



## PROPOSED INTEGRATED SOLID WASTE RECYCLING MODEL IN NAMIBIA

**Tandiwe Mutede (Ph.D.)**

Geography, History and Environmental Studies/University of Namibia Alumni, Namibia.

Email: [tpmutede@gmail.com](mailto:tpmutede@gmail.com); Tel.: +264813992468

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**ABSTRACT:** *This article presents a proposed recycling model in Namibia as a way of enhancing solid waste recycling. Scrap metal, plastic, paper, glass, electronic waste, and aluminium cans are recycled materials in Namibia. Face to face interviews, document evidence and site observations were used to qualitatively establish an understanding of recycling practices in the country. Despite its potential, a national study on solid waste recycling as an emerging industry in Namibia conducted in 2019 concluded that recycling of solid waste in the country was low and limited to major cities of Windhoek, Swakopmund and Walvis Bay. Efforts such as Clear Bag System, Schools Recycling Competitions and Awareness Campaigns were ongoing at the time of study to promote more recycling. Recycling was found to be plagued with a number of challenges, thus struggling to achieve intended goals of raw material production as well as addressing waste management problems that the country faced. Behind this backdrop, a proposed Integrated Recycling Model for Namibia was developed which would assist, if implemented, with the resolution of some of the challenges that were identified.*

**KEYWORDS:** Economic growth, Environment, Model, Solid waste, Sustainable development, World conference on environment and sustainable development, Waste recycling.



## INTRODUCTION

Recycling is a process of giving recovered materials more value and is considered a source of raw materials as well as a waste management strategy. It is also an emerging industry in Namibia, still in its infancy (Mutede, 2019). A variety of materials are recovered for recycling aiming to produce much needed raw materials and to meet the growing demand of managing solid waste. According to Nakatani (2014), recycling is generally a multifunctional system that serves the dual purposes of producing secondary materials and managing waste. According to Sukholthaman (2012), recycling has well-established environmental, economic, and social benefits. However, research indicates that various factors, including behaviour, attitudes, perceptions, and awareness, have been found to influence recycling efforts by various stakeholders across the globe. Anderson et al. (2013) reveal that governments are promoting recycling through several initiatives. Low participation rates and, occasionally, unresponsive attitudes, however, impede growth. Tas and Belon (2014), Ezeah et al. (2013), Gutberlet (2010), Mamphitta (2009), Liebenberg (2007), and Otieno and Taiwo (2007) all mention a number of issues that contribute to low participation rates, including lack of knowledge, budgetary restrictions, lack of legal and policy framework and low levels of engagement. Senzige et al.'s (2012) investigation on Dar es Salaam's solid waste characterization revealed that 98% of the daily generated solid trash was not recycled. Courtois (2012) asserts that the recycling industry in Africa has yet to reach its full potential and highlights the important role that private industry development can play in enabling the continent to reap the benefits of waste recycling.

In her research, Kotze (2015) examined South African women's attitudes and beliefs about recycling and discovered that these individuals lacked the information and awareness necessary to adopt sustainable recycling methods. Banga (2011) carried out a study in Kampala, Uganda, which looked into household habits, attitudes, and awareness of solid waste recycling. The study discovered that while families were aware of the techniques for recycling solid waste, they were not completely involved in these activities since they were not aware of the recycling events happening in their neighbourhood.

A study by Nyathi and Togo (2020) on the overview of legal and policy framework approaches for plastic bag waste management in African countries found that stakeholders' resistance, a lack of effective substitutes, and inadequately enforced laws such as those pertaining to plastic bags are the main obstacles to effective plastic bag waste management in Africa. Recycling is an essential element of waste management (WM) and is ranked third out of the three R's: reduce, reuse, and recycle. According to Nakatani (2014), it is symbolised by three chasing arrows: collection and processing; manufacturing of new products; purchasing of recycled products as launched by Anderson in 1970. Studies have shown that despite its apparent advantages, a number of obstacles hinder its progress internationally, especially in developing nations with efforts being done to improve its efficiency. Namibia is not an exception to this, making it interesting and necessary to highlight challenges faced in the industry and how these can be tackled. Namibia is one of the sub-Saharan African countries, which is more specifically situated in the southern west part of the continent.



## LITERATURE REVIEW

The world is battling with the challenge of increased solid waste generation as well as increased cost of raw materials for manufacturing of commodities. Solid waste is any material that is discarded after use. Among other things, factors like population growth and rising economic development contribute to an increase in commodity consumption and waste generation. Arachchige et al. (2019) point out that rising waste levels in Sri Lanka are a matter for alarm because, if not adequately handled, they are linked to health and environmental problems. In the study conducted by Tsuchimoto and Kajikawa (2022), the bibliometric analysis showed that plastic waste is seriously causing land contamination and ecosystem damage, which calls for urgent action. On the other hand, research indicates that the rising demand for the few accessible resources has resulted in shortages and high costs as a result of the growing demand for raw materials (Hilpert & Milder, 2013; European Technology Platform on Sustainable Mineral Resources, ETP SMR, 2013).

To address these issues, recycling is now seen as a requirement rather than an option due to the need for sustainability of raw materials as well as management of waste. From a historical perspective, balancing environmental protection and economic growth was emphasised in order to promote sustainability following the 1992 Rio de Janeiro World Conference on Environment and Sustainable Development. This advancement has helped recycling become more widely recognised as a sensible strategy for advancing sustainability in the twenty-first century. Some models of the different facets of recycling have also assisted in better understanding the subject.

A model is a human construct to help us better understand real world systems. Models can be conceptual, theoretical, mathematical/statistical and physical. The review of literature revealed mathematical and conceptual/descriptive models developed and proposed for optimising recycling operations. Among the mathematical models are Haque's (2000) simplified model for complex waste recycling scenario for developing economies on plastic waste recycling in Dhaka, Erkan and Yılmaz's (2016) Housewives' Recycling Model (HRM) in Turkey to explain their recycling behaviour, and Sodhi and Reimer's (2001) models for Recycling Electronics End-of-Life Products.

Singh and Raj (2018) developed a conceptual model for addressing municipal solid waste challenges in Patna, the capital city of Bihar, through recycling. The study revealed very low rates of recycling and high volumes of municipal solid waste generation. Singh and Raj (2018) proposed a conceptual model to address low recycling through six specific focus areas: Role of government in promoting stakeholder participation, economic surplus income from savings in both resource and energy conservation, social aspects focusing on public health, health of workers involved and public awareness, manufacturing recycling technology that promotes ecological preservation, environmental protection and economically feasible, research and development focusing on technological advancement and trade system emphasising on trade of recyclables nationally. These studies have demonstrated the use of different models for explaining and addressing recycling issues in other parts of the world. In Namibia, such studies are lacking, therefore, this paper reports a study on a proposed integrated recycling conceptual model that can assist with the addressing of some of the challenges that were identified in solid waste recycling, if implemented.



## **PROBLEM STATEMENT**

From a historical standpoint, after the 1992 Rio de Janeiro World Conference on Environment and Sustainable Development, there was a significant push for the growth of the recycling industry. While recent decades have witnessed an increasing awareness among nations about the significance of recycling solid waste, recycling efforts in developing countries still remain low. Tas and Belon (2014), Ezeah et al. (2013), Gutberlet (2010), Mamphitta (2009), Liebenberg (2007), and Otieno and Taiwo (2007) state that recycling rates in Africa, for example, remain low and poorly organised compared to other developing nations, for a variety of reasons, Namibia included. A national study on recycling as an emerging industry (Mutede, 2019), established at the time of study that Namibia was also facing challenges in implementing sustainable solid waste recycling, thus recycling levels were found to be low. This paper will thus, highlight the challenges that were hindering recycling and propose a model to resolve the issues that were identified.

## **RESEARCH OBJECTIVES**

The overall objective of this study was to improve solid waste recycling in Namibia.

## **SPECIFIC OBJECTIVES**

Therefore, the specific objectives of the study were:

1. To highlight recycling challenges faced in Namibia; and
2. To propose a model to assist in addressing the challenges.

## **METHODOLOGY**

An explorative qualitative study facilitated understanding of recycling practices in Namibia. As a starting point to this proposed model for recycling solid waste, it was necessary to first gather information on how the industry was operating in Namibia. This included finding out what kind of recyclables were being recovered for recycling, motives behind recycling, challenges that were being faced and efforts that were being done to address challenges encountered. The information gathering was critical to enable the crafting of a model that would assist Namibia in overcoming the challenges that were hindering progress in recycling. Thus the researcher conducted a survey through face to face semi- structured interview questions, document search and observations among 15 companies that were willing to participate.

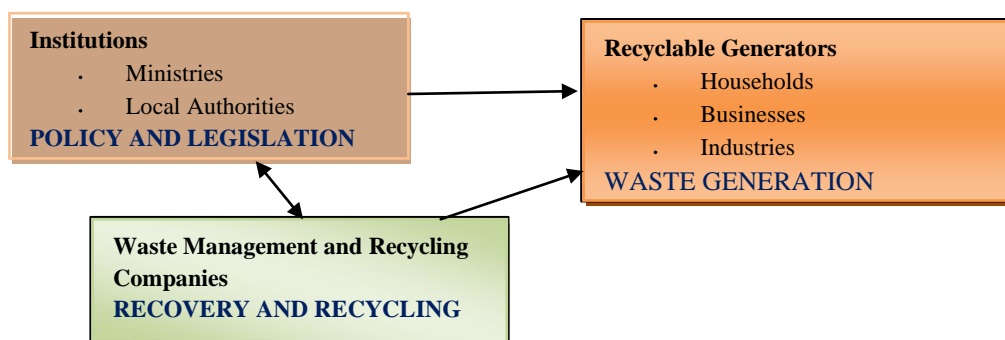
Interviews were conducted with directors, managers, and supervisors from each of the fifteen companies. These interviews served the dual purposes of providing information regarding recycling operations and identifying any obstacles that may have existed. In contrast to other places, document search was crucial to the establishment of industrial operations in the country, Verification of information provided during interviews also required site observations.

Content analysis of the data that was gathered allowed the development of the model to resolve some of the recycling industry challenges faced in Namibia. The section on findings gives more detail about some of the data collected from the companies mainly on challenges that were faced.

## FINDINGS

During the study, a number of issues were raised pertaining to the recycling industry. It was revealed that the sector had a number of challenges, which respondents said would need to be resolved before the sector could reach its full potential. Some of the highlighted challenges are shown in table 1.

In the light of all the challenges discovered and found unsustainable for the recycling industry's success, a proposed model was developed. The operating system was plagued by a number of problems, as was previously described, and the model sought to reorganise it. In order to operationalize the model, three main stakeholder groups, highlighted in figure 1, acknowledged as the primary drivers for the industry's success were recycling companies, waste generators such as homes, businesses, industries, and mines, and the recycling and waste management sector, which included ministries and local authorities.



**Figure 1: Key stakeholder Groups**

Source: Mutede, 2019

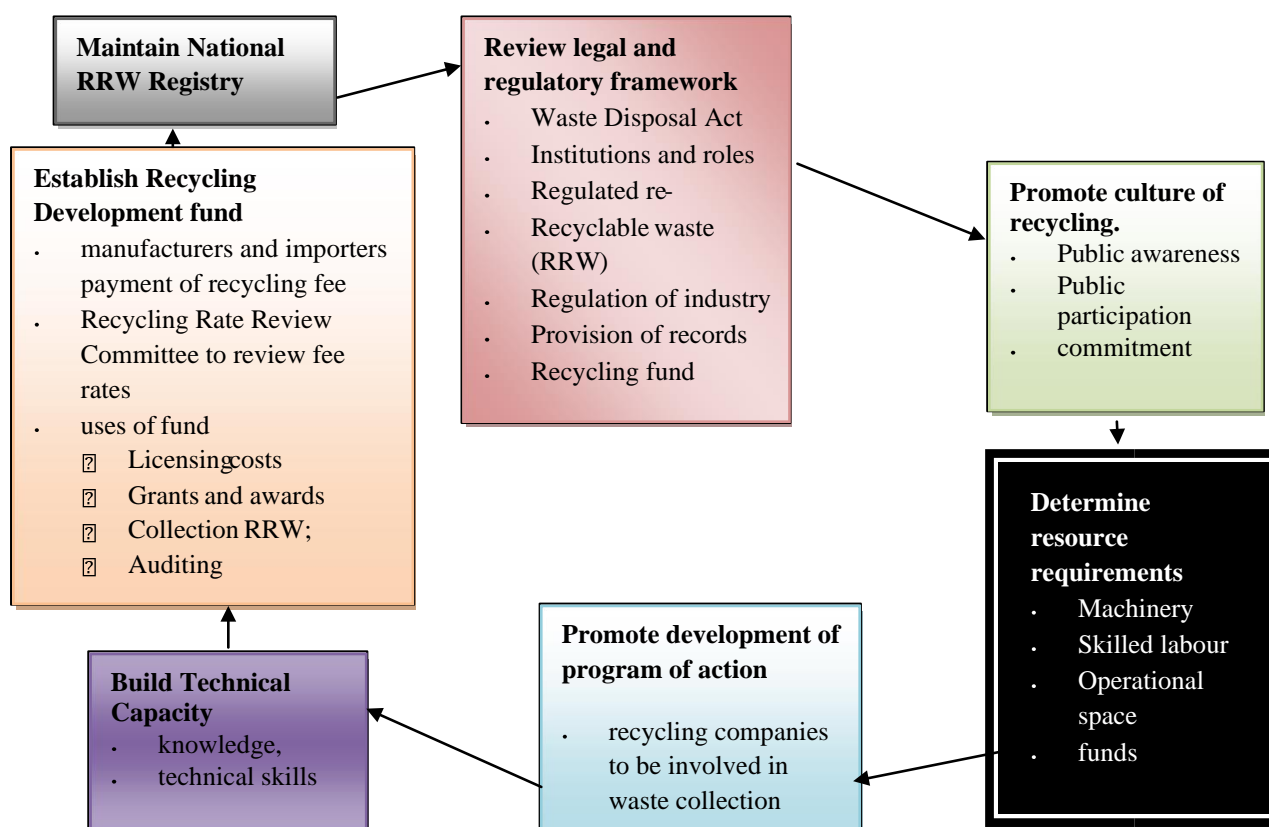
**Table 1: Challenges in Recycling Industry in Namibia**

Challenge	Number of Respondents
<b>Transport and Logistics</b> Availability of transport was a problem to some companies and where it was available the transport costs were high	3
<b>Labour issues</b> Lack of trained staff (skills shortage) was noted for processing and manufacturing companies, And of those skills readily available there was lack of commitment and high turnover of skilled staff	5 4
<b>Financial Constraints</b> The industry was considered capital intensive for start up companies and its viability was very marginal	4
<b>Weather Condition</b> Harsh weather conditions especially coastal environment affected equipments and storage of materials	2
<b>Space</b> Shortage of storage and operational space affected normal operations	5
<b>Low Volumes</b> Low volumes affected viability of establishment of recycling plants for scrap metal, glass and paper etc	4
<b>Machinery</b> Lack of operating machinery and equipment hampered loading and off loading, cutting, shredding, compaction of raw materials Vandalism and theft of equipment affected operations	2 1
<b>Public Participation</b> Poor public participation, lack of cooperation from the public and lack of awareness on recycling practices e.g. waste separation and drop off handicapped recovery and collection of recyclables	10
<b>Enabling Environment</b> Lack of clear policies and legislation on recycling affected full participation by all stakeholders. Lack of enough government support affected full operations of companies	4 2
<b>Market forces</b> Fluctuations in market prices of materials e.g. scrap metals, paper affected companies stability of income	2
<b>Monopoly by big companies</b> Some big companies dominated the industry through exclusive recovery and collection contracts hence disadvantaging small companies	2

Source: Mutede, 2019

## The Model

The recycling model comprises 7 components, namely: review of legal and regulatory framework, promotion of recycling, resource requirement, development of programmes of actions, building technical capacity, establishment of a recycling fund and development and maintenance of a national recycling registry. Figure 2 shows the framework of the proposed recycling model and areas of focus for the recycling industry in Namibia.



**Figure 2: Proposed Integrated Recycling Model for Namibia**

Source: Mutede (2019)

The components are discussed one-by-one below.

### Strengthening Legal and Regulatory Framework

The study found that there was a weak legal and regulatory framework in place to manage recycling. Precisely, there was no recycling law. Local governments were unable to confront significant obstacles in waste management and recycling enforcement due to the absence of national policy and regulation regarding recycling, sentiments that were expressed by some of the company officials interviewed. For instance, one had this to say “*No one can take me to court for not recycling because the legislation is not there in Namibia,*” underlying the fundamental reason why recycling was not taking centre stage.



## Promote Culture of Recycling

The study found that the culture of recycling was lacking. This was particularly noticed at the home level, non-source separation led to material contamination, rendering some resource materials worthless. For example, combining recycling organic and inorganic materials in one receptacle made it more challenging to recycle recyclables. Contaminated recyclables were simply disposed of at landfills and dumpsites. Some companies and local authorities lamented the lack of recycling culture among some businesses as well, as not all businesses considered recycling. Efforts to raise awareness of the need for greater action in recycling were underway, but they were not making much headway. Education was encouraged to be a continuous process rather than a one-time event which had to be in many forms, such as drama, posters, speeches given to the public at meetings, religious events, and school assemblies were also viewed as important in carrying messages about solid waste recycling and waste management.

## Resource Requirements

Any recycling programme's capacity to succeed depends in part on the availability of sufficient resources such as labour, land, infrastructure, and transportation. Labour was an issue of concern within the industry due to lack of skilled manpower, high turn-over and absenteeism. Interviewing one of the collection company officials, *this is the situation: they disappear after being paid at month end, they don't want to work, they are lazy and this is unsustainable*, sentiments that were expressed during the interview. Other businesses, particularly those in the manufacturing industry, struggled to carry out all of their tasks effectively in the absence of knowledgeable and experienced staff. One company had to employ foreign workers to fill the skilled gap. Companies bemoaned their operations were being hindered partly due to limited physical space. The study noted that allocation of affordable land for recycling purposes could assist the recycling sector in reducing their operating expenses as recycling often yielded only a minimal return.

Collating materials into larger quantities requires loading machinery in order to build up enough inventories to allow for sales to end users. This process also required intermediate processing to prepare secondary materials to minimise transportation costs and satisfy end user delivery requirements. In many areas, their lack led to a large amount of items being left uncollected or discarded. For example, scrap metal and other materials were too heavy to load and unload, making them impractical to transport from various parts of the country.

Transport is essential for the efficient working of industries. The results of the study demonstrated that transport shortage had an impact on the industry, resulting in a large amount of some recyclables being left uncollected. Transporting recyclables across long distances made it challenging for all items to get to Windhoek and beyond. Transportation issues disturbed product exports, which was one of the reasons some small-to medium-sized businesses failed. Government could subsidise this by creating a recycling fund.

## Promote Programme of Action

To promote the industry of recycling in Namibia, the idea of Public Private Partnership (PPP) should be strengthened. Depending on capacity, all private companies might be involved in every facet of waste management, which would boost recycling. This study established that recycling is not a feasible solution on its own.





## Recycling Fund

The recycling sector requires a lot of cash. Due to a lack of funding, some recycling businesses in Namibia were having difficulty operating, and in certain instances, small and medium-sized enterprises (SMEs) who were interested in entering the industry failed to do so due to financial constraints. One of the components of the model is the idea of establishing a Recycling Fund, learning from what other countries practise. In Taiwan, for instance, the Recycling Fund provides assistance to the recycling sector. Manufacturers and importers of new Regulated Recyclable Waste (RRW) items must pay fees to the Environmental Protection Administration (EPAT) under the 4-in-1 Recycling Program. The amount of fee depends on the quantity of goods the importer or producer places on the recycling market.

Lack of knowledge about the existence of possible funding programmes in the country, concerns were expressed by some authorities and the difficulty of obtaining financial support from such sources. Suggestions were that the government simplify the process by which entrepreneurs in the industry might obtain financial support through a Fund easily accessible by many.

## Records Management

At the time of study, Namibia did not have national statistics or a centralised data centre on recycling, and the information that was available was very limited and fragmented. Since most companies did not keep records of their recycling efforts, the research suggested that a Recycling Agency of Namibia be established in order to collect and oversee recycling data collection and reporting. If data on waste created, recovered materials, and processed waste could be made available at the national level, the nation could benefit from proper planning of the sector.

## DISCUSSION

The aim of the study was to identify challenges the industry was facing which contributed to low levels of recycling. Solid waste recycling activities were more concentrated in urban environments and the main recyclable materials were plastic, paper, glass, scrap metals and electronic waste. Despite efforts to promote the industry of recycling, results indicated that the recycling industry in Namibia was faced with a number of challenges as highlighted in table 1. Low levels of participation in recycling was mainly reported in smaller urban environments whilst in major urban centres such as Windhoek the capital city of the country, this was mainly witnessed in low income suburbs. Poverty was blamed for some of the causes, since several of the respondents said that getting food was more important to them than recycling.

On the other hand, as reported by one company manager of one of the major towns, some elders countered that since they paid taxes to the municipality, recycling was not their responsibility. Since the research was looking for challenges, the challenges found were acceptable bearing in mind that other studies carried in the country (Croset, 2014; Hasheela, 2009; Jacobsen et al., 2014; Lindell, 2012), whose focus was on solid waste management issues also highlighted some of these challenges contributing to lack of interest in recycling.



The legal and regulatory framework was lacking thus compromising the success of the industry. Therefore, Namibia needed to craft recycling laws in line with what other countries have done such as Taiwan as studies reveal. Lack of legal and regulatory framework as the study found out is not peculiar to Namibia alone. Most African countries are battling with this as well. In Africa, issues of legal and policy frameworks regarding waste management and solid waste recycling are still a challenge as they are lacking or sometimes poorly enforced. For instance, a study by Nyathi and Togo (2020) entitled “Overview of Legal and Policy Framework Approaches for Plastic Bag Waste Management in African Countries” found that poorly enforced plastic bag legislation was among some other factors hindering effective plastic bag waste management in Africa. Thus, the study recommended a need for constant enforcement and public education.

Transport was another key hindrance to recycling. High transport costs were reported making it difficult to transport recyclables to intended destinations, thus leaving recyclables lying around especially in remote or smaller towns. These findings were in agreement with those from similar studies conducted elsewhere. For example, Tas and Belon (2014), Ezeah et al. (2013), Gutberlet (2010), Mamphitta (2009), Liebenberg (2007), and Otieno and Taiwo found that the full potential of recycling in Africa has not yet been realised due to factors such as poor transport.

In light of all the challenges identified and found unsustainable for the success of the recycling industry, the next objective was to develop a model to assist in addressing the challenges faced. The study identified 7 key components to address the challenges as highlighted in figure 3.

Though different to this model, some common principles were found in a proposed conceptual model that was developed by Singh and Raj (2018). For Patna, the capital city of Bihar, in trying to find ways of promoting recycling. For instance, in the two models, the government has an important role to play, especially in promoting stakeholder participation through enactment of appropriate policies and legislation and use of appropriate technology. The proposed model took into consideration the existing operational difficulties of solid waste recycling in Namibia.

## CONCLUSION

Recycling activities are ongoing in the country due to environmental, economic and social reasons. However, the industry was faced with a number of challenges as highlighted earlier on. In light of the numerous issues plaguing the sector, this study determined that the suggested Waste Recycling Model was pertinent as a solution for solid waste recycling in Namibia. The proposed model considered the operational challenges Namibia faced with solid waste recycling and placed special emphasis on reviewing the legal and regulatory framework, promoting recycling, ensuring that production resources are available, developing action plans, developing technical capacity, creating a fund specifically for recycling, and creating and maintaining a national recycling registry. To operationalize the strategy, all stakeholders, government organisations, waste generators and recyclers had to work together. The actors and the model together would most probably make up Namibia's solid waste recycling success story.



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