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Seeking Circularity: A Review of Zimbabwe Waste Management Policies Towards a Circular Economy

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Abstract

Sustainable waste management practices, Resource Efficiency (RE) and Circular Economy (CE) strategies must be mainstreamed in policies to achieve Sustainable Development Goals (SDGs). The Zimbabwean constitution provides for environmental rights which include pollution and ecological degradation prevention, conservation promotion and encouraging ecologically sustainable development and use of natural resources while supporting economic and social development. It calls for the development of legislative and other measures for the protection of the environment. Considering this, the legislative framework of Zimbabwe includes the Principal Act which is the Environmental Management Act and its ancillary regulations. Regulations relevant to waste management include the Effluent and Solid Waste Disposal Regulations (SI 6, 2007). This instrument regulates the disposal of waste (solid waste and effluent), using the "polluter pays" principle but does not explicitly promote circularity as industry can budget for the disposal and not work towards circularity. Hazardous Waste Management Regulations (SI 10 2007) provides for the issuing of licenses for the generation, storage, use, recycling, treatment, transportation, or disposal of hazardous waste for waste generators and waste handlers. In addition, the country also has the Integrated Waste Management Plan published in 2014 that promotes integration of waste management practices.

The legislative framework (policies, acts, regulations, and ancillary legislations) needs to be aligned to fully encompass sustainable practices in the management of industrial waste towards the transition to a CE. The policies were evaluated, analysed and interpreted for their implications on stakeholders by conducting a SWOT Analysis. The review revealed that environmental risks from industrial waste management are complex and need to be managed in a holistic approach. This requires the implementation and enforcement of policies encompassing industrial ecology, economic instruments, regulations, and strategies that create value through the closed-loop systems, internalising the environmental costs and providing incentives for efficient resource use towards a circular economy and achieving sustainable production and consumption patterns. Most of the policies did not explicitly provide for the implementation of CE strategies from a regulatory point of view as industry felt the policies use the stick rather than the carrot approach. Nevertheless, there is voluntary implementation of the strategies as industry strive to achieve a CE.

Keywords
Circularity, Circular Economy, Industrial Symbiosis, Waste Management, Resource Efficiency

Introduction

Zimbabwe's economy is endowed with a wealth in natural resources across many sectors that are contributing to the current linear model of extract, make and dispose. Major Industries are in mining, manufacturing, and agriculture (UN-CTCN 2020). This implies that the country's economic activities are based on the extraction and limited processing of these resources, generating little economic benefit, and impacting significantly on the environment. Considering this there is need to engage in industrial activities that promote value addition in resources, and industrial development based on technology and innovation (Xie, *et al.* 2020). With global environmental pollution and climate change emerging progressively as major global problems as a result of increased resource consumption and, rapid urbanisation and industrialisation, transformation to a CE is vital and more pertinent than ever in industrial development in the new era as it seeks to optimise production by circulating materials within the production system and closing the resource loop (Feiferyte-Skirien, and Stasiškiene 2021). Figure 1 depicts the transition from a linear model to a circular business model in in different part of the value chain.

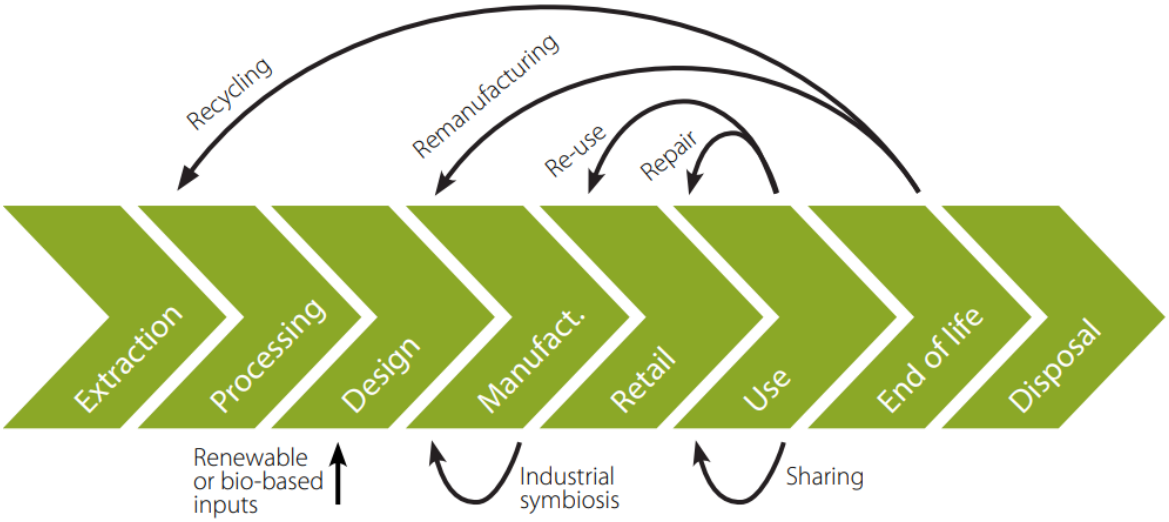

Figure 1. Circular Business Model in Different Parts of the Value Chain (OECD 2019)

RE and CE strategies must be mainstreamed in policies to achieve SDGs (Van Berkel & Fadeeva, 2018; UN-CTCN, 2020). Adopting appropriate technologies, implementing RE strategies, and designing CE patterns coupled with environmental protection legislation will contribute to achieving SDGs (Ncube, *et al*., 2021). McCarthy, Dellink and Bibas, (2018) highlight that RE and CE policies can be classified according to three different objectives that is closing, slowing and narrowing the resource loop as summarised in Table 1.

Table 1. Characteristics of circular economy (McCarthy, Dellink and Bibas 2018)

	Feature	**Key Effect**	**Policy Example**
Closing the Resource Loop	Recycling Product repairing and remanufacturing	Decreased demand for primary materials Increased use of secondary materials	Subsidies to secondary materials Subsidies to recycling sector
Slowing the Resource Loop	Longer-lived products Product reuse and repair	Decreased demand for primary and secondary materials Better quality and durability of goods but at higher prices	Extended Producer Responsibility (EPR) Product design standards
Narrowing the Resource Flow	Increased material productivity Improved asset utilisation Changes in individual behaviour	Decreased demand for primary materials Expanded sharing and services economy	Resource efficiency standards Carpooling driving allowances Material Tax

As depicted by the above table some policies provide for the closing the resource loop, diverting from the traditional linear economic system through recycling and the use of secondary materials implementing the IS strategy where the waste of one process is utilised as a resource by another.

Secondly, some policies are created to slow the resource loop by improving product durability; either in the initial production or in improving re-use and repair possibilities as designers are responsible for the entire life cycle of their product or service (Lifset et al. 2013). For example, the Environmental Management: Plastic Packaging and Plastic Bottles Regulations in Zimbabwea (Rukani 2019) and, the EPR regulations in South Africa for WEEE products Finally, there are policies that aim at narrowing the resource flow, by expanding the sharing and service economy and,

often, encouraging changes in individual behaviour. In essence the objective of a CE to consider activities move towards create-use-reuse, and the cycle continues with a direct impact on the society, ecology, economy, and the environment (Patwa *et al.* 2021) which are the three pillars of Sustainable Development.

Zimbabwe has promulgated public policies and private initiatives to advance towards an Integrated Waste Management (IWM) and a CE, through the Constitution, Acts, regulations, programs and initiatives establishing a framework for Waste Management, providing for waste reduction, recovery, reuse and recycling to protect the health of its citizens and the environment (Government of Zimbawe 2013). However, there is a lack of adequate implementation of the said policies, research on the impact of technological innovation and technology innovation. This paper seeks to review the existing policies and highlight how they fare in contributing towards providing incentives for efficient resource use towards a CE with a focus on Industrial Symbiosis (IS) strategy to achieve sustainability in line with SDG number 12 (Sustainable Production and Consumption Patterns). The objectives of the review were to:

1.Identify the Waste Management policies in Zimbabwe
2.Classify the policies with an impact to industrial waste management
3.Evaluating each policy with regards to Circular Economy Strategies
4. Suggesting implications for stakeholders by conducting a SWOT Analysis

2. Methodology

The review was based on published peer-reviewed articles and grey literature on the concept of CE as well as interviews and participation in seminars on the topic to identify the waste management policies in Zimbabwe and classifying the policies with an impact to industrial waste management through the implementation of IS was carried out. Keywords used for the search included: ("*Circularity, Circular Economy, Circular Economy Policies, Industrial Symbiosis, Waste Management, Resource Efficiency, Industrial Symbiosis and Circular Economy**"). The search investigated, Journal articles, Conference papers, Book chapters Theses, Government policy documents, Magazines, periodicals and Newspaper articles and Online Articles. The focus was to determine and evaluate how Circular Economy policies were implemented globally and compared them to Zimbabwean policies. It also helped in identifying the areas of improvement; Policies were also reviewed, evaluated, analysed and interpretated for their implications on stakeholders by conducting a SWOT Analysis by using interview questions. Interviewees were drawn from regulating authorities as well as circular economy experts from industry and the academia.

Interviewees were drawn from CE experts from industry as well as officers from regulating Authorities administering waste management regulations from Central and Local government. Questions were as shown in the Table 2 below

Table 2. Questions for Government Officials CE Industry Experts and or Policy Makers

1) What are the current policies in place for industrial waste management that span across Zimbabwe? Are there any regulations specific to Harare?
2) Are there flaws to these policies?
3) How well have companies and the general population complied with such policies?
4) What is your perception of industry in terms of awareness of the regulations in place for industrial waste,
6) How much of a priority is this issue at the government level (awareness)? At the Organisational level?
7) Do any policies of waste management promote Circular Economy Strategies like Industrial Symbiosis
7a) How has the government incorporated the SDG goals (Especially goal number 12) in their policies
8) Are there other nations that Zimbabwe should look to as models of Industrial Symbiosis?
8) Do you think it would be viable to support the implementation of Industrial Symbiosis's role in waste management (while providing for safer practices)

3. The Waste Management Policies in Zimbabwe in relation to CE and IS

The transition to a sustainable Circular Economy (CE) requires moving away from linear production processes and transition towards a CE which is based on three fundamental principles driven by design (Ellen MacArthur Foundation 2015):

i. Eliminate waste and pollution
ii. Circulate products and materials (at their highest value)
iii. Regenerate nature

Generation of waste needs to be minimised or prevented as well as reducing the extraction and consumption of virgin materials. This involves extension product lifetime by employing measures that promote recycling, reuse regeneration. Such a transition entails a significant shift in business models. In essence the CE is more sustainable than the linear economic system as it reduces the resources used, the waste and leakage created conserving natural resources thus reducing environmental pollution. Therefore, the role of the law is to enable the change through implementation of policies that support and incentivises sustainable resource utilisation. This section reviews policies in Zimbabwe in relation to CE and IS. Environmental risks from industrial waste management are complex and need to be managed in a holistic approach. This requires the implementation and enforcement of policies encompassing industrial ecology, economic instruments, regulations, and strategies that create value through the closed-loop systems, internalising the environmental costs. This section outlines the waste management legislative framework.

3.1 The Zimbabwean Constitution

The Zimbabwean Constitution provides for environmental rights which include pollution and ecological degradation prevention, conservation promotion and encouraging ecologically sustainable development and use of natural resources while supporting economic and social development. It calls for the development of legislative and other measures for the protection of the environment (Government of Zimbawe 2013). In view of the above there are many pieces of legislation that have been developed as a measure to protect the environment.

3.2. The Environmental Management Act

The Environmental Management Act (Chapter 20:27) No. 13 of 2002 was a result of broad consultations by the then Ministry of Environment and Tourism. It forms a broad legal statement on Environmental Management throughout Zimbabwe. This is the first consolidated Principal Act providing for the country's environmental matters administration. The Act is a general legislative framework that does not cover all environmental aspects but is complemented by other ancillary regulations and policies that are not in conflict with it. However, this Act takes precedence where there are conflicts (Zimbabwe Environmental Law Assosciation 2019). Section 69 of the Act specifies standards Waste Management. Considering this, industries that generate waste are required to employ measures that minimize wastes. The specified measures are.

- Treatment
- Reclamation
- Recycling.

The above measures if employed imply that there is sustainable efficient resource utilisation thus promoting socio-economic development towards a CE.
The section further highlights that contravening this law is an offence punishable by imprisonment of not more than five years or to a fine. It does not highlight any incentives for employing the strategies that promote CE. The Act is supported by its ancillary regulations namely.
Statutory Instrument 6 of 2007 (Environmental Management: Effluent and Solid Waste Disposal Regulations,
Statutory Instrument 10 of 2007 (Environmental Management: Hazardous Waste Management Regulations)
Statutory Instrument 98 of 2010, (Environmental Management: Plastic Packaging and Plastic Bottles Regulations)
Moreso, the Act provides the general environmental principles that should be followed in environmental management through passage of Waste management strategies and plans

3.2.1 Statutory Instrument 6 of 2007 (Environmental Management: Effluent and Solid Waste Disposal Regulations

This instrument regulates the disposal of waste (solid waste and effluent), using the "polluter pays" principle. It is administered by the Environmental Management Agency (EMA) whose main aim is to regulate the issuance of licences in terms of these regulations and generally— (a) to control and regulate the disposal of waste or effluent which may affect the quality of environment; (b) to maintain records of the extent and nature of environmental pollution in Zimbabwe for use in the planning for and management of the nation's natural resources; and (c) to advise the public and the private sector on control of environmental pollution. However, it does not explicitly promote circularity as industry can budget for the disposal and not work towards circularity. As highlighted by Makwara and Magudu (2013) Waste Management Systems are currently in very poor standing and are largely dysfunctional as local authorities who are mandated to collect refuse from industry are incapacitated.

3.2.2 Statutory Instrument 10 of 2007 (Environmental Management: Hazardous Waste Management Regulations)

Provides for the issuing of licenses for the generation, storage, use, recycling, treatment, transportation, or disposal of hazardous waste for waste generators and waste handlers. Generators of hazardous waste are also required to prepare waste management plans and targets. This statutory instrument also regulates waste collection and management by local authorities. The importation and exportation of hazardous waste and waste soils is also regulated by this statutory instrument. Furthermore, the regulations require that every generator of hazardous waste prepare a waste management plan which shall consist of— (a) an inventory of the waste-management situation specifying the quantity and the components of such waste. Implementation of these is to ensure that goals are set for the adoption of cleaner production methods, waste reduction, environmentally safe recycling in general it provides for the adoption of environmentally sound management of wastes. However, implementation in terms of these strategies is still a challenge as focus is mainly emphasised on disposal licences.

From the evaluation of these provisions of these regulations the concept of Circularity is not explicitly outlined as implementation is focused on the issuance of licences to dispose of the waste hence promoting linearity to circularity

3.2.3 Statutory Instrument 98 of 2010, (Environmental Management: Plastic Packaging and Plastic Bottles Regulations

This instrument prohibits the manufacture for use within Zimbabwe, commercial distribution, or importation of plastic packaging with a wall thickness of less than thirty micrometres. This is a Product Policy as it incentivises circularity only on the plastic packaging in design, manufacture, distribution, or import;

Although many of these policies only apply to narrowly specific product types or materials. As highlighted by Rukani, (2019) the regulations have not achieved the intended objectives as plastic waste is still a challenge. There is room for improvement if other alternatives are availed and include Life Cycle Thinking (LCT) to allow the re-use, refurbishment, remanufacture of the plastic containers and re-thinking about the design of these plastic packaging and containers, In addition, the country also has the Integrated Waste Management Plan published in 2014 that promotes integration of waste management practices

3.2.4 National Integrated Solid Waste Management Plan

In order to ensure a holistic approach in managing waste The components of an Integrated Solid Waste Management System, depicting how waste ending up at the landfill can be reduced, and the stages where the various recovery, reuse and recycling activities can be implemented are shown in Figure 1. It has been shown that with appropriate segregation and recycling, significant quantities of waste can be diverted from landfills and converted into resource.

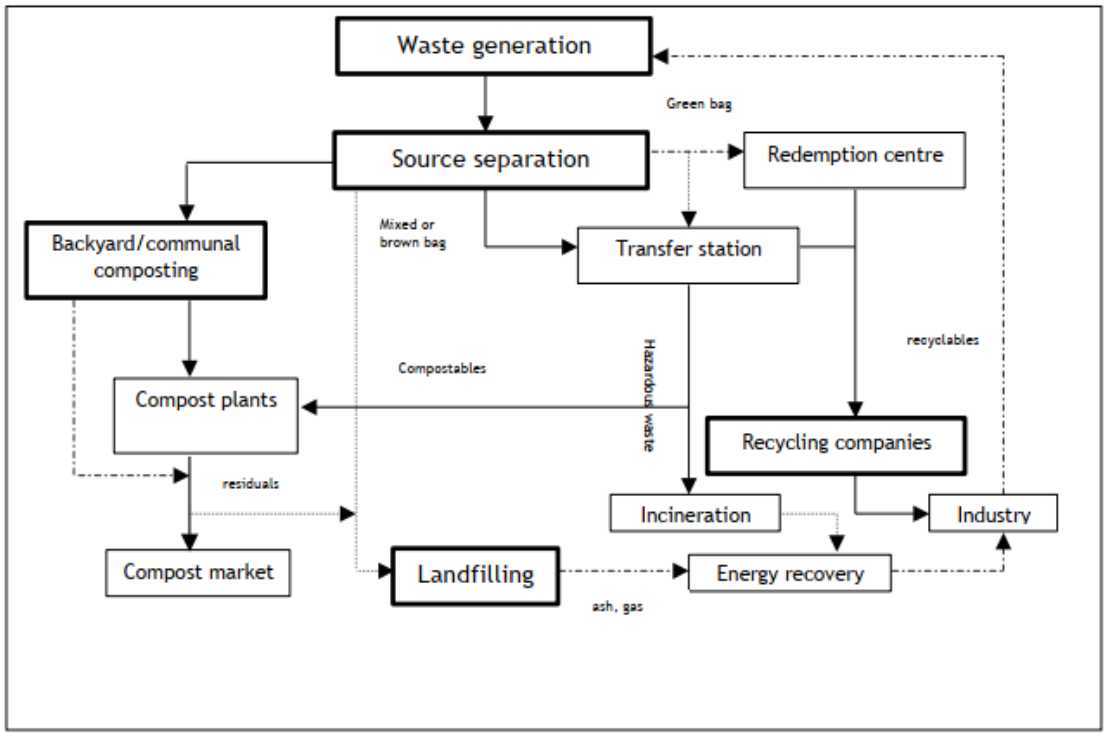

Figure1. Integrated Solid Waste Management System

However, there is a lack of research on the impact of technological innovation and technology introduction on the industrial green transformation of resource-based cities (CTCN 2020). Moreover, there is inadequate information, as well as the coordination failures amongst stakeholders in Zimbabwe with regard to the state and level of development of the CE, as well as inadequate knowledge of the players and the circular initiatives that are being developed in their respective areas, their potential benefits and existing barriers. Zimbabwe requires a national strategy for a CE that collects and systematizes experiences, defines objectives and establishes clear goals, identifies and launches promising pilot projects, and provides information on the dimension of the existing benefits and barriers with a shift on mindset (CTCN 2020).

4. Implications for stakeholders by conducting a SWOT Analysis

The interview questions also assisted in doing a SWOT Analysis so as to assess the barriers, challenges and opportunities in industrial waste management especially with regards towards a CE. It was thus important to evaluate and analyse the current challenges, opportunities and threats to the industrial waste management system in Zimbabwe by looking at the available policies. in order to come up with the appropriate management strategies and formulate policy initiatives. The SWOT analysis approach can be used to identify an organization 's strengths and weaknesses (S-W), as well as broader opportunities and threats (O-T). The method originates from a business management field but has since been broadly used in other disciplines like environmental management, for example Srivastava *et al*. (2005) used it in formulating strategic action plans for waste management in Lucknow, India. The study adopted a research method that integrated stakeholder analysis into SWOT analysis and presented a set of concrete strategic action plans for both the community and Municipal Corporation to improve solid waste management in that region (Srivastava *et al*. 2005; Yuan 2013). It has been realised SWOT Analysis ultimately gives a fuller awareness of a situation and helps with both strategic planning and decision-making. Table 2 shows a detail of the questions addressed under each factor.

Table 2. shows a detail of the questions addressed under each factor

Strength	What are the major advantages of the current waste management policies in Zimbabwe? What are the factors that could lead to a CE through IS?
Weaknesses	What are the gaps in the waste management policies? What could be improved? What is not being done properly? What can be avoided? What are the obstacles preventing progress?
Opportunities	What benefits may occur in effective waste management? Are there any possible changes to government policy related to waste management? Are there any perceived changes in the socio-economic patterns of the stakeholders?
Threats	What barriers are anticipated in the adoption of a possible CE strategy like IS? Are there any support or programmes CE implementation strategies are all relevant stakeholders willing and interested in supporting the programme?

A SWOT Analysis was carried out to identify how waste management policies fare in promoting circularity through the IS strategy. The analysis was guided by questions to experts from the Environmental management agency a regulatory Authority administering the Environmental Management Act. The respondents highlighted the Strength, Weaknesses Opportunities and Threats in waste management. Table 3 highlights the results of the SWOT Analysis. The Municipal Police has no enforcement powers yet the statutory for City of Harare for example, the officers should enforce. In the policies, the National laws give EMA powers to ensure collection of waste by local authorities but there is no penalty. Harmonization is needed as well as aligning to the constitution

Table 3. The results of the SWOT Analysis

WEAKNESSES	**STRENGTHS**
No incentives for sustainable resource utilisation Inadequate waste management and recycling infrastructure Recyclers may prioritise economic gains ignoring the environmental and social aspects No harmonisation of waste management policies with CE strategies	Incentives for green manufacturing Recyclers already exist and willing to expand Ongoing efforts by relevant stakeholders to establish and enhance an EPR Industrial e-waste management plan already exists Redesigning of products to ease material dismantling and recycling processes
THREATS	**OPPORTUNITIES**
Insufficient resources or political will to enforce legislation Inadequate investments policies on research and development for technology innovation that support CE Threat to continuity as a result of lack of involvement by end-of-life consumers	Transition from linear to CE is already a global concern Business and job creation opportunities Waste from one industry may be used as a resource by another (IS) Waste disposal expensive than recycling and reuse costs

Conclusion

The concept of CE is about sustainable resource management and unlocking the opportunity of a CE requires interfacing with the implementation of policies that provide for the implementation of strategies like IS. Transitioning to a circular economy will require a systems approach combined with a depth of sector. The circular economy requires a change in mindset as all stakeholders do not participate in policy formulation therefore leading to the ineffectiveness of waste management regulations in implementing CE strategies. Furthermore, application of awareness Programmes on CE should not highlight more on the penalties but the incentives that come with employing CE strategies like IS. Moreover, the gaps in the existing waste management regulations can be closed by developing inventories of synergies so that industry may adopt IS.

Recommendations

- Multi- stakeholder engagement and developing partnerships is crucial in adopting and implementing policies and strategies that promote a CE
- Standardisation. This will allow for accurate benchmarking and target setting for stakeholders concerned.
- There is need for the central and local government to invest in a concerted and enduring effort to support CE Create an enabling policy and legal framework which promotes multi-stakeholder participation and development incentives for organisations that are implementing CE strategies
- Review regulatory frameworks to support recycling markets and promote waste recycling through enforcement of existing Statutory Instruments on industrial waste management.
- Introduce incentives and subsidies that promote investment in solid waste recycling enterprises and facilities.
- Create a Green Fund in which the banks, private sector and development partners can contribute funds towards solid waste recycling and provide innovative funds and seed money for developing innovative waste
- recycling ideas.

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Biography

Petronella Nyakudya is currently a PhD candidate of Engineering Management, University of Johannesburg. Her research interest is on Industrial Symbiosis for the management of Industrial Waste and Circular Economy. A holder of a Master of Science in Environmental Management from the University of Johannesburg and a Bachelor of Environmental Science Honours Degree in Pollution Science from Bindura University. She has more than ten years of work experience in Environmental Management, Occupational Health and Safety and possesses advanced practical and technical knowledge in SHEQ Management, Education, Training and Sustainability studies, recycling and public conservation projects and corporate sustainability reporting. She advocates for the development and implementation of efficient, integrated SHEQ programs SHE initiatives and applying research to create effective sustainability projects.

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Dr. Nkosinathi Madushele is a Senior Lecturer in the Department of Mechanical Engineering Science and Co-Director of the Biomedical Engineering and Healthcare Technology (BEAHT) Research Centre at the University of Johannesburg. Dr. Madushele is a professionally registered engineer, with the Engineering Council of South Africa (ECSA), and he has worked in Industry as well as Academia. His research interests are in renewable energies modelling from both a Cycle Assessment (LCA) perspective, as well as from an Intelligent Systems Modelling perspective. His involvement in BEAHT serves to incorporate engineering technology