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THE INCIDENCE OF PLASTIC DEBRIS ALONG TYUME RIVER IN ALICE, SOUTH AFRICA

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ABSTRACT

The article is premised on the Zero Waste theory and it addresses the environmental impact of unscientific disposal of plastic debris along Tyume River in Alice Town, South Africa. The researchers confirmed that Alice community lacks awareness on plastic waste management as evidenced by inappropriate disposal of plastic waste along the river causing environmental pollution. Behavioral action is lacking and can be enhanced through environment education and economic enterprise initiatives at the community level. The researchers established that runoff water, wind and irresponsible residents generate plastic debris along Tyume River. The environmental costs of plastic waste along rivers are still poorly understood by South African communities since limited studies have been undertaken on this subject. There is a dearth of knowledge on the effects of plastic waste along rivers. Previous studies focused on plastic debris in the sea ignoring plastic waste along rivers including Tyume River in Alice. The article adds value to the limited knowledge on the incidence of plastic waste through addressing approaches which Nkonkobe Municipal Management and Alice community should take to ensure safe environment along rivers.

Key Words: Plastic waste, Tyume river, Alice town, River debris, Zero waste theory.

INTRODUCTION

"Plastic waste is a global issue that has received relatively little attention from the communities and it has important ecological plus fiscal impacts in river systems" (United Nations Development Programme 2011: 1). "Globally, an issue of particular concern is that giant masses of plastic waste have been discovered in the North Atlantic and Pacific oceans, the full environmental impacts of

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which cause severe damage to seabirds, marine mammals and fish" (European Commission Environment 2011: 11). Constant monitoring is fundamental to assess the efficacy of measures applied to reduce the abundance of plastic debris along watercourses. The ubiquity and abundance of plastic debris along the water bodies is an observable cause of concern throughout the world including African countries (Galgani 2010). A number of countries in Southern Africa are experiencing escalating health and environmental problems because of the incompetent and unsanitary disposal of plastic waste as evidenced by increasing number of plastics disposed along the rivers (World Water Assessment Programme 2006; 2011).

Nonetheless, certain questions cropped up during the process of crafting this article. These are: *What is plastic waste? What practices can best address plastic waste management along rivers in South Africa? How do we recover, reuse and recycle the valuable components of plastic waste?* The article addressed these questions through a case study focusing on Tyume River flowing through Alice town under Nkonkobe Municipality. Reviewed literature confirmed that plastic waste along water bodies is a worldwide problem that has received relatively little attention for decades. This difficulty cascades down to Southern Africa, South Africa, Eastern Cape Province to a case of Tyume River lying between Alice Town and the University of Fort Hare. The researchers outlined that since 2009, the Alice and University of Fort Hare communities reduced the amount of plastic waste along Tyume River through Mandela Day community engagement programmes.

This study provides an overview of measures based on Zero Waste theory to reduce environmental impact of plastic waste along rivers in South Africa. Zero Waste is a philosophy that encourages the redesign of resource life cycles so that all products are reused. "Zero Waste is a goal that is ethical, economical, efficient and visionary, to guiding people in changing their life styles and practices to emulate sustainable natural cycles, where all discarded materials are designed to become resources for others to reuse" (Young and Fan 2010: 236). The article is building on the existing inadequate knowledge through addressing the plastic river debris problem in South Africa using a case study of Tyume River in Alice town.

Further the researchers reviewed relevant literature; described the study area and used interviews as well as observations to establish that ignorance and attitudes of people contribute to the problem of plastic waste accumulation along the rivers. Added to this is the lack of knowledge on waste minimization and benefits of recycling. Little information is available on the amounts, rates, fate or impacts along the rivers in South Africa. The impact of plastic wastes on the economy cannot be ignored and managing them has become a major problem. However, unscientific and illegal disposal of plastic wastes along rivers can lead to many environmental problems. The researchers assessed plastic waste generation and disposal, together with abundance, composition and fragmentation of plastic. They also analyzed collected data to evaluate whether river plastic debris is increasing and whether it varies geographically in South Africa. The study aimed at identifying

the environmental awareness level of stakeholders and their attitudes towards cross-sector collaboration in the management of plastic waste.

THE IMPACT OF PLASTIC RIVER WASTE: A REVIEW

River debris is mainly discarded human rubbish suspended in the river and roughly the greater percentage of the river debris is plastic which has been accumulating for years. “Plastics are lightweight, strong, durable, cheap, and these are characteristics that make them suitable for the manufacture of a very wide range of products” (Laist, 1987: 319). “These same properties happen to be the reasons why plastics are a serious hazard to the environment” (Pruter 1987: 305).The researchers observed that the literature on plastic waste pollution throughout the world largely focuses on marine systems not on rivers. “The pollution of the oceans and the North Sea is still a ubiquitous problem, particularly with regard to plastic waste” (Hartwig, Clemences and Heckkroth 2007: 595). “From the 100 millions of plastic tonnes produced every year, about 10 % become a problem of huge proportions of litter in the oceans and along the coasts” (Derraik 2002: 843). “Long-term waste recording projects along the Germany North Sea coast have shown an average plastic content of 62.5 % of the beach-washed amount of plastic garbage” (Hartwig *et al.* 2007: 595).

Discarded plastics affect terrestrial water systems, including ingestion by and entanglement of animals, blocked drainage systems and aesthetic impacts (Mangizvo 2007; Ryan 2009: 1999). Plastics disposed irresponsibly result in clogging up of open drains, posing health threats to livestock and people and defacing the surrounding environment. Plastics are readily transported for lengthy distances from source areas and accumulate mainly in the rivers, where they have a variety of significant environmental and economic impacts.

Mankind’s handling of the waterways through responsible plastic waste disposal is a decisive trial on the way to a sustainable future. Human activities are perceived as responsible for the increase in plastic waste. This concern is most apparent in urban areas where the population is growing, while fiscal resources and management systems are not improved. “Since they are also buoyant, an increasing load of plastic debris is being dispersed over long distances, and they may persist for centuries when they finally settle in sediments” (Hansen 1990: 17).

In South Africa, there is little evidence showing efforts to reduce the use of plastic bags. Almost all retailing shops and other small outlets always encourage customers to access plastic bags after shopping (Sarangan 2008). However, the municipalities in South Africa are finding it difficult to implement an outright ban of plastic bags by way of government legislation because governments resist enforcing policies due to the important role played by the plastic factories in emerging economies. The policy concerning banning plastic papers is clear on paper but it is lacking implementation (Steyn and Dlamini 2000). Reports of accumulation of plastic waste spread rapidly

in Alice community through Nkonkobe Municipality Health Inspectors due to the geographical location of the affected sites along Tyume River.

Assessment of plastic accumulation along rivers in Southern Africa has been relatively neglected for decades. "To gain an accurate and meaningful assessment of plastics and their influence, large-scale and long-term monitoring is needed across countries and environments and across a range of debris sizes" (Barnes, Galgani, Thompson, and Barlaz 2009: 1985). There are many sources of plastics accumulating along the river from direct dropping and dumping of litter on land or along rivers to blowing from landfill sites, losses in transport and accidents.

The issue of plastic debris along rivers is one that needs to be urgently addressed in Southern African countries. Plastic waste is dangerous to human beings, environment, wildlife, fisheries and domestic animals especially cattle. For example, many animals living in the rivers consume fishing nets especially made of plastic because they look similar to their natural prey. "Plastic debris poses considerable threat by choking and starving wildlife" (Barnes *et al.* 2009: 1985). Further, unscientific disposal of plastic wastes can lead to many environmental problems such as bulky debris which is difficult to pass and causes environmental pollution (Republic of South Africa 1996).

However, plastic waste kills many animals when they mistake plastic for food. "Many water-birds have been found dead, their stomach filled with medium sized plastic items such as bottle tops, lighters and balloons" (Barnes 2005: 916). So any animal eating these pieces of plastic debris will also be taking in highly toxic pollutants. It is against this background that the researchers considered the need for enforcing regulations, policies and procedures related to this discourse. Further, millions of birds and mammals are killed each year by ingestion of plastics or entanglement (ibid).

The researchers confirmed that regulations are not targeted specifically at plastic production and waste disposal. Policies and procedures focusing particularly at plastic waste are required, in synchronization with broader waste policy. "Over the past fifty years however, there has been a very steep rise in plastics production, especially in Asia and the European Union accounts for around 25% of the world's production; China alone accounts for 15%" (European Commission 2011: 12). Southern African countries are following a similar trend.

"Nevertheless, in 2008, total generation of post-consumer plastic waste in Norway and Switzerland was 24. 9 % and therefore, packaging is by far the largest contributor to plastic waste by 63 %" (European Commission 2011: 13). This problem can be addressed through recycling, disposal and incineration without energy recovery. Overall, the level of environmental impact associated with plastic waste is anticipated to increase over the period to 2015 due to continued growth in plastic waste production. Negative consequences in terms of littering and plastic pollution in river waters would also be anticipated to increase in the absence of any additional curbs.

Their inexpensive, lightweight and durable properties have made plastic much more single use and thrown away than previous synthetic artifacts. Most waste plastics, including large proportions used in single-use applications such as packaging, are disposed off in landfill sites. However, plastic persists in landfill sites and if not properly buried can later surface to become debris. Durability of plastic ensures that wherever it is, it does not go away; that is, placing plastics in landfill means storing a problem for the future. Plastics are released to the environment mainly through inappropriate waste management and improper human behavior such as littering. The researchers cement the debates on plastic waste along rivers in Southern Africa through giving a detailed description of the study area focusing on the case study of Alice Town in South Africa.

Description of the Study Area

Alice Town is under Nkonkobe Municipality in the Eastern Cape Province of South Africa. It is 60km from Bisho, the capital city of Eastern Cape. Further, it is 120km from East London. Alice town is surrounded by some rural areas and is roughly 2km from the University of Fort Hare. Tyume River, the main focus of this study is the only river flowing between Alice town and the University of Fort Hare. The majority of the Nkonkobe population (67%) uses their own refuse dumps owing to the rural nature of the area. About 13 % of the houses have no refuse disposal services and therefore dump their refuse anywhere they choose and this poses health hazards. Only 20% depend on the municipality's weekly refuse disposal services but these are mostly households in Alice, Fort Beaufort, Middledrift and Seymour. Solid waste sites are located in Middledrift with a permit. Alice has no permit, but a new site is under construction. There is a shortage of staff within the department and the municipality needs to budget for more posts and also implement by-laws in order to reduce unscientific plastic waste disposal along Tyume River.

RESEARCH METHODOLOGY

This section attempts to present and justify the appropriateness of the selected methodology for the study. Nevertheless, at the same time, it acknowledges strengths and limitations of the methodology. Research methodology deals with how research should be planned and executed (Mouton and Marais 1990: 15). Research methodology therefore means the planning of the actual structure and what direction the study takes in order to achieve its intended objectives. It is a perceived plan of action and how that plan of action is to be carried out.

Research Design

The methodology adopted for this article is a case study research design of Nkonkobe Municipality, Alice branch. The case study was the most suitable design structure of this article and was used as the operational framework for data gathering. A research design is a specific and concrete procedure that the researchers apply in data collection and interpretation. These are sets of rules or guides that enable the researchers to conceptualize and observe the problems under examination (Babbie and Mouton 2001). Apart from the review of relevant literature on

unscientific plastic waste disposal, the article analyses the concept of plastic debris from a Zero Waste theoretical public administration perspective.

Data Collection

The methods used in this article were interviews, observation and literature review to develop a theoretical framework. The researchers used face to face focus group interviews with respondents including students and staff members from the University of Fort as well as shop owners. The researchers also interviewed solid waste experts and the residents of Alice. Interviews are gathering activities which serve the purpose of finding out what is on the respondent's mind in relation to a given question. The task of the interviewer makes it possible to bring the respondent into a new world. The quality of the information obtained during the interview is largely dependent on the interviewer. According to Babbie and Mouton (2007), interviews are extremely sensitive devices for the acquisition of reliable and valid data because many people are more willing to communicate verbally or non-verbally react than write a response to a question. Data for interviews consists of direct quotations from respondents about their feelings, experiences, opinions and knowledge (Patton 1990: 12). However, observation reduces error due to translation and provides a richer dataset that includes non-verbal and physical behavior of the respondents. Through observation the researchers were able to observe directly the behaviours of the respondents rather than self reported behavior. Further the literature review in this article is underpinned on Zero Waste theory which is a summary and synthesis of content available on the incidence of plastic debris along the Tyume River in South Africa.

DATA PRESENTATION AND DISCUSSION

An Overview of the Problem

The objective of this study is to gather and analyze available data and information on plastic waste management and the related environmental health impacts. The study addresses the problem of plastic debris along Tyume River. It also aims to consider potential measures that can be taken at various levels to reduce plastic waste and its associated impacts. The study executed in Alice town disclosed that there is a serious problem of plastic waste along Tyume River. This has become a cause of concern to the residents of Alice and the University of Fort Hare community. The most affected areas include the Tyume River Bridge and the banks of this water body. The improper disposal of plastic waste at Alice dumpsite is amid the contributing driving forces behind the proliferation of plastic waste in Alice town. From the interviews carried out with environmental experts, University of Fort Hare community and the residents of Alice, researchers established that the problem of plastic waste along Tyume River has existed for decades.

Some of the respondents indicated that they have been in Alice for more than ten years and this water way has been characterized by the problem of plastic debris. This problem is affecting the health of livestock, people and also defacing the environment of Alice as participants in the clean-

up campaign along the Tyume River during the Mandela Day revealed that they observed some cattle feeding on plastics. They also mentioned that they saw some dead fish in the river that might have probably been entangled by plastic. These responses add value to useful existing knowledge available in the literature consulted during the process of executing this study. The discussion below outlined the impacts of plastic waste problem in Alice and some possible solutions to alleviate this predicament.

Nature of Participants and Plastic Quantities Collected

The observations made during the study revealed that plastic waste are available in Alice town. During the interview, respondents outlined that on 23 July 2011, forty five participants from the University of Fort Hare and Alice Communities contributed through picking up plastics along Tyume River. The participants covered a distance of 1 800m ranging from the edges of Hillcrest residential suburb stretching beyond the fence of the University of Fort Hare up to the edges of Ntselamansi residential suburb. They used gloves and black plastic bags to collect the waste from Tyume River. Each participant collected roughly 50kg of plastic waste which was loaded in a municipal truck for dumping at Alice dump site.

The interpretation of the above data could be that the respondents were very concerned about their safety and health as evidenced by the use of protective clothing during the process of cleaning up Tyume River. The large quantities of plastic waste collected portray that plastic debris is a serious problem along rivers in South Africa. This is a similar case with Alice. According to Afzal etal (2012) millions of plastic bags end up in the litter stream outside of landfills-estimates range from less than one to three percent of the bags. Billions of plastic bags end up litter each year (ibid). Plastic waste also imposes negative environmental externalities. It is regularly non-biodegradable and can remain as waste in the environment for an extremely long time (Republic of South Africa, 1998). It may pose risks to human health as well as the environment.

Further, disposed plastics can be difficult to reuse or recycle in practice. Therefore the giant masses of plastic waste discovered along Tyume River have the full environmental impacts which cause severe damage to river birds, mammals and fish. Surprisingly, very few members from Alice community participated during the clean-up campaign and yet they need to address the subject discussed in this article as a team. The contributing factors to this type of human behavior could be ignorance or lack of awareness concerning the harmful impacts of plastic waste in the environment. Overall, the level of environmental impact associated with plastic waste is anticipated to increase over the period to 2015 due to continued growth in plastic waste production (European Commission DG Environment, 2011).

Reasons Motivating Participants in Cleaning up Tyume River

The participants were highly motivated in picking up waste debris along Tyume River because it was important to execute some community work on a Mandela Day and they were also interested

in the concept of Green Clean Environment. During the focus group interview, respondents indicated that Alice town is part of the community and should become a habitable home for everyone. The researchers observed that every human being requires a clean habitable environment free from plastic waste pollution. This applies even to the culprits responsible for environmental pollution.

The community members are expected to maintain a health environment in Alice town and its surrounding areas. The community is also expected to actively participate in reducing plastic waste along the rivers because plastic debris contaminates water resulting in affecting living organisms in the water. Further, 75% of the respondents indicated that, they enjoyed participating during the cleaning up campaign since it affects the character of residents because the way they keep their environment is an outer expression of how their mind is organized. The participants had a passion of cleaning the river because they extended the set time frame with two hours. Moreover, the message: *"ADOPT THE RIVER"* which was on the T/shirts was didactic in nature because it promoted the spirit of ownership and responsibility. During the study it was observed that the plastics were disposed by the consumers after purchasing commodities from the retail shops around Alice.

However, most shops sell the plastics at cheaper prices ranging from thirty five cents to sixty cents only. Some retail shops like Pep and Jet Mart offer the plastic bags free of charge irrespective of the quantities purchased. The researchers also noted that till tellers especially those from Spar Supermarket and Just On Cosmetics always encourage the customers to buy plastic bags to carry the purchased products. From experience it is common that plastic waste is destined to the disposal legitimate dumpsites or they litter public spaces. This is the case in Alice town. The plastics are light in weight and this makes them airborne ready to be transported long distances by wind. The area around Alice dumpsites and the sides of the dust road heading to the University of Fort Hare from Alice town are in bad situation.

Further, this unpleasant environmental condition irritates the eyes of passers-by. The researchers observed piles plastic waste behind the saloons and beer hall near Tyume River Bridge. The mounds of plastic debris continue to grow time and again since the community and responsible Municipality authorities are not showing concern about removing them. In some cases the plastics are blown off by the wind and they end up hanging on the braches of the trees along Tyume River. Observations made in Alice revealed that there is a lot of illegal dumping in open public areas. The study reminded the municipality authorities as well as the community of their role and responsibilities towards appreciating a health environment free from plastic waste pollution. Nkonkobe Municipality officials were satisfied with the Tyume River cleaning up campaign and they also appreciated this initiative because chances are that if people are involved in picking up unpleasant waste they are likely not to dispose waste irresponsibly. They can also share the experience and sense of responsibility to others.

Ability to Capture the Attitudes and Interests of the Residents of Alice Town

The focus group respondents confirmed that they managed to capture the interests and attitudes of the residents of Alice during cleaning up Tyume River because some of the residents in Alice were passing positive comments about this initiative. This attitude was very encouraging but it needs commitment to alleviate the problem of plastic waste along Tyume River. Nkonkobe Municipality officials also stated that interests of the Alice community are being captured by a project called Alice Regeneration conducted every first Tuesday of each month by Nkonkobe Municipality and University of Fort Hare representatives. They always meet to discuss strategies of keeping Alice town clean and habitable. Alice has the potential to develop into a clean environment where academics, students and the business community would enjoy staying. The incidence of inappropriately disposed plastic debris in Alice town has the potential to cause an increase in the spread of waterborne diseases such as typhoid and malaria.

Further, improperly disposed plastic wastes accumulate stagnant water which promotes breeding space for disease carrying vectors like mosquitoes. According to Afzal etal (2012) some countries have taken action to reduce plastic bag litter because of specific consequences of accumulating bags such as flooding and malaria. The prevailing plastic debris in Alice town is a cause of concerning to those who give value to environmental health ethics. Alice town in the Eastern Cape Province of South Africa is 120 km from the sea. Areas near the oceans are characterized by windy weather conditions and Alice town is not exceptional. Therefore, Alice town is a windy area and plastic wastes are easily blown up, resulting in some hanging on the trees whilst others are scattered along the river banks and also floating on the water.

Programmes to Educate the Community on Waste Debris Management

This study explored the challenges concerning plastic waste management along Tyume River. As already been noted, the main expectation of Nkonkobe Municipality and its community is to improve their professionalism and attitude so that they can succeed in maintaining a health environment along this water way. The findings of the study concur with Mangizvo (2012) who reveals that the presence of plastic litter in Alice is a time bomb. The study established that there is need for the local responsible authorities to intervene and find solutions to this challenge. Thus, the researcher observed that, Nkonkobe Municipality has programmes meant to educate the community responsible for the generation and irresponsible disposal of plastics.

The community is being encouraged to have a friendly behavior towards waste management through the Risk and Vulnerability Assessment Centre project meant to reach out the community. Nkonkobe Municipality designed a plan for 2012 to train students as interns and its staff members to reach out the community on the importance of managing the environment through treating waste plastics in a friendly manner. Furthermore, the study noted that there is need for Nkonkobe Municipality to encourage the sponsored seminars and workshops to dig deeper on how we can engage the community to participate towards environmental good practices. The above mentioned

initiatives are very essential towards promoting a friendly health environment along rivers in South Africa. The article is premised on the Zero Waste theory and it addresses the environmental impact of unscientific disposal of plastic debris along Tyume River in Alice Town.

Reasons Why People Keep on Disposing Thin Plastic Waste Irresponsibly

The study observed that plastics are the common floating debris materials in the Tyume River. They are the most ubiquitous form of waste along this water way and its surrounding environment. They hang in trees and litter open spaces. The study observed that plastic debris is a threat to human, animals and aquatic life. The researchers noted that communities in South Africa have actually adopted the crescent plastic papers as the flame lily of the country. In South Africa thin plastic bags have been banned and the problem of plastics is quite serious. The South African government has instituted regulations that prohibit the use of thin plastic bags and encouraged the use of thicker, strong plastic bags which can be recycled. This is really surprising.

What is worrisome is that, after the adoption of the act, it appears nothing is really happening because there is no improvement in the generation and unscientific disposal of plastic waste. The residents of Alice keep on disposing plastic debris irresponsibly. The focus group respondents outlined that when approaching the bridge at Tyume River, the rate of waste increase because rubbish bins are inadequate. Further, the saloons and beer outlets near Tyume River produce uncontrollable plastic waste. The plastics are just disposed randomly due to the inadequacy of rubbish bins. The researchers observed that the shopping mall is expanding to meet the demands of the increasing population in Alice.

The interpretation of the above information could be that the Alice population is increasing and is not corresponding with the waste bins. Further the end users of plastic bags are careless about their disposal due to ignorance and attitude. The study confirmed that the law of abolishing thin plastic bags is not being observed because the business communities still give plastic bags freely and where customers buy the plastic is so cheap that consumers can continue buying the plastic. The Municipality Police need to enforce the law and make the culprits pay a fine for disposing plastic waste haphazardly.

Dangers or Impact of Plastics to the Environment From A Scientific Perspective

It was observed that plastic waste debris is a cause of numerous problems in the water way environment. Tyume River is drinking water point for livestock in Alice. The researchers noted some cattle consuming plastic bags. From a medical point of view plastics cause illnesses and fatalities when consumed by livestock. According to Afal etal (2012) the study showed that the impact of plastic waste production on environment is that the plastic debris produce 1.1 kg of atmospheric pollution and it contributes in acid rain plus smoke. Acid rain is recognized as a dangerous substance for natural gas and human made environment. The researchers were informed by the Nkonkobe Health Inspector that, the process of manufacturing plastic bags also produce 0.1g

water borne waste which has the capability of disrupting ecosystem. During the study the researchers observed that there is evidence of plastic waste being burnt near the shops closer to Tyume River. This is unhealthy to human, livestock and water life.

Additionally, smoke produced from burning plastic waste along the rivers is the significant problem concerned with human health. The findings of the study indicated several environmental impacts associated with plastic waste. Plastic debris pollutes the environment when it is not properly controlled. The main focus of this study is to identify the degree of plastic environmental pollution along Tyume River since plastic bags take much time to degrade in water. From a scientific point of view, plastics take decades to decay especially within a river (Republic of South Africa, 2001). Further, the cleaning of Tyume River is not done regularly and some removed plastics are taken back by the wind. They end up hanging on top of trees which proved to be difficult to reach as witnessed by the respondents during the cleaning up campaign. The focus group respondents indicated that they could not remove the plastics that were on top of trees since they did not have long sticks to hook the plastics off the trees. Tyume River flows into a local dam associated with Nkonkobe Municipality through drawing water for domestic use. Therefore it is quite significant to keep rivers clean especially those which provide water to the surrounding communities.

The Role of the State

The role of the state in development is at the forefront and has ignited debate on developmental states in Africa. “In South Africa, the developmental state concept is attracting attention mainly because of possibilities it offers for tackling challenges associated with transformation and service delivery” (Dassah 2011: 588). During the focus group interviews it was observed that there is no political will to solve the plastic waste problem due to poor service delivery system. The respondents argued that the government has to do something for them rather than what they can do for themselves. It is the role of the state to have monitoring and evaluation mechanisms of alleviating the problem of unscientific disposal of plastic waste in South Africa, particularly along Tyume River. The Department of Environmental Affairs and Tourism (DEAT), 2000 and 2001 tried to address the subject discussed in this article. On the other hand, it is noted that plastic litter has negative impact on tourism. However, the act of tourism itself generates a large amount of waste which also has a considerable impact on the rivers and oceans (Republic of South Africa, 2003).

Therefore, South Africa realized the impact of waste on the environment and a policy referred to as Integrated Pollution and Waste Management Policy (IPWM) of 2000 was established (DEAT 2000). The policy outlined goals to be achieved through the National Waste Management Strategy (NWMS) of 2001 (DEAT 2001) and focuses on different key elements of integrated waste management planning, waste information system, general waste collection, waste minimization, recycling, waste treatment and disposal, capacity building, education and awareness. The main

objective of the NWMS is to reduce waste generation and environmental impact of all forms of waste and to ensure that the health of the people and the quality of the environment are no longer affected by uncontrolled, uncoordinated waste management.

CONCLUSION AND RECOMMENDATIONS

In nutshell, it is the responsibility of Nkonkobe Municipality to ensure that plastic debris along Tyume River is removed to create clean and healthy environment for the inhabitants of Alice town. It is recommended that Nkonkobe Municipality should achieve Zero Waste declaration target of 50% plastic waste reduction along its surrounding environment by 2020. The study concluded that plastic waste is posing serious littering problem in the urban areas. There is a need to develop an integrated waste management plan for Alice Town with a priority on waste recycling to reduce the final amount of waste for disposal. The Nkonkobe Municipality should develop an environmental awareness on recycling supported by placement of the recycling containers at strategic points to collect recyclable waste. The programme of cooperatives for litter picking should be extended to include recycling.

Therefore plastic recycling helps in employment generation along with the reduction in the volume of transport and space requirement for dumping. The municipality should distribute black plastic bags as well as bins for collection and also ensure that the refuse is collected and transported to the dumpsite. Significant reduction in the plastic debris is possible when the residents of Alice are willing to change their habits. There is need to enlighten the populace on the wealth inherent in their plastic wastes. Plastic debris management policies and enforcement of sanitation laws in various South African cities should be energized, and various environmental organizations and societies should do more until the clean environment goal in South Africa becomes a reality.

It is recommended that all urban residents in South Africa contribute by avoiding plastics in the things they buy and through disposing waste responsibly. If properly managed at the end of its useful life, plastic waste may be recycled, burned in combustion facilities to generate energy or buried in landfill. In each of these alternatives the waste should be destroyed or contained, so that plastic is not released to the environment. The local authorities should create jobs through using social grant to pay unemployed members of the Alice community to collect plastics for recycling. Nevertheless, a key ingredient in addressing the issue of plastic debris is developing a sustainable approach by changing the awareness in environmental issues of the local population through publicized campaigns supported by Nkonkobe Municipality. It is also recommended that Nkonkobe Municipality should provide local officials with skills on how to become friendly to the environment.

Further plastic waste can be addressed through providing solid waste containers all over the place, procurement of a press machine to compact the collected waste and provision of training on sorting

plastic. There is also need for discussions concerning making professional ethics and general cleanliness mainstream in everything that we do and making contact with Alice community so that the residents can take pride in their environment and make it more pleasant, cleaner for habitation. Waste bins must exist in every corner so that if anyone has some litter in hands, they should be within a close area to dispose it responsibly into the rubbish containers. Apart from cleaning plastic waste along Tyume River, it is necessary to educate the community about environmental health. There is need for education and awareness materials for schools and posters on the main roads to and from the villages and residential areas of Alice town.

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