

An Analysis of the Waste Tyre Management Plans in South Africa

Nhlanhla Nkosi, Edison Muzenda and John Zvimba

Abstract—South Africa is considered as one of the fastest growing economies and the economic growth is realised through the bulk industrial production of goods to meet the socio-economic needs of a growing population. This paper reviews the three proposed Waste Tyre Management Plans which are meant to address the waste tyre problem. The study objectives were achieved through reviewing and analysing the three plans as well as interviewing organizational personnel. The REDISA Plan which was submitted to government on the 19 April 2010 and gazetted for implementation on 30th November 2012 is the most viable approach to address the waste tyre problem in South Africa. The plan does not address waste tyre problem only but has the potential to contribute to job creation, capacity building, establishment of small businesses as well as research and development of new and innovative waste tyre utilization techniques. Despite being gazetted, the plan is still to be implemented.

Keywords—Waste tyres, REDISA Plan, SATRP Plan, RMIO Plan

I. INTRODUCTION

WASTE tyres present a challenging disposal problem. The same properties that make tyres desirable such as durability, in turn make their disposal and reprocessing a challenge. Tyres are immune to biological degradation due to their complex nature. Land filling has been the only feasible waste tyre management strategy to date. However tyres take up plenty of land space and they pose fire, environmental and health risks [1], their disposal at landfill sites has been banned. Over 200 000 tonnes of tyres become waste tyres in South Africa annually. About 11 million used tyres are dumped illegally or burnt to retrieve the steel wire. With this figure estimated to increase by around 9.5 % annually, the country has a serious waste tyre problem [2].

The South African government is looking for alternative and ecologically friendly waste tyre disposal options. The Department of Environmental affairs is tasked with protecting

the environment and public health. The Waste Management Act declares its objectives as being to protect human health and well-being as well as the environment. This Act, in Section 28(1), addresses waste management options for waste that occurs in more than one province. The Act anticipate the need to address national issues with a holistic national plan, hence the plans had to be drafted taking cognisance of this. The Department promulgated Waste Tyre regulations that took effect on the 30th of June 2009, compelling tyre producers to register with the Ministry of Water and Environmental Affairs, and prepare and submit an Integrated Industry Waste Tyre Management Plan (IIWTMP). Several plans were submitted to the Department of Water and Environmental Affairs, but only three passed the initial screening stages, namely: The South African Tyre Recycling Programme (SATRP) which initially submitted its first draft in June 2009, The Retail Motor Industry Association (RMI) which submitted its proposal on the 21st of December 2011 and The Recycling and Economic Development Initiative of South Africa (REDISA plan) which was submitted on the 19th of April 2010. The REDISA plan was approved and gazetted for implementation on the 30th of November 2012 [3].

II. WASTE TYRE GENERATION

Approximately 10 million tyres per year are currently sold in South Africa. All these tyres, except those exported will become waste tyres. Fig. 2 shows the projected waste tyre figures with an annual increase of 1 million new tyres over a period of five years [4]. A consistently increasing trend was experienced and projected for the period of 2010 to 2014 with exception of 2011. This could be attributed to the fall in new tyre sales by 1.5 million units in South Africa in 2011 [5]. This might have been a consequence of recession in the previous year which weakened production in the manufacturing sector.

South African (SA) Tyre Recyclers was formed in late 2005 in order to establish the country's most modern tyre recycling facility. This facility is situated in Atlantis, Cape Town, and operates with a recycling capacity of about 10,000 tonnes per annum. SA Tyre Recyclers work closely with local authorities and government bodies on recycling and environmental matters regarding post-consumer tyres [6]. Some of the products are (i) tyre shreds used in matting, sport surfaces, turf and playgrounds, (ii) granules and chips used in athletic tracks, playgrounds, horse arenas and asphalt (iii) crumbs and powders used in new tyres, brake pads, road sealing, adhesives

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and paints (iv) large shred tyre chips used in civil engineering and fuel derivatives. The facility is fully operational and addressing the growing waste tyre problem. Table 3 shows various applications for waste tyre rubber in South Africa.

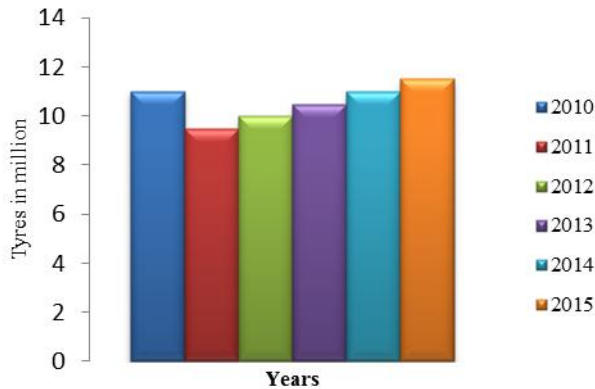


Fig. 1 Waste tyre projection figures [7]

III. THE REDISA PLAN

The REDISA plan has been accepted in accordance with the National Environmental Management Waste Act, 2008 (Act No. 59 of 2008) as stated in the Government Gazette, 17 April 2012, No.35147. REDISA, registered as REDISA NPC (2010/022733/08) is a non-profit making organization representing various people and organizations in the tyre and waste tyre industry. All tyre assortments that are imported or manufactured, including locally retreaded tyres, will reach the end of their useful life and become waste tyres need to be managed. According to REDISA, the annual projection of the quantities and types of tyres that are manufactured or imported will be managed through the Integrated Industry Waste Management Plan. For the ease of waste tyre management, tyres will be divided into nine categories as listed in Table I.

TABLE I
TYRE CATEGORIES

Category	Type of tyre
1	Passenger tyres
2	Light commercial tyres
3	Heavy commercial tyres
4	Agricultural tyres
5	Motorcycle tyres
6	Industrial tyres
7	Aircraft tyres
8	Earth moving tyres
9	Any other pneumatic tyres

Similar to the general waste hierarchy [8], waste reduction and avoidance form the foundation of the REDISA waste tyre hierarchy. This is succeeded by recycling, re-use and recovery as the last option, Fig. 1.

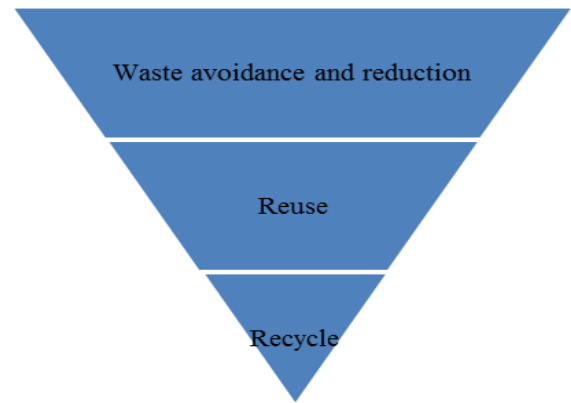


Fig. 2 REDISA Waste tyre hierarchy

A. Waste Tyre Avoidance and Reduction

Priority will as required in terms of regulation 7 (1) of the Waste Tyre Regulations of 2009 to be directed to re-treading plants [6].

B. Re-use

Retreading of high performance tyres is a common practice in Europe [6], but rarely practiced in South Africa due to lack of funding associated with the establishment of suitable plants and consumer and dealer preconceptions.

C. Recycling

Many recycling processes require significant capital investment, which in turn necessitates assured long-term supply of the raw material to enable them to recoup the investment. As a result, one of the most vital roles of the REDISA Plan is to manage the flow and supply of tyres to recycling operations to ensure sustainability of those facilities.

The plan will promote and support the establishment of recycling facilities nationwide. These facilities create employment opportunities for the informal sector and previously disadvantaged individuals in both urban and rural communities. The collection of waste tyres to the depots and/or tyre processors will be the main source of job creation and the establishment of small businesses [9].

Applications to produce industrial and consumer products include sport surfaces, indoor safety flooring, playground surfaces, shipping container liners, conveyor belts, automobile mats, footwear, carpet underlay, roof tiles, flooring and activated carbon [7].

Fig. 3 shows the REDISA Plan waste tyre hierarchy. The particular recycling process shown is illustrative and will evolve as the project develops.

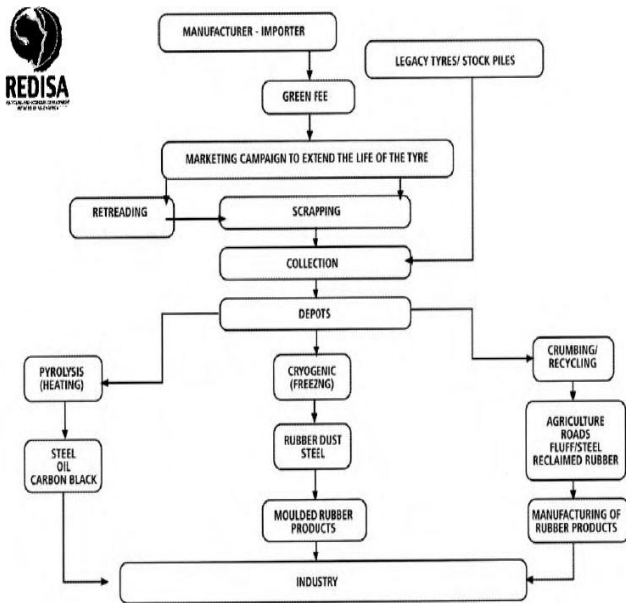


Fig. 3The REDISA waste tyre route map

D. The plan in a nutshell

The basis of the REDISA Plan centres on the following fundamental aspects:

Job creation: Attaching a value per kilogram to waste tyres provides small entrepreneurs and the previously disadvantaged with opportunities to earn income by delivering tyres to 150 depots throughout South Africa. REDISA aims to specifically identify micro operators, provide the relevant training and create business opportunities by awarding specific collection points, thereby ensuring sustainability.

Small Medium-Micro Enterprises (SMMEs) and Broad-Based Black Economic Empowerment (BBBEE): One of the biggest hurdles faced by SMMEs is access to capital. Establishment of depots requires funding that the SMMEs do not generally have access to. Under the REDISA plan which addresses the entire industry, depots will initially be funded by REDISA and leased to BBBEE entrepreneurs. This has the secondary advantage that should a depot fail through mismanagement it becomes easier to re-start operation with new management. Managers of these depots can over time, as they themselves become fully self-sustaining, take over full ownership of their depots.

Need for informal participation: Tyre manufacturers and importers must shoulder the primary responsibility for waste management. In practice, it is the tyre dealers who handle waste tyres through their life cycle, hence the management approach must fit in with the practicalities of the retail industry through the integration of both entities. The informal sector deals with a large proportion of the waste tyre, estimated to be at least 75% [6]. Thus, without informal sector participation no plan will succeed, hence the plan must be inclusive of this sector.

Fairness: A single plan approach, with a simple and

equitable system for apportioning the waste tyre management fee will simplify administration and auditing. As a result, the plan will be far less open to suspicions of behind the scenes manipulation by the influential participants.

Finance and audit control: The management of waste tyres on a national scale is a massive task involving very large sums of money, thus proper financial management is essential. There will be multiple plans implemented for the project in order to prevent the deliberate misallocation of stock or the movement of tyres between the plans to gain advantage. Multiple plans mean that every participant in the tyre industry would have to comply with multiple set of rules and be subjected to multiple audits. There are approximately 2300 tyre dealerships nationally [6], and hence the scale of potential problems is huge, as would be the remedial cost.

Training and communication: The REDISA Plan will provide various training programmes in order to equip all stakeholders with the relevant skills and competencies. Similarly, there will be a need to market the concept of waste tyre recycling and encouraging participation. A single plan with consolidated funding is not only more effective, but the message is simpler and can easily be communicated.

Resilience and longevity: There are many other sources of environmental waste which can and should be alleviated similarly such as electric goods, small appliance batteries, compact fluorescent lights and many other forms of waste. This can contribute towards a fund to cater for the eventual safe recycling and disposal of these goods [6]. It is a fundamental concept with a relatively simple underlying structure, which avoids affiliations with particular industry players and is structured to carry out government mandate.

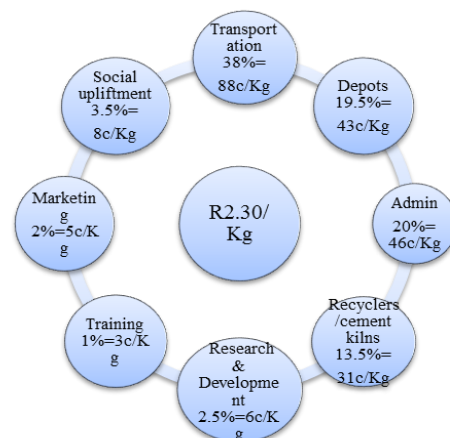


Fig. 4 Initial cost allocations

The waste tyre management fee levied by REDISA on subscribers will be calculated to recover the cost of the waste tyre management process. The fee will be levied on both produced and imported tyres. The Plan will raise funds from the levied fee of R2.30 per kilogram (kg) and the fee will be

reviewed annually to meet demands. The cost is calculated taking into account the initial cost allocations, Fig. 4. From a research point of view, for the early implementation stages of the Plan, the 2.5% allocated should be sufficient. As the plan develops and grows, unconventional primary and secondary products will be discovered through research and development initiatives. Thus, more funds will be required for research and development in the long run.

IV. THE SATRP PLAN

In response to the Waste Tyre Regulations, 2009 the SATRP Company (Association incorporated under Section 21), Company registration no: 2002/027503/08) prepared this Integrated Industry Waste Tyre Management Plan, the "SATRP Company Industry Plan". This plan was aimed at solving the waste tyre problem in South Africa, create many jobs for previously disadvantaged individuals (PDIs) as well as establishing SMEs.

TABLE II

TYRE CATEGORIES

Category	Type of tyre
1	Passenger car tyres
2	Commercial vehicle tyres
3	Agricultural equipment tyres
4	Motorcycle tyres
5	Industrial and lift truck tyres
6	Earthmoving equipment tyres
7	Aircraft tyres
8	Other pneumatic tyres

The REDISA and SATRP plans will basically deal with the same tyre assortments.

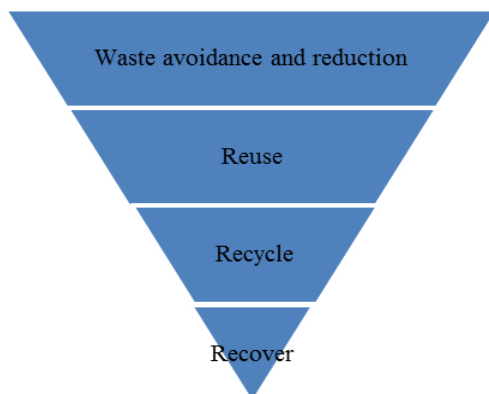


Fig 5 SATRP waste tyre hierarchy

A. Waste Tyre Avoidance and Reduction

Priority will be given to preventing and reducing waste tyre generation through the launching of awareness campaigns on maintenance and producers guidelines. Secondly, the SATRP plan will encourage investment in the retreading industry and

actively promote the use of retreaded tyres. Used tyres classified as retreadable by tyre dealers as required in terms of regulation 7 (1) of the Waste Tyre Regulations of 2009 to be directed to retreading plants[10].

B. Re-use

The re-use of a product is defined in the Waste Act, 2008 [11] as "utilising articles from the waste stream again for a similar or different purpose without changing the form or properties of the articles". The re-use of waste tyres is defined as "the utilisation of waste tyres, in whole or in part, without changing the composition of the waste tyre". The Guidelines list the applications for whole, cut or shredded tyres, Table III.

TABLE III
VARIOUS APPLICATIONS FOR WHOLE, CUT, OR SHREDDED TYRES SATRAP PLAN

Application	Material				Source	Method
	Whole tyre	Cut tyre	Shred	Chip		
Embankments	x		x	x	PW, TW, MW	M, A
Erosion control	x	x	x	x	PW, TW	M, A
Landfill engineering	x		x	x	PW, TW	M, A
Slope stabilization	x		x	x	PW, TW	M, A
Temporary roads	x		x	x	PW, TW	M, A
Thermal insulation	x		x	x	PW, TW, MW	M, A
Collision barriers	x	x	x	x	All	M, A
Light weight fill	x		x	x	PW, TW, MW	A
Noise barriers	x	x	x	x	PW, TW, MW	M, A
Train and tram train beds				x	PW, TW	M, A, C

Key for TABLE III

Sources		Technology (size reduction)	
PW	Whole passenger tyres	M	Mechanical (cut, compress)
TW	Whole truck tyres	C	Cryogenic size reduction
MW	Mixed whole car/truck tyres	A	Ambient size reduction
ALL	All		

C. Recycling

An infant recycling industry exists in South Africa at present with crumbing plants in operation. A number of companies involved in the cutting and punching products from tyres are also in operation. Listed below are some of the recycling technologies applied to crumbed rubber which are considered in the SATRP plan.

TABLE IV

VARIOUS APPLICATIONS FOR CRUMBED RUBBER

Application	Material				Technology
	G	P	B	R	
Concrete construction additives					P
Asphalt additives		x			P, D
Asphalt rubber	x	x			A, C
road furniture	x	x	x		A, C, R, D

Keys to TABLE IV

Material	Source	Technology
G-Granulate	PW-Whole passenger tyres	C-Cryogenic size reduction
P-Powder	TW-Whole truck tyres	A-Ambient size reduction
B-Bufferings	MW-Mixed whole car/truck tyres	D-Devulcanization
R-Reclaim	ALL All	R-Reclaim
D-Devulcanizates		P-Pyrolysis
Y-Pyrolytic products		
Z-Upgrade material		

D.Recovery

There is currently little energy recovery initiatives from waste tyres in South Africa but their use in industrial processes, such as cement, lime or steel production and power stations world-wide is well documented and accepted. The authorization of the use of waste tyres as a substitute for fossil fuel is done on a plant by plant basis according to the existing provisions of the Waste Act, 2008 and the Department of Environmental Affairs (DEA) National Policy on thermal treatment of general and hazardous Waste.

E. The plan in a nutshell

Job creation: The job creation potential of the SATRP Company Industry Plan, over the 5 year period of the implementation of the Plan, is forecast to be in (i) new tyre dealers, (ii) waste tyre transportation, (iii) waste tyre transfer sites, (iv) Waste tyre processing. The potential contribution of the SATRP Company Industry Plan to the green economy is therefore forecast at 5000 informal jobs transformed to formal jobs; 5060 PDIs new jobs; 1500 SMMEs; and 335 SMEs.

Training and development: The SATRP Company will develop training programmes for informal tyre dealers to enable them to provide an upgraded service to their customers. Included is the provision of (i) fully equipped workshops; (ii) training in the use of the equipment provided; (iii) training in general business management and finance (iv) support in stock control and supply (v) business skills for SMEs.

Previously disadvantaged individuals (pdi's): Individuals presently employed in the informal second-hand tyre trade will be incorporated into the formal market by means of a training

programme, and the provision of tools, equipment as well as the formation of SMMEs. The SATRP Company will, together with professional organisations, launch a programme to train the present roadside and township informal tyre dealers to become recognised as part of the formal tyre industry.

Subscribers: Any tyre producer having received a registration number from the DEA, in terms of Part 3 of the Waste Tyre Regulations, 2009 [12], and wishes to, may become a subscriber to the SATRP Company Industry Plan.

Auditing: The SATRP Company will appoint external auditors for a period of three (3) years through a tender process.

Research and development: The SATRP Company intends working closely with its international partners in the area of research and development. Matters currently under research are road surface treatment, concrete composite and odours. Products presently being developed are fibres for reinforcing road coating materials, thermoplastic compounds, acoustic screens and textile fibres used as fuel [12]. The SATRP Company plans to approach the Council of Scientific and Industrial Research (CSIR) as well as the Department of Science and Technology to specifically consider issues of the South African environment.

The rate to be charged to subscribers to the SATRP Company Plan will be R1.98/Kg, resulting in a cost estimation of R487 million during the first year of operation [12]. It is estimated that 30 transfer sites will be required to store and pre-process the waste tyres collected from tyres dealers and the legacy stockpiles

Based on Fig. 6, it is evident that the SATRP Company will prioritise its plan mainly on instituting a well routed and reliable waste tyre transportation system as well as properly established transfer sites. Only 1.3% of the total cost will be allocated for research and development. This percentage might need to be revised in order to have a growing technological plan. Research and development is essential for the integration of new and old waste tyre treatment technologies.

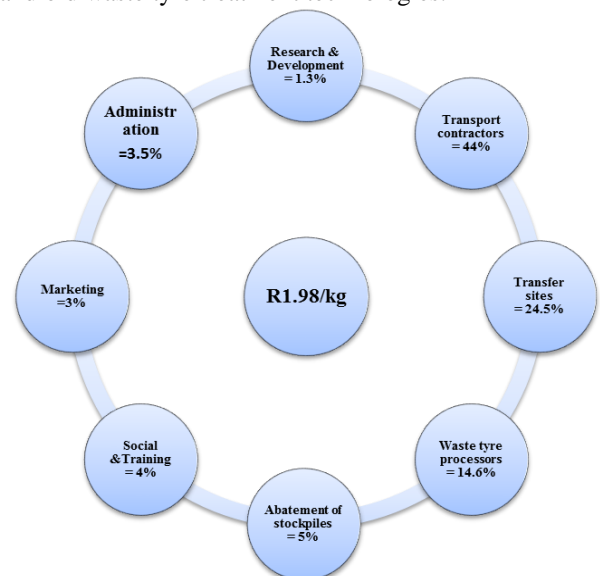


Fig. 6 SATRP Initial cost estimates

V. INTEGRATED INDUSTRY WASTE TYRE MANAGEMENT PLAN OF THE RETAIL MOTOR INDUSTRY ORGANISATION (IIWTMP-RMIO)

In accordance with the Waste Tyre Regulations of 13 February 2009, Part 1 heading 2, the purpose of this plan is to facilitate and manage the disposal of waste tyres in accordance with the Waste Tyre Act 2009. Research done by the RMI show that, majority of the fitment centres has entrepreneurs collecting their scrap tyres. In some instances these tyre collectors have been involved in doing so for 3 generations [13]. The RMI further supports the implementation of a collaborative integrated Waste Tyre Management Plan that includes all stakeholders within the tyre industry. This level of involvement will ensure sustainability of a new industry, given their expert industry experience. Tyres, shown in Table V, will become waste tyres and will be managed through this integrated industry waste management plan:

TABLE V
TYRE CATEGORIES

Category	Type of tyre
1	Passenger vehicle tyres
2	Commercial vehicle tyres
3	Agricultural equipment tyres
4	Motorcycle tyres
5	Construction and earthmoving equipment tyres
6	Pedal cycle tyres
7	Aircraft tyres
8	Other diverse tyres

The Parties to the Plan intend implementing the tyre hierarchy in the manner as shown in Fig. 7.

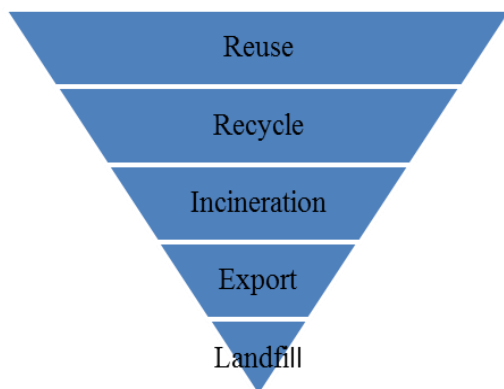


Fig. 7 RMIO waste tyre hierarchy

A. Reuse

The Retail Motor Industry Organisation (RMIO) recognises reusing of waste tyres as their main priority in the waste tyre hierarchy through retreading.

B. Recycle

Mechanical shredding and crumbing are the preferred method of recycling as well as reclaiming. Crumbing activities render tyre waste as suitable raw material for many processes such as moulded rubber products, road surface and many others. Crumbing is also a precursor for reclaimed rubber. The latter is exportable and used in small quantities in many rubber formulations for a variety of moulded and extruded products. The Plan will also actively promote and support the establishment of recycling facilities throughout the country.

C. Incineration

Incineration will be facilitated through processes such as pyrolysis as well as energy recovery for power generation advocacy. The pyrolysis products from waste tyres are fuel oils, char/carbon black and steel. These value added products are saleable and a source of income. Energy recovery from waste tyres can be beneficial to South Africa in reducing the carbon footprint caused by coal usage in SA.

D. Export

Export is preferred to landfill, illegal dumping and burning disposal. It has the benefit that waste tyre volumes in excess of recycling and other requirements are disposed of in a more environmentally friendly manner. Furthermore the process of preparing waste for export for steam generation can create jobs.

E. Landfilling

Landfilling is the last resort in the waste tyre hierarchy; it is undesirable and should be avoided.

F. The plan in a nut shell

The potential number of waste sites is estimated at about fifty countrywide. Sites may vary in size depending on the geographical locations and the concentration of consumers, and waste generators.

National awareness: The RMI currently actively promotes awareness in relation to the management of waste tyres in various advertising mediums, including national and regional media, monthly magazines and newsletters as well as at national and regional meetings/road shows. Funding will also be made available for consumer awareness programs.

Job creation: The plan provides for on-going monitoring of job creation in the various processes. Preferences will be given to the lower income earners and previously disadvantaged, whilst not excluding the existing industry.

Training and development: The fund will establish a full training committee to deal with training and skills development throughout the value chain. The approach of the parties to the Plan is to develop their candidates into independent businessmen who will compete in local and international export markets.

New opportunities: The Parties to the Plan believe these actions will spawn many profitable downstream industries such as moulded rubber products, chemical, oil refinement and servicing export markets with these derived products.

Independent auditors: To ensure transparency, all

movement of waste tyres, from import and/or manufacture of new tyres and casings to final recycling or other disposal, will be documented, audited and reconciled on the National Centralized Computer System (NCCS). The operations of all recyclers and processors will also, at their cost, be audited in terms of the Companies Act and other applicable legislation.

Research and development: The Research and Development department, under the auspices of the Fund, will also be active in providing other processes applicable to our environment.

VI. ANALYSIS OF ALL PLANS

The proposed REDISA Plan has come at a time when South Africa needs to reinforce stringent laws on their waste management strategies in particular the waste tyre problem. Before the proposition of the plan no clear approach was used to tackle the accumulation of waste tyres at landfill sites and illegal stockpiles. Beside, addressing the waste tyre problem which includes the setting up and managing a national network for collecting and temporarily storing waste tyres, delivery to recyclers, as well as supporting the development of a waste tyre recycling industry. The plan also helps with job creation, capacity building, and creation of small businesses and as well as research development of new and innovative techniques on waste tyre utilization. Despite the various challenges and criticism the plan has received from competitors, it has been gazetted and only awaits the implementation stage. However, the plan lacks media exposure as majority of tyre dealers from disadvantaged communities, who account for 75% of waste tyre recycling [13], are not aware of the existence of the plan. Lastly, the REDISA stockholders should compare the SA levy to those of other countries in order to obtain a well- rounded and calculated figure.

The SATRP Plan is an all rounded and well detailed plan which considered most of the relevant key objections which are required for a the IIWTMP. However, the Department of Environmental Affairs has the following concerns on the plan: The SATRP plan excluded some of the key issues such as inadequate consideration of the Waste Hierarchy, which is the cornerstone of waste legislation in the country. In addition, the plan failed to address the inclusion and development of previously disadvantaged communities, which are currently involved in the informal tyre sector.

Lastly, The RMIO has existed longer than SATRP and REDISA, however the plan lacked proper definition in their waste tyre strategy. The plan was not conclusive on future projected costs as well as implementation strategies. This resulted in a poorly structured plan which lacked the inclusion of current waste tyre dealers. However, RMI supported the implementation of new technologies such as pyrolysis.

VII. CONCLUSION

Waste tyre management has been a challenge in SA. This led to the unsafe burning of waste tyres to recover the steel components for selling, the illegal dumping of waste tyres in undesignated areas, as well as landfilling which results

environmental degradation challenges. The three plans meant to address these problems were carefully analysed and considered. The REDISA Plan was finally accepted and gazetted as the most viable approach to solve the waste tyre problem in South Africa.

ACKNOWLEDGMENT

The authors are grateful to National Research Foundation (NRF) of South Africa and the Council for Scientific and Industrial Research (CSIR) for financial and technical support.

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