operational areas and report issues that need to be addressed to their immediate supervisors [111, 112, 134]. Inspections of workplaces by a SHE representative are a legal requirement in South Africa [135]. It is possible that these exposures to the EMPs and their implementation, shared environmental studies, and inspections influenced the perception of certain NMEs and MEs to such a degree that they felt that pollution management was not a problem in the port.

One of the findings of a 2022 TNPA internal audit report revealed that there are certain areas of the port environment, as far as pollution conditions are concerned, that require more attention [136]. This could suggest that pollution is managed differently in different parts of the port, better in some parts than others. The size of the Port of Cape Town is 253 ha on land and 9163 ha on water [34]. There are multiple services rendered by the port [137]. Therefore, it is possible that different operational activities may produce different waste and pollution, resulting in varying impacts on the environment in terms of pollution. This may result in the need for different strategies to manage pollution in different parts of the port. This may have contributed to the varying responses to the statement of whether pollution is a problem at the port.

In terms of how a person thinks of pollution, the perception is more than factual knowledge. An individual's level of pollution risk perception is considered in the expression of that individual's exposure, which is likely to be different from others that he had before with matters such as toxic chemicals, land development (in this case, the port), waste disposal, runoff, and air or water pollution [138]. Environmental perception represents a situation where individuals can interpret environmental information and, with their understanding, can explain how they perceive the environment at that moment in time [139]. Knowledge about an environment and the problems of that environment play an important role in contributing to people's understanding of their environmental perception and the required actions to be taken [92, 140-142]. Understanding how people perceive the port environment helps to deal with pollution generated by port activities. It is also important to understand stakeholder perceptions concerning port operations and their impact on the environment [22].

There were statistically significant differences between the MEs and NMEs of all the target groups with regard to the statement: "There is enforcement of pollution management at the port" ($P<0.05$) (Fig. 2). Both the variables "organizational position", and "gender", had a significant impact on their response (Table 1).

51% of all MEs and 67% of all NMEs "agreed" that enforcement of pollution management is happening at the port (Fig. 2 and Table 2). The various categories of the NMEs had a higher response percentage (61.4-81.8%) than MEs (28.1-75%) (Table 2). However, 21.5% of the respondents were "unsure" whether pollution management enforcement is happening (Fig. 2).

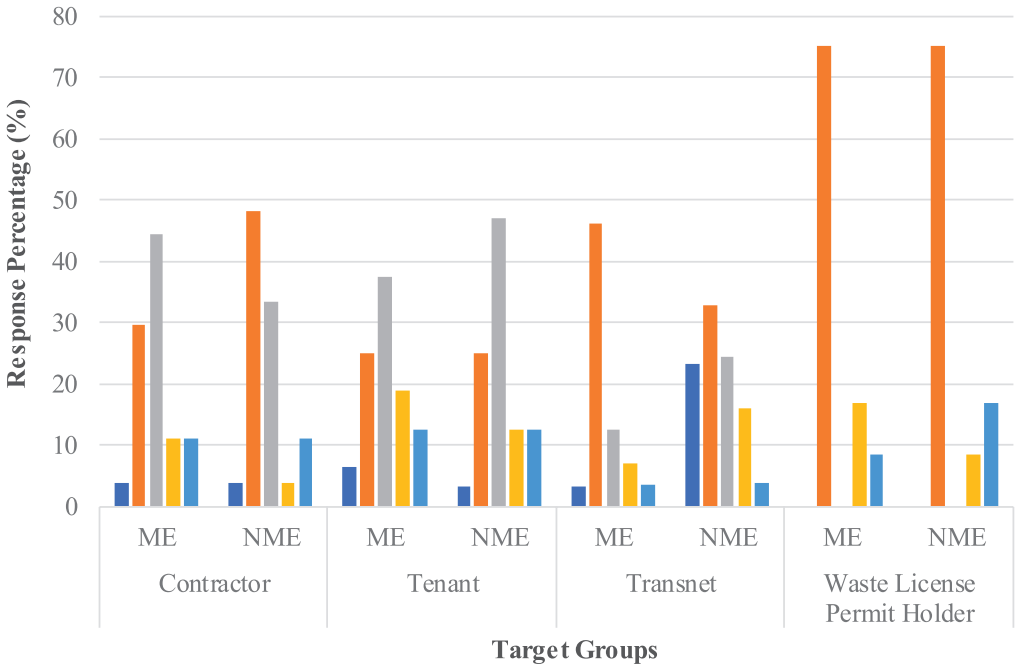

Fig. 2. Response percentages of ME's and NME's from all target groups on the statement: "There is enforcement of pollution management at the port".

Table 2. Response percentages of ME's versus NME's on the statement: "There is enforcement of waste and pollution management at the port".

	Categories	Agree	Unsure	Disagree	Total
	NME Contractors	70 (75.3%)	18 (19.4%)	5 (5.4%)	93 (100%)
Position Group	NME Tenants	95 (66.4%)	36 (25.2%)	12 (8.4%)	143 (100%)
	NME Transnet	180 (61.4%)	54 (18.4%)	59 (20.1%)	293 (100%)
	NME Waste License Holder	54 (81.8%)	9 (13.6%)	3 (4.5%)	66 (100%)
	ME Contractors	14 (51.9%)	9 (33.3%)	4 (14.8%)	27 (100%)
	ME Tenants	9 (28.1%)	15 (46.9%)	8 (25%)	32 (100%)
	ME Transnet	46 (56.1%)	20 (24.4%)	16 (19.5%)	82 (100%)
	ME Waste License Holder	9 (75%)	0 (0%)	3 (25%)	12 (100%)

Tyler stated that age and gender were the best predictors of environmental compliance [143]. Most researchers [144, 145] agree that the focus theory of normative conduct is a "psychosocial theory built on the concept of social norms to explain and predict social behavior, which has been explicitly applied to anti-ecological behavior". This theory also indicates two types of social norms. Firstly, injunctive social norms involve perceptions influenced by the behaviors of a group or population for approval or disapproval of certain practices and are also motivated by environmental enforcement or rewards (146, 147). Secondly, descriptive social norms involve perceptions of certain behaviors practiced by a group or population and are motivated by demonstrations of what is effective, as well as a structural model on illegal anti-ecological behavior [148, 149].

The National Ports Act (No. 12 of 2005), Section 56 (2), requires all service providers intending for port services in the Port of Cape Town to apply for a permit with the TNPA [39 94, 95]. In the dry docks, procedures must be complied with before flooding and unflooding may occur. This is done in conjunction with a vessel's preparations, docking, and undocking process to ensure that enforcement of the procedures for pollution and water-related matters is adhered to so that the environment is not compromised [150-153]. Close monitoring during this period is very critical [154]. This process would constitute more direct involvement of NMEs and certain of the MEs due to their roles and responsibilities in the operations. These NMEs and MEs would also experience the environmental management inspectors that visit the port randomly for inspections [155]. In Table 2, the response percentages of NMEs (61.4 – 81.8%) were higher than the MEs (28.1 – 75%) for the enforcement of waste and pollution. It is not surprising due to the enforcement procedures that involve more of the NMEs than MEs (Table 2). The Port of Cape Town was given a warning for environmental pollution in its operations in the dry docks that have the potential to compromise the environment [155]. This type of experience by the NMEs and MEs is evidence that enforcement of pollution management matters in the port is happening.

Those NMEs and MEs that "agreed" perceive enforcement of pollution management matters as something that is taking place in the port. Some of the duties of contractors and tenants are performed in the dry docks, depending on the operational requirements. They must also submit a Safety, Health, and Environmental Plan (SHEP) file for work done in the dry docks. The SHEP file must be reviewed and approved by the Risk Specialist (RS) of TNPA [156]. In recent times, most organizations that prioritize Safety, Health, and Environmental Management, strive to comply with legal requirements in order to reduce accidents and negative environmental impacts [157-159]. Before and/or after the conclusion of operations, the TNPA dock master and a supervisor (or project manager and selected NMEs) from the tenants or the contractors, who are responsible for particular operations or projects in the dry docks, conduct pre and exit inspections to check for compliance [126, 160, 161]. It is thus possible that the tenant and contractor NMEs and MEs perceptions that enforcement of pollution management matters is taking place are due to the inspections of the Department of Labour (DoL), the RS, and the dockmaster of the TNPA. Furthermore, the Environmental Specialist (ES) of the TNPA conducts oversight audits on tenant premises to ensure compliance and enforcement of environmental regulations and laws. Audits conducted by the ES could also have influenced the MEs and NMEs perceptions in a positive way [111, 162]. Generally, the WLPHs held the perception that pollution matters are enforced in the Port of Cape Town. Before the port license permit is issued, audits must be conducted, and all the legal requirements must be met. The National Ports Act stipulates that TNPA has the right to monitor and enforce pollution and environmental-related issues of the applicant to ensure that the operational activities do not threaten the environment [39, 103]. The environment should always be protected [60]. The port license permit is issued with conditions that the applicant must familiarize themselves with. It is possible that the knowledge of the port permit

license conditions, National Ports Act requirements, and audits conducted on WLPH operations positively influenced the MEs and NMEs perception that there is enforcement of pollution management-related matters in the port.

South Africa participates in INTERPOL programs where joint operation teams conduct random inspections to monitor and enforce pollution management-related matters at ports. The authorities that get involved in these collaborations, among others, are the Department of Forestry, Fisheries, and the Environment (DFFE) (previously known as the Department of Environmental Affairs (DEA)), the South African Police Services (SAPS), Customs, relevant provincial departments, the South African Maritime Safety Authority (SAMSA), and intelligence structures, together with Transnet and other stakeholders [163, 164]. It is possible that these joint operations also contributed to the positive perception of MEs and NMEs.

However, there were many MEs and NMEs that chose the "unsure" option on the issue of the enforcement of pollution management matters (Fig. 2 and Table 2). This is of concern that so many MEs and NMEs chose "unsure". Certain of the MEs and NMEs of the tenants and contractors normally become involved at later stages of operational activities. After completing the operational activities, again, not all MEs and NMEs are involved on-site for the flooding and unflooding of the dry docks [92, 111, 140]. This situation may have contributed to the relatively high level of "unsure" responses from MEs and NMEs. Furthermore, environmental management inspectors do random inspections in the Port of Cape Town [93, 111]. More often, the main problem as far as proper management services are concerned is a lack of enforcement and non-compliance [165, 166]. One of the challenges that South Africa faces in managing the environment is a lack of enforcement and effective monitoring because of a shortage of suitably trained experts in the field of pollution-related management [167]. A DFFE report found a lack of enforcement at one of the dry docks of the Port of Cape Town [111]. It is possible that certain MEs and NMEs do not experience these inspections due to the often short time periods contractors and the tenants are on-site in the dry docks. This may have also contributed to the uncertainty of certain respondents regarding the enforcement of pollution management matters in the port. The National Ports Act (No. 12 of 2005) states in Section 11 that the TNPA can enforce environmental laws to protect the port environment [39, 104]. The tenant ME's and NME's receive SHE induction training programs that are offered by TNPA. They are also informed of the relevant environmental legislation [66-68]. There are only two ES's appointed for the Port of Cape Town. Only one of them is conducting oversight audits with the tenants [77, 168]. It should be noted that the port has 120 tenants, and the ES is able to conduct audits with only 15 tenants per year. This means that not all the MEs and NMEs were trained in pollution-related matters, attended inductions, have knowledge of the environmental legislation and TNPA rules, or are aware of the oversight audits. Many of them may not have experienced these audits conducted by the ES as yet due to the fact that it will take the ES several years to do one audit for each of the tenants in the port. However, environmental pollution problems can only be resolved if law enforcement measures are taken [169, 170].

A study was conducted at leading ports in Europe and Asia, namely, Antwerp, Rotterdam, Singapore, and Shanghai. The findings stipulated that environmental standard regulations were highly exercised in these ports, leading to prevalent enforcement. This approach was found to be very effective and influential [19]. The TNPA interdepartmental heads, managers, and supervisors conduct visible field leadership (VFL) for inspections, as well as compliance regarding safety and various environmental issues in the Port of Cape Town [171, 172]. Studies have shown that managers can easily influence organizational outcomes [173, 174]. Leadership can affect the organization's performance and influence how things are done [171, 175]. Furthermore, the TNPA must improve interdepartmental communication for effective pollution management in the port [13, 82, 84]. All the above factors may have influenced the perception of the MEs and NMEs regarding the enforcement of pollution management issues in the port.

There were statistically significant differences between the MEs and NMEs for all the target groups with regards to the statement: "People get fines for environmental pollution in the port" ($P<0.05$) (Fig. 3). The variables "gender" and "nature of the position" also had a significant impact on their responses (Table 1).

A number of researchers [176-178] found that diversity in gender, age, and position in companies plays an important positive role in environmental pollution, and more attention is also given to environmental litigation issues, especially in companies that pollute. Ibrahim 2009 stipulates that in companies where females were in managerial positions, more positive results were found with respect to ethical issues, misconduct, and litigations avoided [179].

54% of the contractor and tenant MEs were "unsure" whether fines are used to deal with pollution in the port. 52% of the Transnet MEs agreed on this issue, while only 48% of the Transnet NMEs "agreed". The WLPH MEs and NMEs overwhelmingly agreed (75% and 82.1%) that fines are used to deal with pollution in the port (Fig. 3).

In total, 59% of the respondents agreed that penalties are used as a means to enforce proper pollution management in the port (Fig. 3). Contractors and tenants must submit SHE files where they acknowledge that if they do not comply with pollution management matters, as per the requirements of relevant rules and regulations, they are in danger of receiving fines in the case of non-compliance [39, 151, 160]. Environmental Management Inspectors (EMIs) do environmental monitoring, compliance, and enforcement visits to

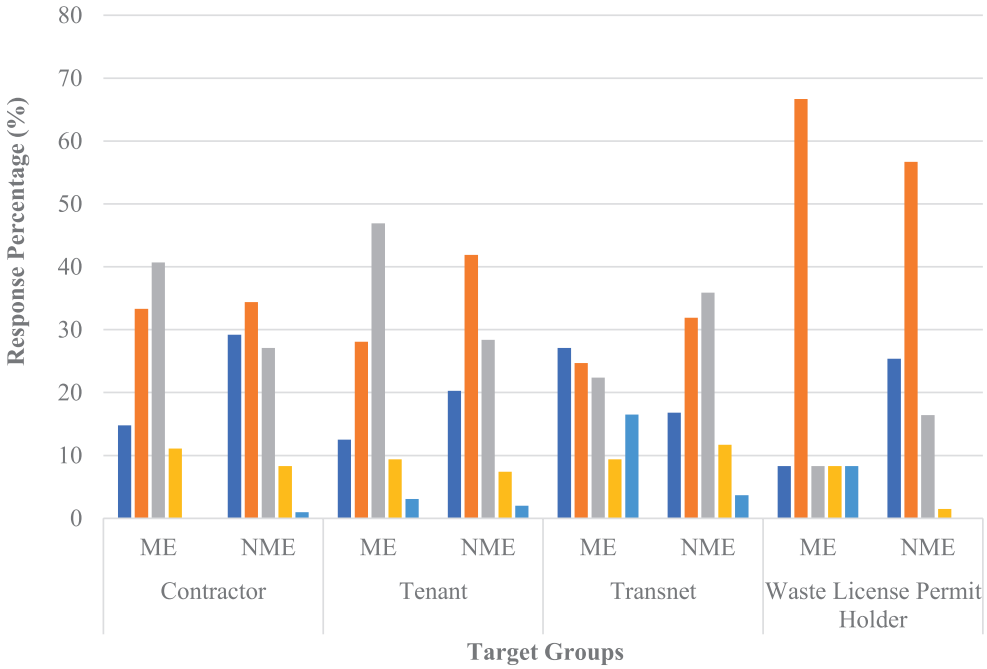

Fig. 3. Response percentages of ME's and NME's from all target groups on the statement: "People get fines for environmental pollution in the port".

facilities in the country, including the ports. Where there is a contravention of the National Environmental Management Act (NEMA), they issue a notice and hand the matter to the National Prosecuting Authority (NPA), which may issue fines [180]. The Pollution Control Officer's (PCO) job description for the Port of Cape Town indicates that this person attends to all port waste and oil spill-related incidents, ensuring a quick response and rapid clean-up with accurate recording of costs [181-183]. During the investigation of this study, no legislation was found to give TNPA, as the landlord, specific powers to issue environmental fines; this includes the National Ports Act (No. 12 of 2005), although Section 11 requires the port to enforce environmental laws in order to protect the environment. These may also include other environmental unpromulgated legislation related to ports [184, 185]. There seems to be a gap that may require policymakers to consider empowering the port authority and promulgating other environmental legislation related to ports. In terms of Section 26 (1) of NEMA, no person may dispose of waste anywhere on land or water unless authorized and/or (2) causes environmental pollution. Section 67 (1b) states that anyone who contravenes or fails to comply with waste and pollution commits an offense. Section 68 (2) states that any person who offends the law concerning waste and pollution is liable for a fine of not more than R10,000, imprisonment for not more than 10 years, or both [186]. The DFFE, as well as the SAMSA, visit ports for environmental inspections and issue fines where necessary. The WLPHs are obliged, due to their contract conditions, to report pollution offenses in the port to the TNPA and other relevant external authorities [39, 106, 187]. The more frequently the authority conducts inspections, the higher the chances of environmental compliance [188, 189]. The inspections and consequential sanctions (fines) issued by enforcement agencies have the potential to deter future environmental violations and further encourage environmental compliance [190-192]. There are instances where WLPH's were inspected by the port's joint operations team and/or agencies. Non-compliance and offenses from WLPH's may result in notices in the port, and in some instances, operations may not continue until the non-compliance is rectified [39, 109, 151, 163, 193, 194]. This may have contributed to their perception that fines are issued for pollution offenses. Therefore, it makes sense that most of the respondents (MEs and NMEs) agreed that fines are issued. The legal measures that are in place to "police" environmental pollution may have influenced the perception of many respondents that people get fines for environmental pollution offenses in the port, maybe even through their own experiences of these measures. In order to bring polluters under environmental compliance, even by deterring them from future environmental violations, fines are found to be an effective means of doing so. The theories of firm behavior and empirical records are the mechanisms that inform policies. These policies then guide the design of the fines [195-197].

It should be noted that many of the respondents, especially among the contractor, tenant, and Transnet target groups, were "unsure" whether fines are used to deal with pollution issues in the port. The "unsure" responses could be from individuals who are not directly involved in dealing with notices and fines due to pollution issues. Therefore, it is unsurprising that so many of

the MEs and NMEs responded "unsure". In situations where people are ignorant of environmental regulations and legal requirements, promoting environmental awareness is perceived as the best approach to deal with this lack of knowledge [198, 199]. From a policy point of view, it is crucial to understand the people's awareness as far as environmental legislation is concerned, as this can quickly inform the methods to encourage compliance [25, 196, 199, 200].

The external audit report of 2020 stipulated a risk for TNPA that would attract fines and penalties if attention is not given to certain areas of the port on pollution-related issues [201, 202]. Furthermore, it was revealed that not all the employees received training in legal requirements and environmental pollution [91]. The individual's reception may vary from one person to the other due to their exposure and experience [139, 203, 204]. According to previous research, the knowledge and accessibility of information to individuals may influence their perception differently from one group of people to another [197, 205, 206]. Thus, there is a potential that MEs and NMEs are not knowledgeable enough on legislation and environmental pollution issues. Consequently, uncertainty regarding fines might be due to a lack of training and a related lack of relevant knowledge. It is further possible that compliance and fines are not part of only certain employees' responsibilities. These could be contributing factors to some employees' uncertain perceptions.

Conclusions

The study suggests that pollution is managed differently in parts of the Port of Cape Town; some areas are managed better than others. Although respondents generally perceive (with influencing factors) that fines are enforced to manage pollution issues, also many respondents feel that pollution management is a problem at the port. One of the opportunities identified is that TNPA, Port of Cape Town, may incorporate GIS to monitor and manage environmental pollution as an effective tool to complex environmental challenges as far as pollution is concerned for continuous improvement. During the investigation of this study, it was found that there is a lack of legislation empowering the TNPA-specific powers to issue environmental fines. There seems to be a gap that may require the policymakers to consider empowering the TNPA to issue environmental fines and other unpromulgated environmental legislation related to ports. Therefore, current enforcement processes do not necessarily effectively address pollution management issues. Another concern is that some of the employees were unsure whether pollution management is a problem and whether penalties for pollution management are enforced. This seems to be due to certain employees not receiving the appropriate training and awareness programs at the time of this investigation. There were "mixed bags" of responses concerning fines for environmental pollution in the port. This was due to various contributing factors that influenced the perception of the respondents.

Acknowledgments

This study was approved by the Faculty Research Ethics Committee (Registration number NHREC: REC-230408-014, REC approval reference number: CPUT/HW-REC 2016/H1). Appreciation to all the organisations that participated in this study and for permission. Mr. Abou Bamba (Ex-Officio: General Secretary – UNEP/Abidjan Convention) for granting the opportunity to the principal investigator (PI) (Aupaki Michael Melato) for African ports exposure. The PI was also an official representative during IMO Member State Audit Scheme (IMSAS) Audit, Republic of South Africa.

Conflict of Interest

AM Melato (Author) is an employee of one of the target groups (Transnet National Ports Authority) that participated in the study. However, being an employee of Transnet did not compromise the integrity of the research investigation.

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