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15VALUE ADDITION OF RECYCLABLE SOLID WASTE MATERIALS: THE CASE OF NAMIBIA

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ABSTRACT: *Solid waste recycling is an important component of sustainable economic development. Research indicates that the growing need for raw materials and the difficulties associated with managing solid waste have led to the development of recycling as a rational strategy for advancing sustainability in the twenty-first century. While value-addition processes are highlighted in various research on solid waste management carried out in Namibia and other parts of southern Africa the focus has been on single waste streams, actors industry, waste reduction options or recommendations on recycling processing systems. This paper aims to highlight value chains of a variety of recyclable materials in the Namibian recycling industry an endeavour which may assist policymakers in understanding how the industry can contribute to sustainable industrial growth and employment creation. The study was a descriptive case study design, which was qualitative. Results indicate that in Namibia recycling industry processes a wide range of recyclable products such as plastic, paper and glass bottles. Except for plastic, the value addition of recovered materials was limited to the pre-processing stage. The full growth of the industry is still to be realised. Policy and intervention programs should promote more value addition in raw materials in the country as a whole considering the benefits to sustainable economic growth.*

KEYWORDS: Economic Development, Recyclable Materials, Recycling, Solid Waste Management, Value Addition Chains

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INTRODUCTION

Namibia is one of the driest countries in Sub-Saharan Africa, more specifically the southern west part. Namibia borders South Africa to the east and south, Botswana to the east, Angola and Zambia to the north, and the Atlantic Ocean to the west. The country has a population of over 2.6 million and spans 824,292 square kilometres of territory. The high unemployment rate in the nation, which Croset (2014) reports as 27.4% of the population, with a young unemployment rate of almost 40%, is one reason for concern according to (Mulama & Nambinga, 2016). Industrialization is viewed as the solution to solving the unemployment problem.

To promote industrialisation, the government is encouraging and promoting value addition to be part and parcel of economic growth. Tourism, Animal husbandry, Fishing and Mining (diamonds, uranium, gold, silver, and base metals) are the four pillars of Namibia's economy. Among these economic activities is an emerging solid waste recycling industry, which is an addition to the diversity of the Namibian economy. According to Hickman *et al.* (2009), recycling entails adding value to recovered materials. In Namibia, studies on value addition as an element of recycling are still limited or nonexistent making it an interesting and necessary topic to examine. The purpose of the study was to highlight value-addition processes in the recycling of solid waste materials such as plastic, metals and glass.

LITERATURE SURVEY

Recycling entails adding value to recovered materials. Value addition is a concept that gained significant traction in the 1990s and is now one of today's buzzwords commonly used in discussions (Coltrain et al. (2000). Michael Porter first proposed the value chain idea in 1985 (Hickman, 2009). Generally speaking, adding value is the act of transforming a product from its initial condition into a more desirable state that is sought after by customers. Scientifically, Kaplinsky defines the term value chain as the full range of activities which are required to bring a product or service from conception, through different phases of production, marketing, delivery to customers, and finally disposal after use (i Isoaho, 2019; Hoffman & Schenck, 2020) which is in agreement with Hickman (2009).

The development of value-added products offers a great opportunity for stimulating economic growth. Value-added products are becoming more and more popular internationally as the world economy continues to expand. However, launching a value-adding company comes with a lot of risk, particularly in the beginning (Coltrain *et al.*, 2000).

The concept of value-addition cuts across different industries and is critical for economic growth. According to Harry and Kalagbor (2019) achieving economic diversification via industrialization necessitates significant levels of value-addition. On the other hand, Chokera *et al.*, (2022) point out that policymakers are turning to value addition as a launching pad for economic growth in response to the growing need to revitalize the industrial sectors, particularly in emerging nations.

The subject of value addition in general has been researched in different economic sectors such as manufacturing, mining and agriculture in different parts of the world. Such researches

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include Harry *et al.*, 2019; Coltrain *et al.*, 2000, Mwanza *et al.*, 2019, Chokera *et al.*, 2022, Chandrana *et al.*, 2017, and others.

In general economic growth in the rural sector particularly in developing countries lags in terms of employment opportunities. According to Coltrain et al. (2000), adding value to agricultural goods is essential for rural development by enhancing farm income and providing employment in processing businesses. In a research titled *Natural Resource, Value added and Economic Growth: Empirical Analysis from Selected African Countries*, (Fakoya, 2014), tried to establish the cause of unemployment, inequality, and poverty in selected African countries such as South Africa, Algeria, Botswana, Namibia, Nigeria, and Zimbabwe and concluded that one path out of poverty is through value addition—a notion that is still relatively new in the majority of African nations. Lakshmi, & Aparna, (2022) in the article *Scope for value addition of agriculture products for enterprise promotion in rural areas* highlighted the significance of value addition to agricultural products. They contend that merely producing agricultural items has a much less economic impact than providing value to agricultural products beyond the farm gate. The importance of value addition was also emphasised by Melembe *et al.* (2021) in a study investigating factors influencing value addition agricultural choices of smallholder farming agribusinesses in the Gauteng Province, South Africa. The study revealed that there is a need for government intervention in promoting agro-processing and value-addition activities to enhance farmers' livelihoods and poverty alleviation.

In a study by Chokera *et al.* (2022) entitled *Value addition as a determinant of enterprise growth among SMEs in the leather sector in Zimbabwe* results revealed technology use, inbound logistics, marketing, and sales had a statistically significant positive association to company development. Chandran *et al.* (2017) in the study *Value-Added Performance in Malaysian Manufacturing: To What Extent Research and Development and Human Capital Matter?* One of the findings showed that labour, both skilled and unskilled, contributes considerably to raising value-added in manufacturing subsectors for both domestic and international businesses, with unskilled labour having a greater impact on domestic businesses than on foreign ones.

Mokhtar *et al.* (2022*)* in a study on *Converting wood-related waste materials into other value-added products:* reviews converting wood-related waste materials from agriculture activities, wood-based industry and forestry into other value-added products such as construction materials, bio-energy, handicraft applications, agricultural compost, instead of letting them decay in the forests or at the factory yards sites. The results showed that such waste materials could generate income and create job opportunities for the local community.

In the study by UNIDO (2021) on the *Plastic Value Chain in Egypt*, one observation was that different players across the plastic value chain lack the skilled labour for waste collection, segregation and processing activities among other challenges.

Mwanza's *et al.* (2019) study on *Value Addition to Plastic Solid Wastes: Informal Waste Collectors* revealed that sorting, cleaning, classifying, and washing are just a few of the value-adding processes involved in plastic recycling. In addition, along the supply chain, buyers are viewed as a component of value addition. The value chain and activities of polyethene terephthalate plastics in the South African waste economy by Hoffman and Schenck (2020), the study found that collection, sorting, cleaning and production of pellets

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are some of the value addition activities involved. Buy-back centres' competitive advantage is that they have the facilities to add value to the recyclables according to the recycling industry's standards and specifications (Viljoen *et al.* (2012). To be viable, they need to attract large and sustainable volumes of recyclables, which often poses a challenge.

The subject of value addition in general has attracted researchers for some time in Africa.

In Africa recycling value addition processes were observed to be limited mainly to collection. Thus value addition to recycled products is generally very low. For example, in Mozambique, most of the material products are semi-processed and exported to South Africa and Asia, as reported by Tas & Belon (2014). The same findings were revealed in an earlier study by Fadlalla (2010) on the management of PET plastic waste through recycling in Khartoum, Sudan.

However, in South Africa a study by Hoffman & Schenck, (2020) entitled *The Value Chain and Activities of Polyethylene Terephthalate Plastics in the South African Waste Economy* found that plastic underwent different value addition activities and subsequent production of plastic goods similar to developed countries. UNDP (2015) found that waste value chains for plastics as well as other recyclable materials like paper, cardboard, and metals were well-established in Jordan in a study titled *Mitigating the Impact of the Syrian Refugee Crisis on Jordanian Vulnerable Host Communities: Solid Waste Value Chain Analysis Irbid and Mafraq Jordan.*

In a study, *A Recommended Recycling Processing System for the Informal Waste Collectors of Oshakati, Namibia* (Chretien *et al.*, 2017), a recycling processing system to add value to their collected materials as a way of increasing their earnings from their current state was recommended. Bearing in mind the benefit of recycling to economic growth and employment creation, in Namibia, studies on value addition as an element of recycling are still limited or nonexistent making it an interesting and necessary topic to examine on the different solid waste streams recovered.

Problem statement

Solid waste recycling in Namibia is an emerging industry still in its infancy (Mutede, 2019) but not everyone understands what is going on regarding the operations of the industry. One of the important aspects of this industry is the value addition of recovered materials. Not everyone knows how industry players add value to recovered materials before trading or use in manufacturing as raw materials. An understanding of the value addition component is paramount for planners and policymakers in understanding how the industry contributes to the economic development of the country. While studies done in Namibia (Croset, 2014; Hasheela, 2009; Jacobsen *et al.*, 2014; Lindell, 2012; Magen, 2010; Westphal & Pfeffer, 2013) have revealed some activities of waste recyclers, lack of a comprehensive study on value addition of the variety of recyclables motivated the research and the writing of this paper. Therefore, this paper aims to highlight value-addition processes for recycled solid waste in Namibia.

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Objectives

The main objective of the study was to identify the players in the industry, recoverable recyclable materials streams and the stages in value addition processes of solid waste.

Therefore, the specific objectives of the study were:

1. To identify recycling companies and their demography
2. To establish types of materials recovered for recycling
3. To outline the value-addition processes for the waste streams in Namibia.
4. To highlight the main items produced in the recycling chain in Namibia

RESEARCH METHODOLOGY

The study was conducted among solid waste recycling companies in the whole of Namibia. The plan was to interview all identified companies. However, some of the companies were no longer in existence and others were unwilling to participate in the study. As a result accidental sampling a procedure that includes choosing study participants who are competent and willing to participate was used. Fifteen (15) companies were ultimately interviewed (Hoyle *et al.*, 2002).

Data was obtained using two collection methods namely: primary and secondary sources. This was done to ensure that sufficient information about the value addition of recyclable materials was obtained and the reliability of the data optimised. Primary sources included personal semi-structured interviews and field observations, while secondary data was obtained through the internet and readily available hard copy sources such as books and company brochures. Key personnel from the fifteen companies including directors, managers, and supervisors, were interviewed. The purpose of these interviews was to learn about their interpretation of value addition as well as the procedures they used to add value to the materials they recovered and the finished goods they created. After the interviews, observations of the real value addition activities were undertaken together with the companies' officials facilitating dialogue on various processes. Discussed issues were verified using checklists.

Finally, the use of document search was to have a comprehension of what value addition is all about. Content analysis was used to gain more insight into companies' operations in terms of value addition. The section on findings gives more detail about some of the data collected from the companies and various value-addition processes of different materials recovered for recycling.

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FINDINGS

The study findings are presented here starting with the demographic data, recoverable recyclable material, and value addition processes and products sold back to the market.

1) Demographic information of companies

Table 1 shows the demographic information of companies that were identified and studied in the research including their location and positions of people interviewed.

Table 1: Demography of companies

Source: *Research Data*

Company	Gender of participant	Location of Company	Title of Participant	Age of company in business (years)	Years of experience with recycling	Number of Workers
A	Male	Windhoek, Walvis Bay, Oshakati, Swakopmund &Husab mine	Business Developer	27	5	+_500 total 35 Swakopmund 34 Walvis Bay
B	Male	Windhoek	Public Relations Manager	34	10	400
C	Male	Okahandja	Director(owner)	48	20	74
D	Male	Okahandja	Production Manager	10		35
E.	Male	Windhoek, Swakopmund, Walvis Bay, Rundu, Ondangwa, Oshakati, Angola, South Africa	Plant Manager	35	35	150
F	Female	Windhoek	Supervisor	8	8	56
G	Female	Windhoek	Country Representative	22	22	Not given
H	Male	Oshikango	Supervisor	20	20	53
I	Male	Windhoek	Contract manager	15		Not given
J	Female	Windhoek	Director(owne	8	8	10

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			r)			
K.	Male	Windhoek	Logistic Manager	4	4	3
L	Female	Windhoek	Corporate Relations Manager	95	5	Not given
M	Female	Windhoek	Coordinator	10	10	Not given
N	Male	Keetmanshoop	Director (Owner)	22	22	17
O	Male	Windhoek	Solid Waste Management Education & Marketing Officer	19	5	322

Recovered Recyclables

Companies collected a wide range of recyclable products, as obtained from interviews conducted with company officials and observations done afterwards. Table 2 shows the range of these materials.

Table 2: Recovered Recyclable Solid Waste Materials

Material	**Category**	**Types of recyclable products**
Plastic	Soft	Carrier bags, sheeting, wrapping packaging,
	Hard	Wheelie bins, refuse bags, juice and water bottles, storage containers, UPVC pipes, chairs, tables, cutlery, crate boxes, detergents containers, tyres
Paper	Office	Bond paper, writing, newspapers, magazines, envelops
	Packaging	carton boxes, envelops and wrapping paper
Glass/ Bottles	Containers	Milk, soft drinks and juice
	Beverage	Beer, soft drinks, wine
Scrapmetals	Cans	Steel and aluminium (soft drinks, beverage, fruit)
	Ferrous	Steel, iron
	Non-ferrous	Aluminium, copper, brass, silver, lead, nickel, tin, zinc, gold, silver, platinum

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E-waste	Industrial	Desktop computers, mouse, and computer screens, mp3 players, irons, microphones, laptops, calculators, printers, copy machines, keyboards, fax machines, cod players, video machines, speakers, remote controls, cameras, kettles, toasters, vacuum cleaners, answering machines, DVD players, electronic toys, servers, modems swiping machines mobile phones, batteries, circuit boards, hard disks, and monitors and sporting equipment, and any other electrical
	Household	Televisions, electric kettles, hair brushes, microwaves, irons, food processors, toasters: home appliances such as, air conditioners, electric cookers and heaters, fans, DVDs, radios

Source: *Research Data*

Value Addition process and products

The value-addition processes identified during the study covered the materials highlighted in Table 2: plastic, paper, glass bottles, scrap metals and electronic waste.

i) Plastic

During the time of the study, plastic value addition processes involved recovery which comprised (collection, sorting, washing, crushing, shredding, chipping baling and transportation), followed by processing comprising of (washing, drying, heating, moulding, pelleting), manufacturing of products and finally packaging of products for sell.

Seven companies were involved in the recovery activities of plastic. Four stages were identified within the plastic value addition process: recovering, processing, manufacturing and selling as highlighted above. Dirty plastics were cleaned after sorting e.g. plastic from the fishing industry and from mines to get rid of smell and corrosive materials at times. All this added to the high costs of plastic recycling. Soft and hard plastic were recovered informally and formally from different sources such as streets, landfills, shopping centres and homes. Soft plastic was mainly sheeting, wrapping packaging, and carrier bags and hard plastic was, storage containers, refuse bags, and wheelie bins as shown in Table 2. Upon collection, plastic products were sorted according to type, texture and colour. For example, (Polyethylene terephthalate) PET plastic was sorted into green, brown transparent and white recyclables followed by crushing to reduce bulkiness. This was manually and mechanically done.

Processing was the second value-addition activity. Only one company was involved in the production of pellets as raw materials. Products such as wheelie bins, and beverage crates were cut and chipped into small pieces to be melted down. Dirty plastics such as wheelie-bins had to be washed first to remove contaminants. All plastics after chipping were cleaned with an alkaline detergent to get rid of glue, paper labels, dirt, and any traces of the substance they had formerly held. This was done in a spinning tower after which, the plastics were rinsed and dried ready for the pellet formation procedure. The pellets forming process was considered the most important part of processing. The plastic material was melted in a tubular metal chamber using the moulding extrusion method. The melted paste was then forced out of the paste tube through a hole resembling a mince grinder, much like toothpaste. The material extruded like spaghetti. The spaghetti threads were immediately submerged in cold water to harden and prevent tangling before being sliced into extremely tiny oval-shaped

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pellets using a spinning cutter. The different plastics such as PET and HDPE were produced similarly.

Three companies were involved with the manufacturing of plastic products like pipes and plastic packaging which was sold to wholesalers. Two companies were manufacturing plastic pipes: irrigation, sewage and waste water pipes using some of the raw materials obtained from the only company which produced pellets. It was revealed that virgin pellets produced more durable pipes compared to secondary or recycled pellets. The other company produced a variety of plastic packaging products such as carrier bags, meat packaging plastics, agricultural bags, refuse bags as well as liquid containers, chairs, and household utensils etc. The researcher established that some carrier bags, disposal bags as well and wrapping plastics sold by some retail shops in the country were produced locally from both recycled and virgin material. Products were made following client requirements. In one firm, throw-over blankets, duvets, and pillows were made from some cracked, translucent plastic.

The final stage in plastic value addition was marketing and selling. When new items were produced, they were first examined for flaws before being packaged and stored in warehouses, and then they were sent to various clients both inside and outside the country to Angola, Botswana, Zimbabwe, and Zambia. Defective items were disposed of as waste to be recycled again Government and international standards of quality were a crucial component of quality control requirements.

Figure 1 shows a summarised version of the value addition chain for plastics in Namibia.

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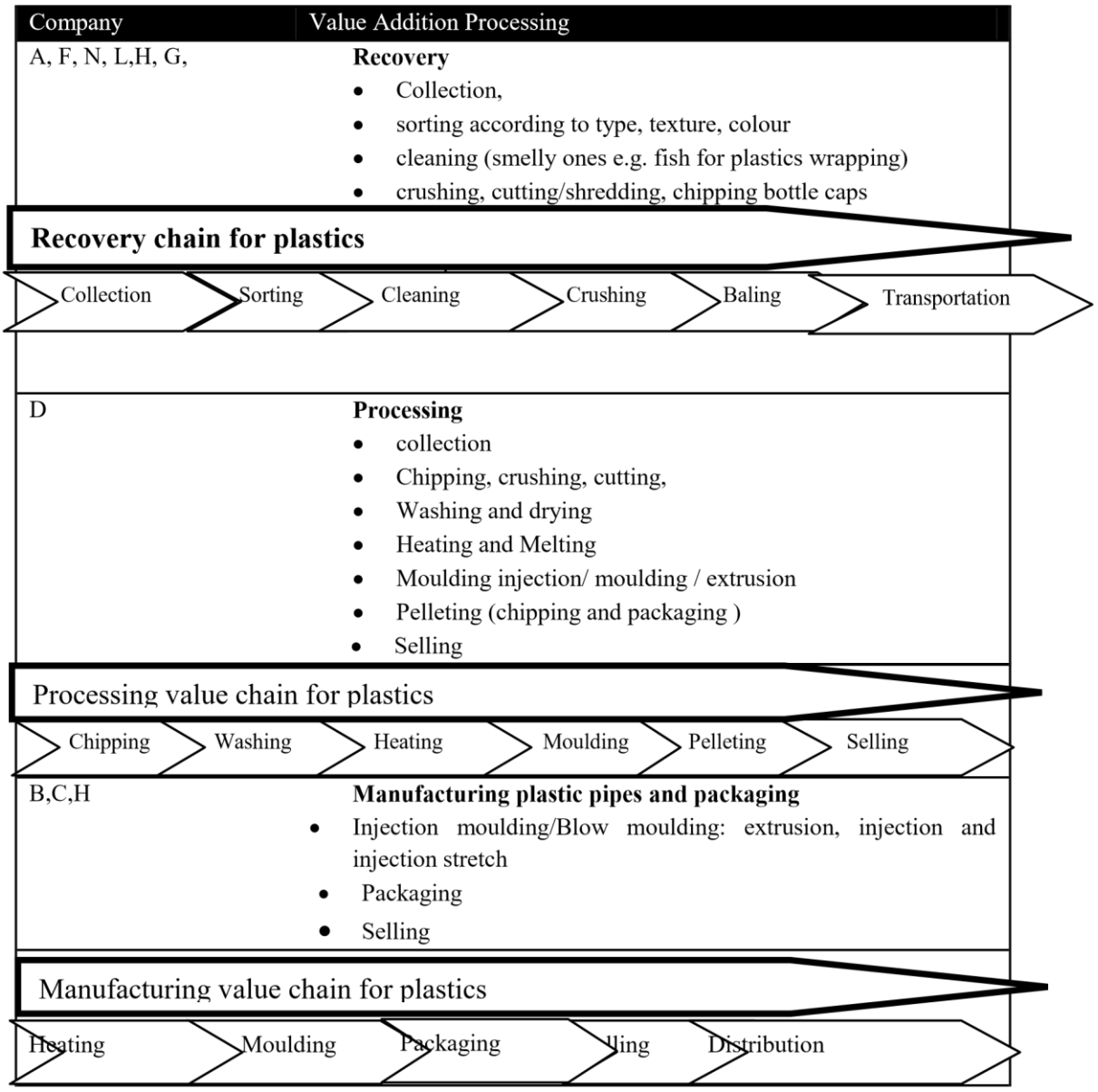

Source: Research data

Figure 1: Value Addition Chain for Plastic:

ii) Paper

In Namibia, value addition for paper involved recovery: collection, sorting, shredding and baling. Only two companies were involved in paper recycling at the time of the study. Different types of paper such as newspapers, white printing paper, writing papers, paper packaging, and envelopes with or without plastic windows, telephone books, magazines and cardboard/carton boxes were handled. The primary waste paper product recovered was cardboard since the majority of the nation's consumer goods are imported and come in a variety of such packaging. Wholesalers disposed of a lot of these waste products. The remaining paper goods were disposed of or gathered from a variety of sources, which included residences, retail shop establishments, institutions and enterprises, and commercial businesses like banks etc. Five value-addition processes were identified in the recovery stage

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for the paper: collection, transportation from different sources, sorting, shredding, baling and final transportation to South Africa for further processing and subsequent production of new paper products such as toilet paper and packaging material.

Sorting the various forms of papers was the first step in the value chain since companies occasionally received commingled. The papers were sorted by colour, type, texture i.e. hard or soft and khaki or white under two main categories namely, office and packaging. Any contaminated or dirty paper was condemned and thrown at landfill sites as it was considered costly to clean. All the other papers were just sorted and baled. The majority of paper, particularly that which came from establishments like banks and government offices, was first shredded before being baled in case it contained important or secret information. After sorting, cardboard/carton boxes were simply compacted to maximise space and baled before transportation to South Africa for further processing. At the time of investigation, one of the companies was exporting 700 tonnes of cardboard boxes to South Africa monthly. Newspapers were also treated the same way. Transportation to South Africa was the last stage since Namibia lacked the necessary infrastructure for further processing. The study discovered that exporting the recyclables was the only cost-effective method at the time.

Figure 2 shows a summary of the value addition chain for paper.

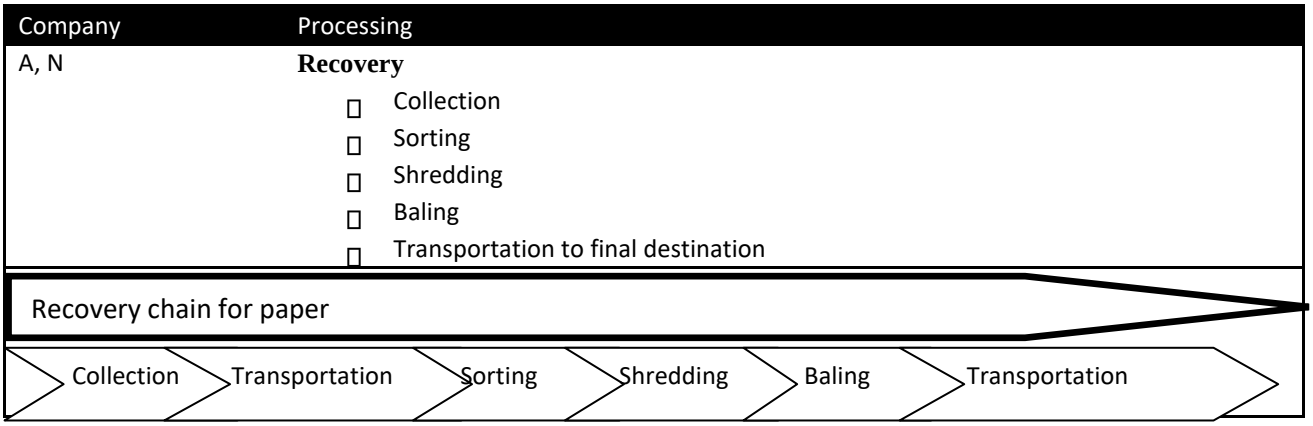

Figure 2: Value Addition Chain for Paper

Source*:* *Research Data*

iii) Glass

Three companies were into glass bottle recycling. Glass bottles were recovered from various sources such as open spaces, landfills and shopping centres. Upon collection, the glass was sorted according to colour and type. Beer bottles constituted the most. After sorting, one company reported sending bottles to a local bottling company in Windhoek and wholesaling for reuse or further processing. To reduce bulkiness before exporting the glass, crushing of the glass was done. In Namibia, the glass value addition chain was found to involve the steps summarised in Figure 3.

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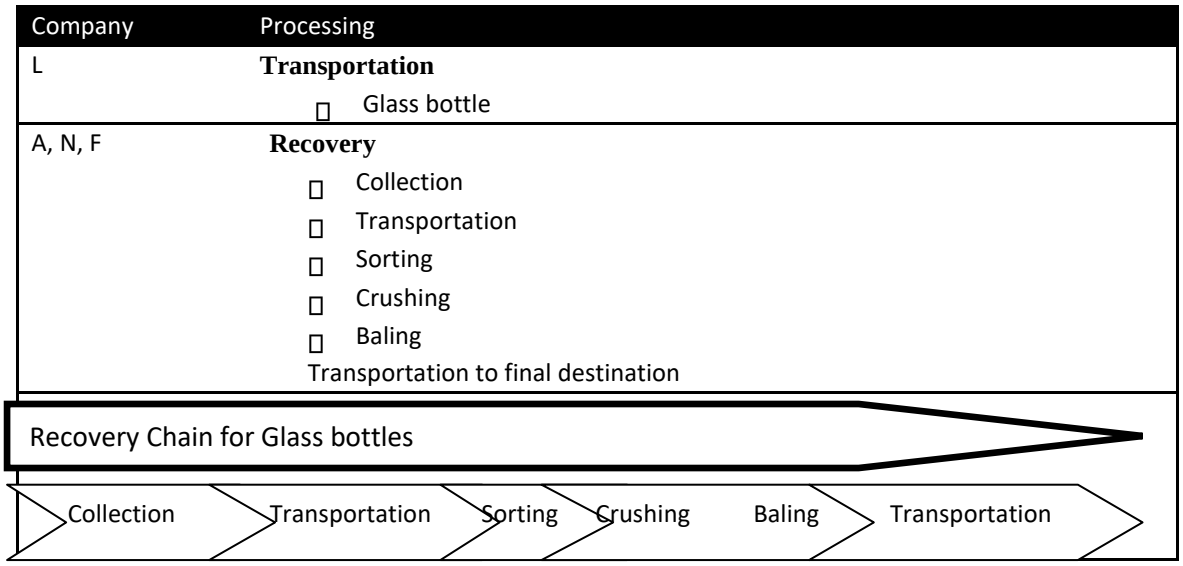

Figure 3: Value Addition Chain for Glass

Source: *Research Data*

iv) Aluminium and Steel cans

Five companies were involved in recycling cans. Both steel and aluminium cans were collected and pre-processed. The major value addition process is still in the recovery stage like glass and paper involving collection, sorting, crushing, baling and finally transportation to South Africa for further processing. Figure 4 shows a summary of the recycling chain.

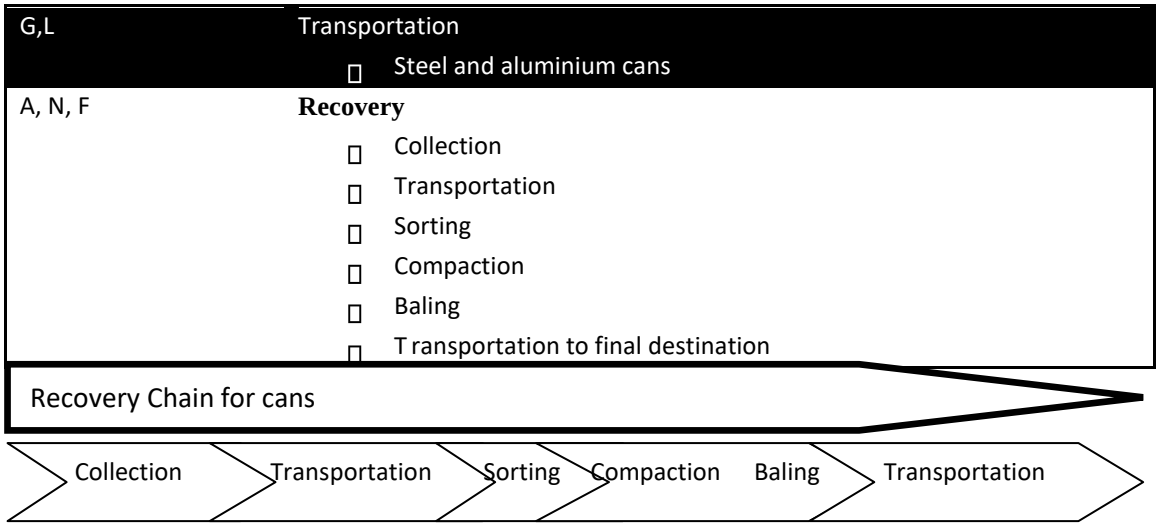

Figure 4: Value Addition Chain for Steel and Aluminium Cans

Source: *Research Data*

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v) Scrap metals

A variety of scrap metals, ferrous and non-ferrous, from industries, construction sites, farms, ship-wreaks, mines and dumpsites were also part of recyclables processed in Namibia. Both formal and informal actors were involved in this sector. Precisely, three companies were involved in scrap metal recovery. Collected scrap metals collected were assembled at scrap yards.

Collection and transportation of recovered scrap metals was the first step in the recycling process followed by the sorting of various materials. After sorting, some of the materials were dismantled and shredded.

Dismantling and shredding were the main activities of value addition before compaction. After compaction scrap metals were baled before transportation and shipping to Asia via Walvis Bay Port Corridor. In Namibia, value addition to scrap metals was limited to collection, sorting, dismantling, shredding, and compaction before baling as depicted in Figure 5. Further processing was done in South Africa and some Asian countries.

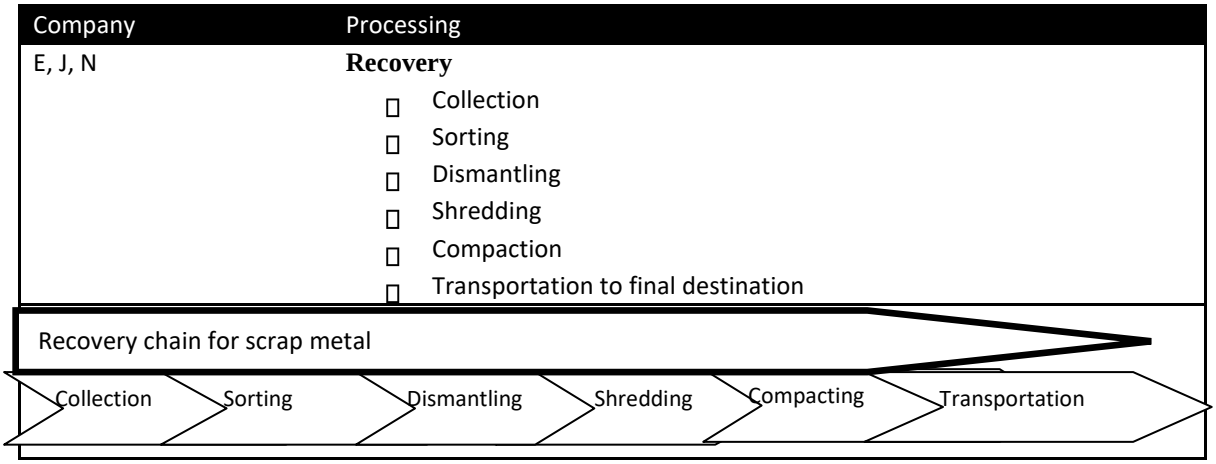

Figure 5: Value Addition for Scrap Metals

Source: Research Data

vi) Electronic-Waste

Only one company in Windhoek was involved in electronic-waste recycling at the time of the study. A variety of household electronic gadgets, computers, and computer accessories and ATMs were collected from various sources within Windhoek only. These materials were either collected by the company mobile trucks or dropped off at the company by the consumers. Primary processing included collection, sorting, dismantling, shredding, and separation, as part of the entire e-waste recycling value chain. Dismantling was done to retrieve essential mineral elements as well as to remove hazardous metals before sending them for further processing outside the country. Figure 6 shows the value addition chain witnessed in Namibia

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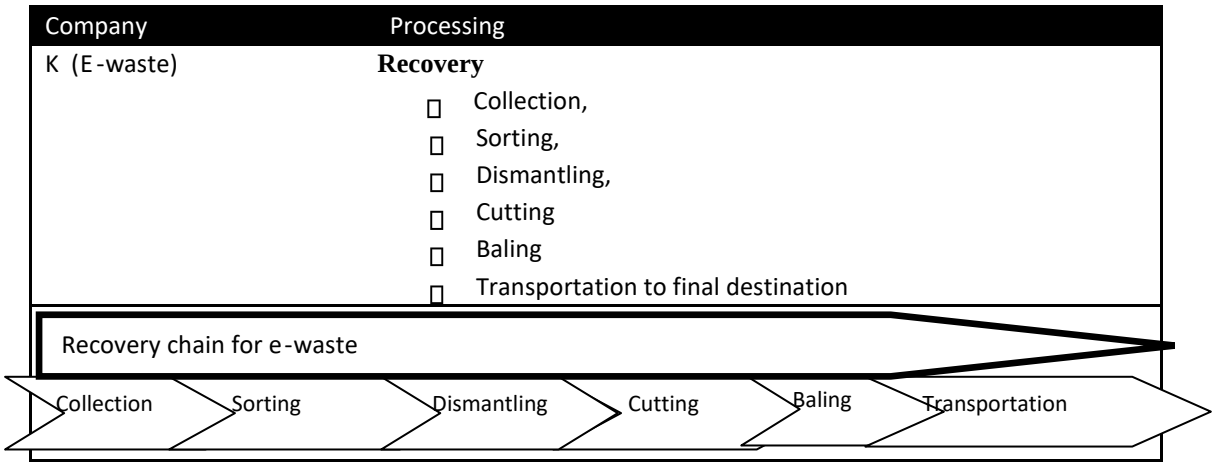

Figure 6: Value Addition Chain for Electronic Waste

Source: *Research Data*

DISCUSSION

As previously mentioned, value addition is a notion that spans several industries, including manufacturing, mining and agriculture and is critical for economic growth as earlier highlighted. Among other economic pursuits like mining, fishing, and agriculture, Namibia is witnessing the emergence of a solid waste recycling sector that is adding value to recovered recyclable materials.

Findings revealed that plastic, paper, glass, scrap metals and e-waste were the major waste streams that were recovered for recycling in Namibia, a situation similar to developing countries in other parts of the world as revealed in different researches (UNDP 2015; UNDP 2019; UNIDO, 2021; Silva de Souza Lima *et al.*, 2022).

For all companies which were into physical activities of recycling, the collection of recyclable raw materials was the initial process in the value addition process. Studies carried out in Nigeria, South Africa, and The Middle East revealed similar findings that collection was the first step in the value chain analysis. For example, Hoffman and Schenck (2020)'s study entitled *The Value Chain and Activities of Polyethylene Terephthalate Plastics in the South African Waste Economy* found that collection was the first step in the value chain of plastic recycling. Most companies indicated that they collected for free either directly from the source or point of generation such as households, commercial businesses, industries, institutions mines and construction sites, while others indicated that they collected from drop-off centres located mainly at shopping centres, along streets, parks, open spaces and at landfill sites. Those companies which collected from disposal sites managed to do so through the services of waste pickers. The use of informal waste pickers was also a familiar practice as practised elsewhere thus forming part of the chain in the recycling industry (Hoffman & Schenck, 2020; UNDP 2015; UNIDO, 2021). In some cases, companies used the services of middlemen to collect recyclable raw materials from farms or tourism resorts. In such cases, they paid the middlemen based on the weight delivered. Large companies also had ongoing

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agreements in place to collect recyclable raw materials from sources like mines and fishing enterprises

Although not quantified, plastic in its different forms was the main recyclable product among companies who were involved. The large amounts of plastic were partly attributed to increased consumption due to growing populations in urban centres as well as the use of plastic for packaging by manufacturers. In Namibia, plastic is considered a threat to both humans and the environment, hence, to promote sustainable development, many stakeholders have been working together to promote plastic recycling since the mid-1990s. These results are in agreement with those from similar research carried out elsewhere (2021; Hoffman & Schenck, 2020; Silva de Souza Lima *et al.*, 2022; UNIDO, 2021; UNDP 2019; UNDP 2015).

Value addition processes differed from one material to the other. In general, the plastic recycling industry in Namibia is fully developed a situation which was found to be benefiting the country in terms of employment creation and production of cheaper household, industrial and agricultural goods; and promotion of other downstream industries. In South Africa a study by Hoffman & Schenck (2020) found that plastic recycling was fully developed similar to the findings in Namibia and benefits included employment creation and availability of cheaper goods as well. Some countries in Africa however still do not have complete recycling of plastic. For example, research conducted in 2010 by Fadlalla on the recycling of PET plastic waste in Sudan, Khartoum indicated that the processing of plastics only involved recovery before export. Thus the industry was still not fully developed compared to what was going on in Namibia.

The benefits of value addition cannot be overemphasised. Lakshmi & Aparna, (2022) pinpointed the significance of adding value to raw materials although in a different sector. In the article *Scope for value addition of agriculture products for enterprise promotion in rural areas* they highlighted the significance of value addition. They contend that merely producing agricultural items has a much less economic impact than providing value to agricultural products beyond the farm gate. The benefits are many, an observation which was also supported by Melembe *et al.* (2021) that promoting agro-processing and value-addition activities in agriculture enhances farmers' livelihoods and poverty alleviation a welcome development, particularly in developing economies bedevilled by high unemployment and poverty.

In Namibia, value addition for paper, glass, e-waste and metals was not yet fully developed. Considering steps involved in recycling of these wastes, the extent of value addition of paper, glass and metals in the country was still limited if full growth of the recycling industry was to be realized. Stages 2 and 3, i.e. processing and manufacturing are still done outside the country a situation which compromises the full development of the industry locally for the benefit of the country. Value-addition processes were observed to be limited mainly to collection. Similar findings were observed elsewhere. Saremo (2015) discovered that there was minimal scrap metal recycling occurring in the city of Bulawayo, Zimbabwe, as a consequence of low technical capability, which led to the majority of the material being dumped and endangering both the environment and people. Despite its potential benefits, value addition remains low in Africa and Namibia included.

Value addition for most recovered materials was limited as the study established. Most companies felt it was not viable to establish recycling plants for most of the recyclable

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materials. This was caused by the high start-up costs of new businesses as well as the insufficient amounts of recyclable resources to keep the sector going. This is supported by Coltrain *et al.* 2000) who pinpointed that launching a value-adding company comes with a lot of risk, particularly in the beginning. In Namibia, some small-scale recycling companies were reported to have ceased operations due to high capital investments which they could not afford especially at the beginning.

The market pressures for selling created goods were also mentioned as a problem impeding the industry's complete growth, given the low level of production. Thus, most of the recyclers exported their products for further processing to South Africa and further afield, a common practice found in Africa. In Mozambique, such findings were also established as well by Tas, & Belon (2014) in a study *A Comprehensive Review of the Municipal Solid Waste Sector in Mozambique. Nairobi, Kenya.* In addition, labour and technology were other issues raised that impeded the growth of the sector. Three companies raised issues of lack of commitment and skills by workers. If the industry is to grow, these issues need attention as respondents highlighted.

CONCLUSION AND RECOMMENDATIONS

A variety of recyclable materials such as plastic, paper, scrap metals and electronic waste were recovered for processing. Value addition processes differed from one material to the other. In general, value addition to recyclables was still limited to pre processing stage except plastic. At the time of this study, plastic had a complete loop in terms of value addition. All steps of recycling namely: recovery and collection, processing, production of new products and subsequent marketing of the goods were done in the country. Although efforts were there to have full processing of all recyclables, it was not possible at that time as it was deemed economically non-viable due to the high costs involved and low volumes produced. Thus the rest of the products were exported, mainly to South Africa, for further processing and subsequent production of raw materials and goods. Pre-processing was the main activity after recovery and collection. Policy and intervention programs should promote more value addition in raw materials in the country as a whole considering the benefits to sustainable economic growth. However, the success in the recycling industry will depend on the viability of volumes that will be produced and collected in future.

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