# Evaluating training of Gauteng reclaimers in repairing and refurbishing small WEEE appliances

**Mbali Zwane, MSc Environmental Management**
University of Johannesburg Department of Geography
Environmental Management & Energy Studies
South Africa

# Outline

- Background
- Reclaimers in the WEEE value chain
- WEEE & the circular economy
- WEEE Opportunities
- Needs Assessment
- Methodology
- Results
- Concluding remarks
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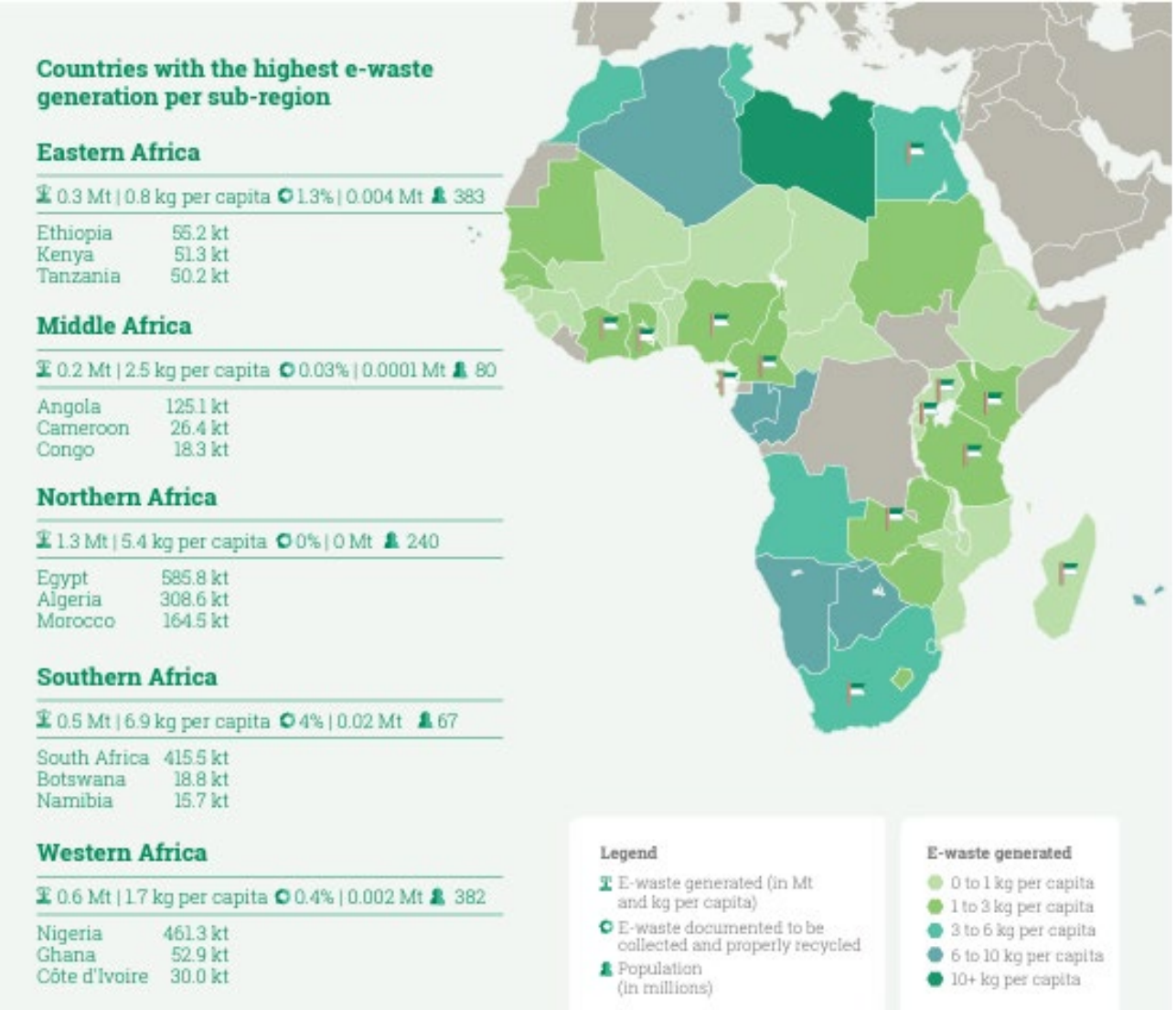
# Background

- The rate of WEEE generation expected to increase drastically in several African countries than in most developed countries.
- Concern around infrastructure and legislative requirements for managing WEEE in an environmentally friendly manner.




Godfrey et al., 2019; Forti et al. 2020

# South Africa

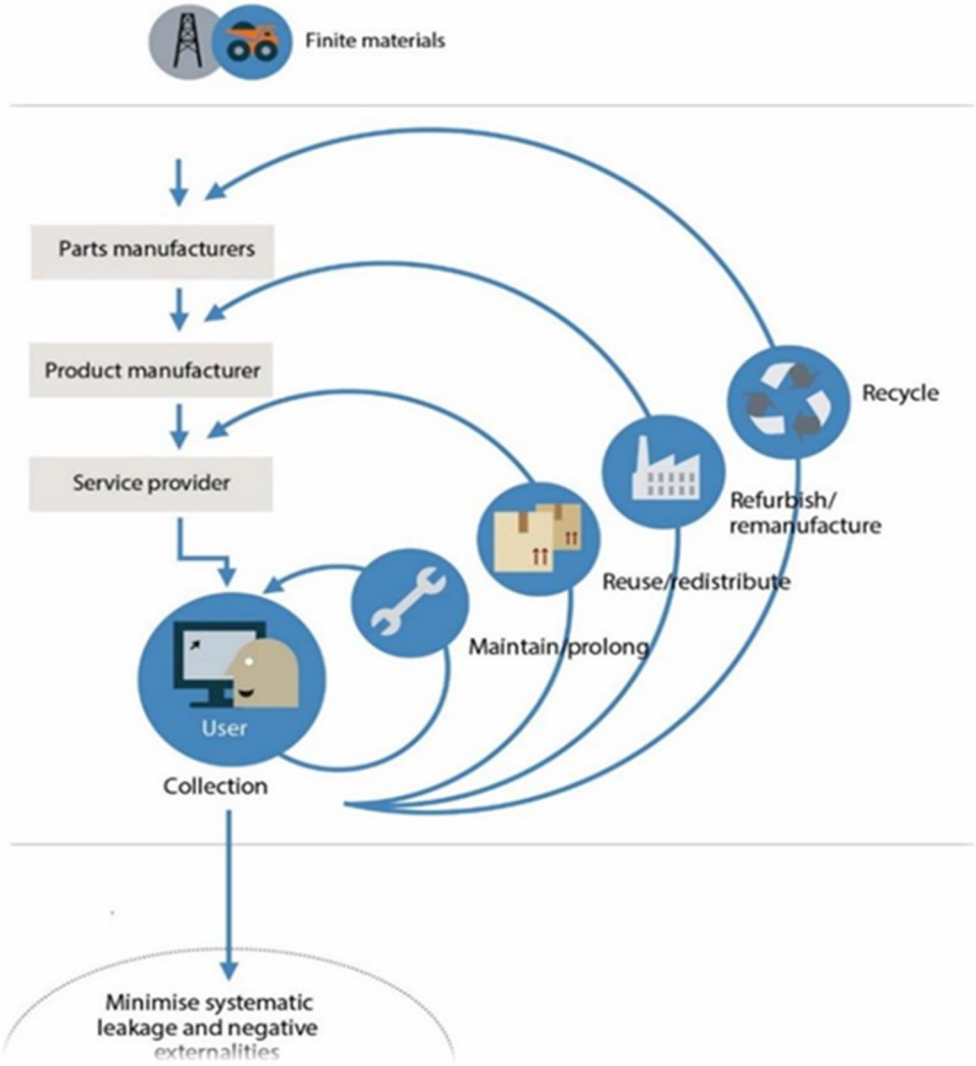
- SA considered the leading country in Sub-Saharan Africa in effective management of WEEE (Tetteh & Lengel, 2017).
- South Africa has variable statistics on WEEE generation:
  - 74 923 tonnes (t) of WEEE were generated in 2015, with a collection and recycling rate of 11.0% (Lydall et al., 2017).
  - 300 000 t of WEEE generated in 2017, at a collection and recycling rate of 10.0% (DEA, 2018).
  - 415 500 t of WEEE was generated in the country in 2019 (Forti et al., 2020).
- Lack of comprehensive legislation and database for WEEE coupled with the lack of infrastructure and the presence of the informal sector (Waste Reclaimers) (Maphosa & Maphosa)

# Reclaimers in WEEE Value Chain

- Reclaimers collect WEEE along with other materials (plastic, paper, cardboard's, textiles etc.) for reuse, repurpose or recycling.
- Access to WEEE due to a lack of accessible information on how to dispose used and unwanted electronics (Maphosa & Maphosa).
- Engage in the initial stages of the value chain (Collecting, sorting, dismantling, processing and sometimes repairing)
- Untrained personnel and vulnerable members of society unaware of the environmental and health risks associated with their operations using methods detrimental to health and the environment (Asante et al., 2019).
- Using methods such as open burning to extract copper of cables or dismantling the WEEE using hands or outdated tools that cause bodily harm (Tetteh & Lengel, 2017; Godfrey et al., 2019).

# WEEE & the Circular Economy

- Manufacturing of EEE necessitates the use of the earth's finite natural resources; many rare and valuable resources are used and disposed of every year (Veit & Bernardes, 2015).
- There is a need to keep the EEE circulating in the system, to reduce dependency on virgin materials and reduce the disposal of waste.
- Implementing circular economy (CE) principles aim to eliminate waste and pollution, circulate resources, and regenerate nature.
- CE aims to restore old products, their parts, and materials to their original and intended use, using very few resources to provide the same function.



# WEEE Opportunities

- Unemployed youth and adults in developing countries often work as waste pickers to earn income through waste
- Implementing CE principles in WEEE management offers opportunities such as employment amongst others
- WEEE recycling has the potential to be an important employer as 25 jobs can be created for every 1000 tonnes of WEEE managed (Lydall et al., 2017).
- The repair and refurbishment of WEEE offer superior margins to those offered by recycling activities (Manjengwa, 2019); SMEs conducting recycling activities had to incorporate refurbishment since a significant portion of their revenue (60.0%) was issued from refurbishment rather than from dismantling for recycling.
- Establish and encourage a second-hands goods market and culture.

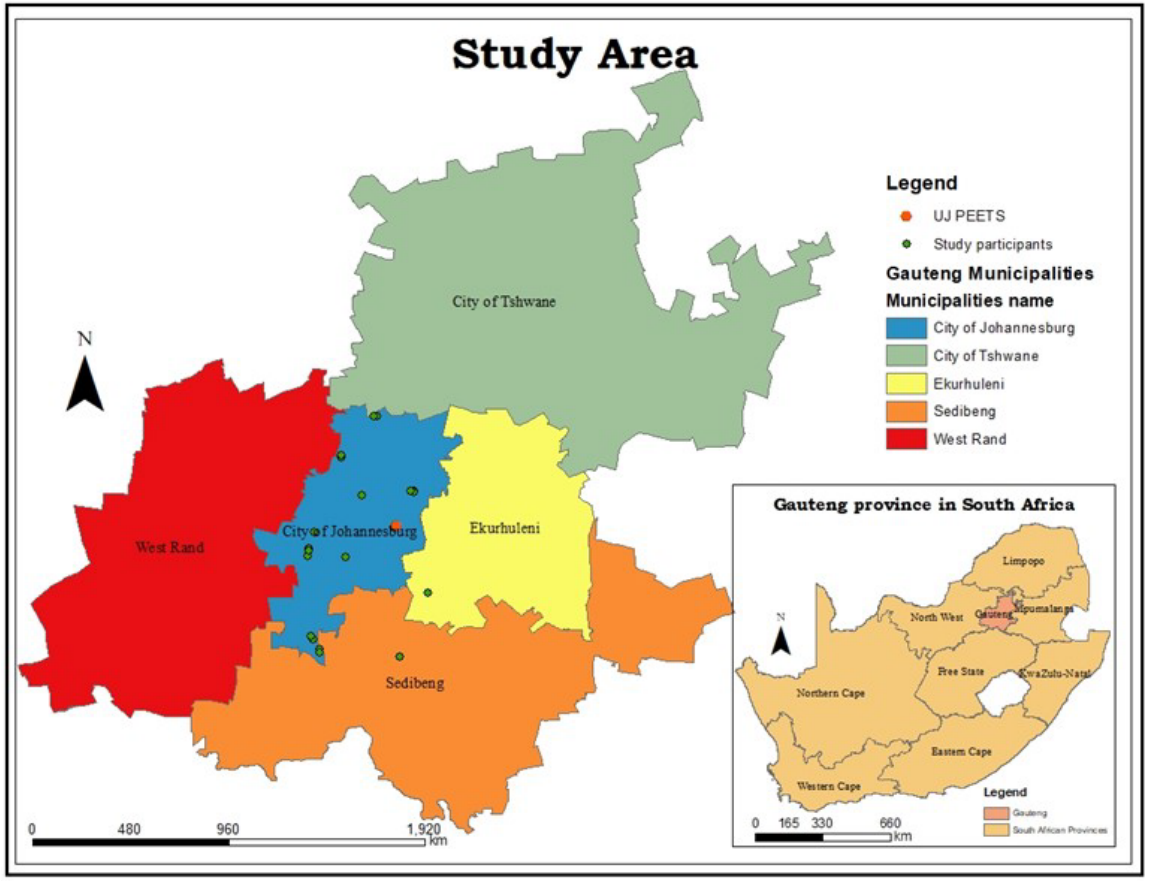
# Needs Assessment- Schoeman & Ramutanda

- The DEA (2016) report on waste pickers and the guidelines developed for the integration of waste pickers (DEFF & DST, 2020) both emphasized the importance to up-skill waste pickers and that municipalities should provide training for waste pickers
- Conducted a study in the Greater Johannesburg area to determine operations and skills requirements of active reclaimers in the WEEE value chain.
- Three-quarters of the reclaimers (75.0%) indicated that they do the repair themselves for personal use or to sell
- More than half of the respondents were very willing to be trained on the repair and refurbishment of WEEE.

| Recommendations | % responses |
|---|---|
| Information, education and awareness | 43.3 |
| Provide PPE | 11.2 |
| Provide jobs | 8.2 |
| More bins | 7.5 |
| More e-waste recycling facilities | 7.5 |
| Equipment | 6.7 |
| Fine non-recyclers | 3.7 |

# Methodology

- Research design: mixed method approach
- Data collection: Face-to-face questionnaire survey and participant observation
- Sampling methods and study population: Purposive and snow balling sampling
- Data analysis:
  - Descriptive statistics
  - Inferential statistics
  - Thematic analysis
  - Kirkpatrick's model of evaluation
- Problems encountered: Organising training & study participants



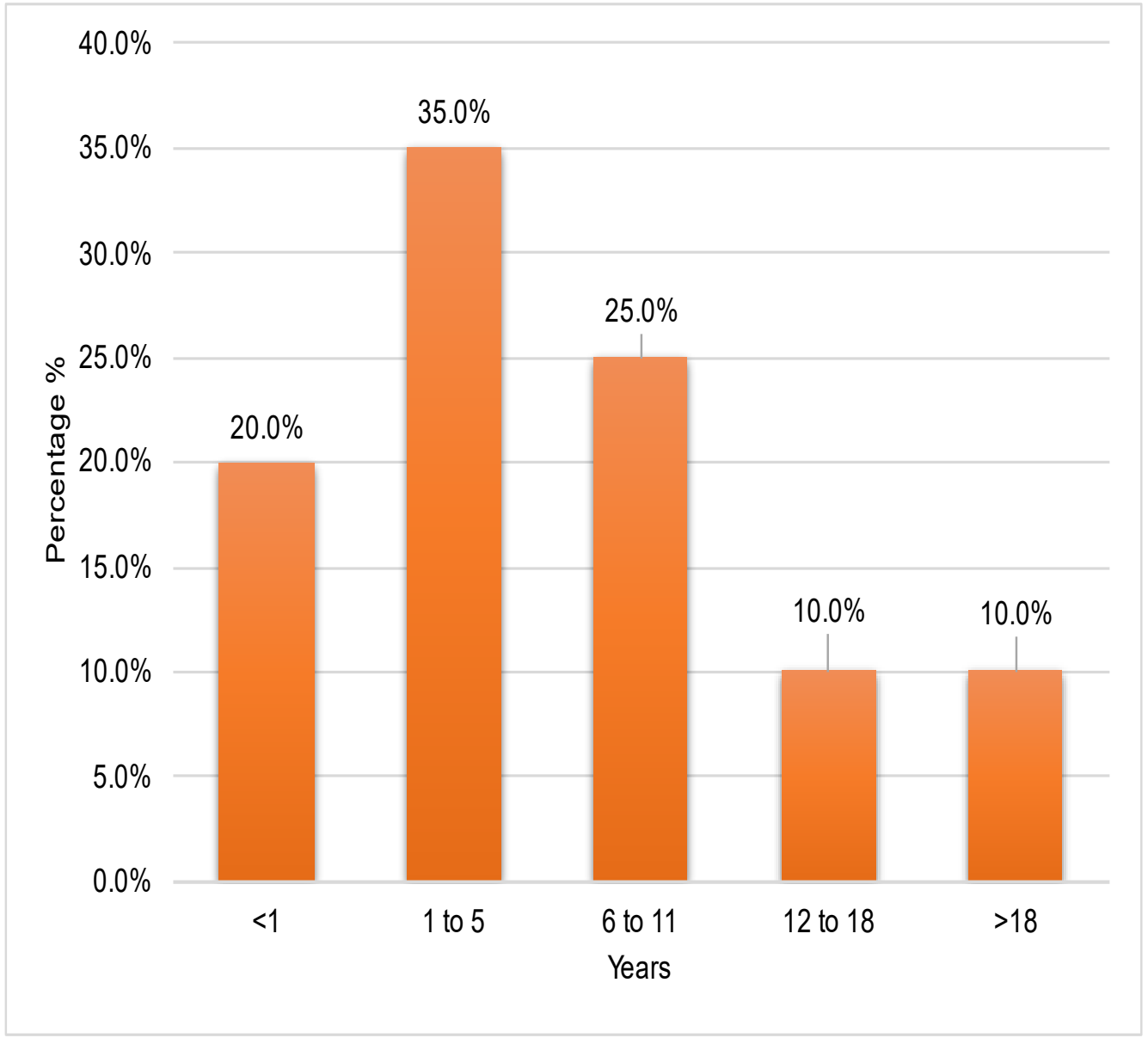
# Results

- Waste reclaiming is a strenuous job expected to be dominated by males as they have greater physical strength than females
- The representation of gender distribution in this study could be attributed to the nature of the training opportunity.
- Contrasting results in terms of nationality –this might be due to Covid restriction & undocumented foreign nationals do not participate in studies

| Demographic | Class | First training | Second training | Percentage |
|---|---|---|---|---|
| Gender | Female | 2 | 9 | 55.0% |
| | Male | 7 | 2 | 45.0% |
| Language | English | 3 | 1 | 20.0% |
| | Sesotho | 1 | 1 | 10.0% |
| | IsiZulu | 2 | 5 | 35.0% |
| | Setswana | 1 | 0 | 5.0% |
| | IsiXhosa | 1 | 2 | 15.0% |
| | SiSwati | 0 | 1 | 5.0% |
| | Tshivenda | 0 | 1 | 5.0% |
| | Shona | 1 | 0 | 5.0% |
| Country of origin | South Africa | 6 | 10 | 80.0% |
| | Lesotho | 1 | 1 | 10.0% |
| | Zimbabwe | 2 | 0 | 10.0% |
| Level of education | Completed some primary | 0 | 0 | 0.0% |
| | Completed primary | 0 | 1 | 5.0% |
| | Completed some high school | 4 | 4 | 40.0% |
| | Completed matric | 3 | 4 | 35.0% |
| | Post-matric qualification | 2 | 2 | 20.0% |
| Municipality | City of Johannesburg | 8 | 10 | 90.0% |
| | MidVaal | 1 | 0 | 5.0% |
| | Ekurhuleni | 0 | 1 | 5.0% |

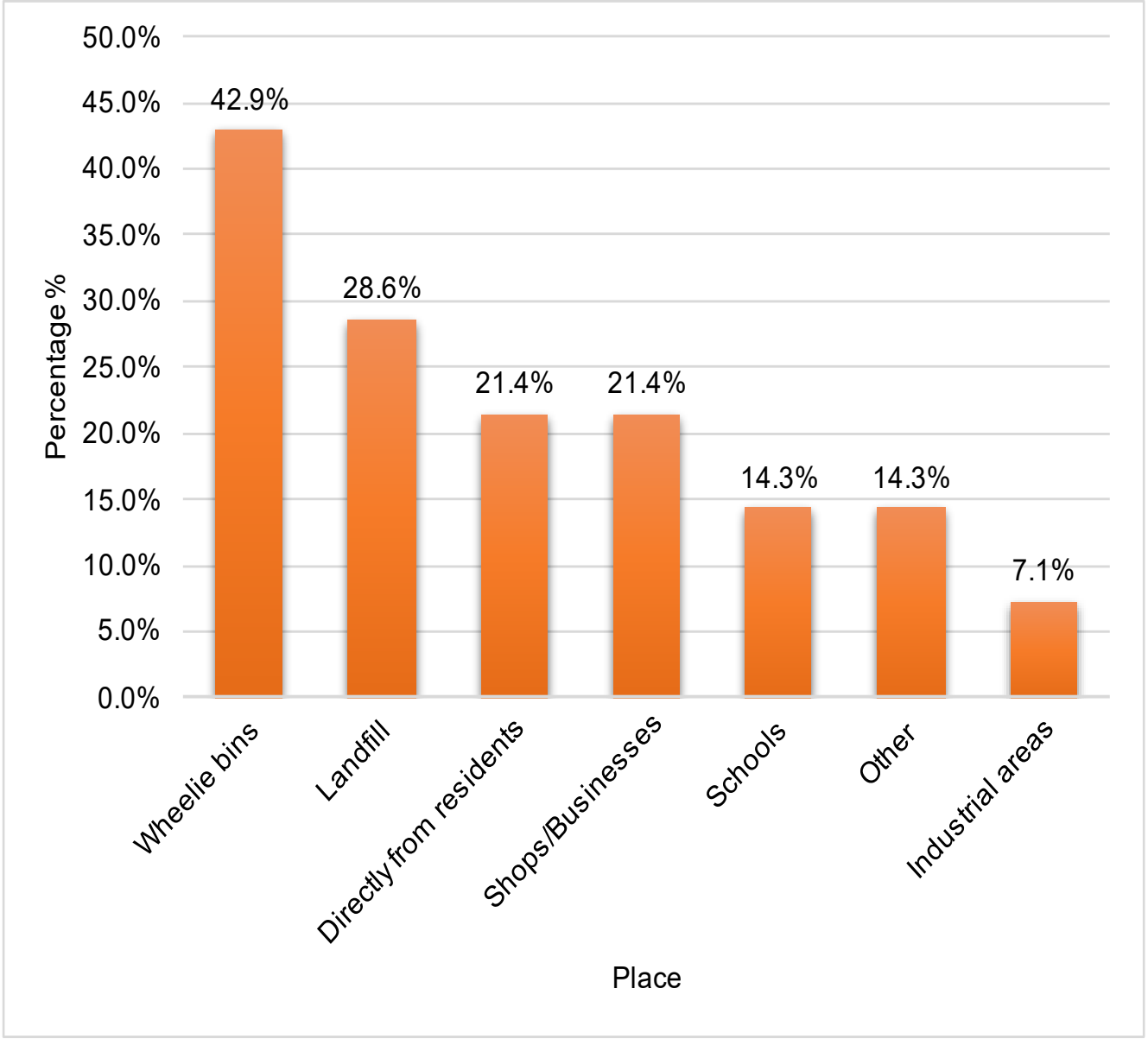
# Results

- The results indicated that the older generation of reclaimers started operating while they were still young and that they had accumulated more than 18 years of experience in the sector.
- Validating that children are also involved in reclaiming activities.
- One such reason is high youth unemployment
- A small proportion (30.0%) of the respondents indicated that they do not collect WEEE, while the majority (70.0%) do



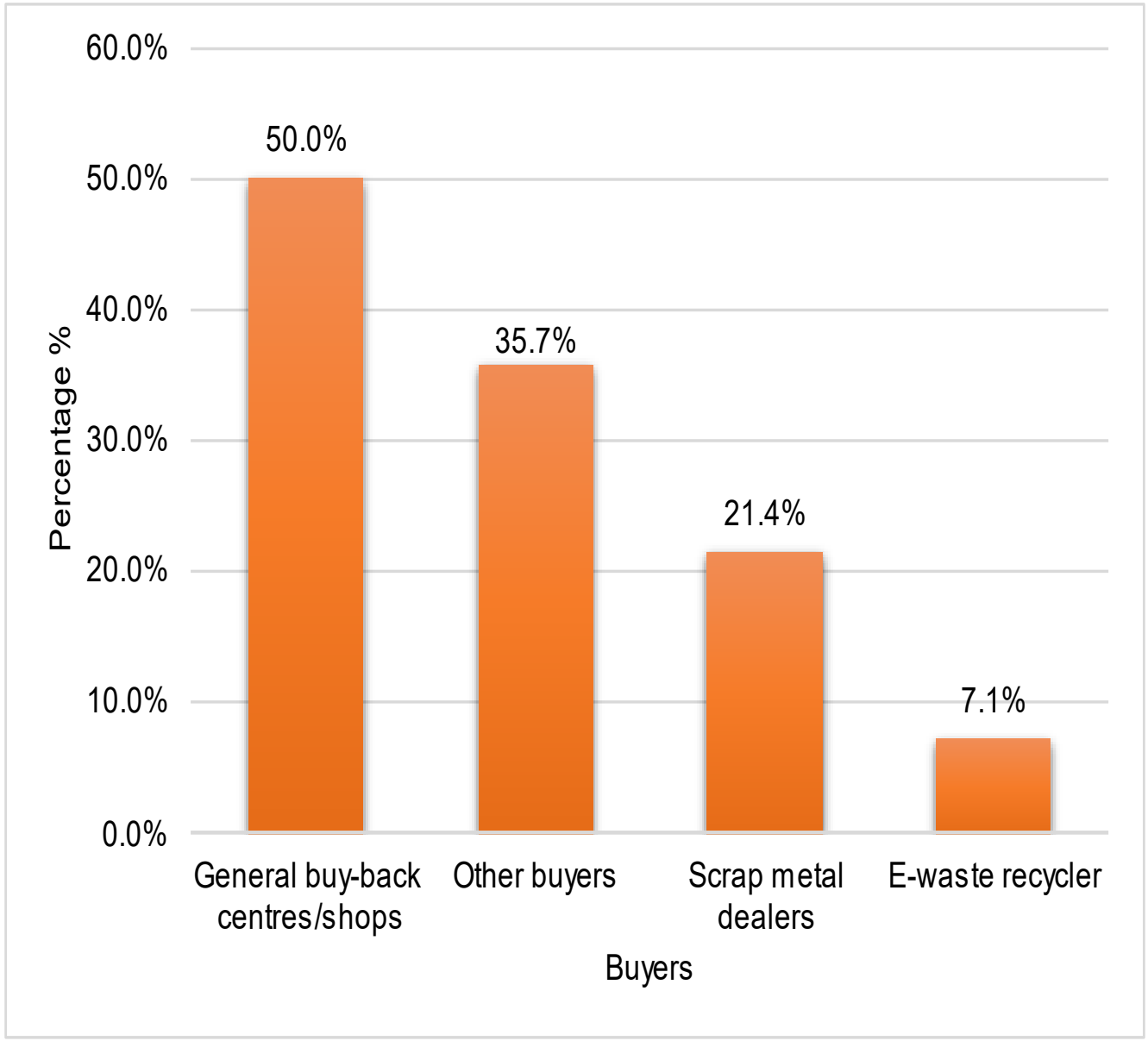
# Results

- Reclaimers collect any recyclables that they come across at various places.
  - Wheelie bins outside residential areas and landfill sites were the most common places, with 42.9% and 28.6% of reclaimers collecting from these places
- A small proportion (30.0%) of the respondents indicated that they do not collect WEEE, while the majority (70.0%)
- Small appliances such as kettles, irons, microwaves, heaters, and stoves, together with cables, are the most prevalent among the items collected



# Results

- General buy-back centres (50.0%) were found to be the most common places where reclaimers sold their WEEE. It was interesting to note that only a small proportion of the respondents sold to WEEE recyclers
- If repairable, some of the WEEE is repaired and then sold to consumers; some sell the WEEE to consumers that buy the WEEE for its parts to fix their EEE (represented as category 'other').



# Results

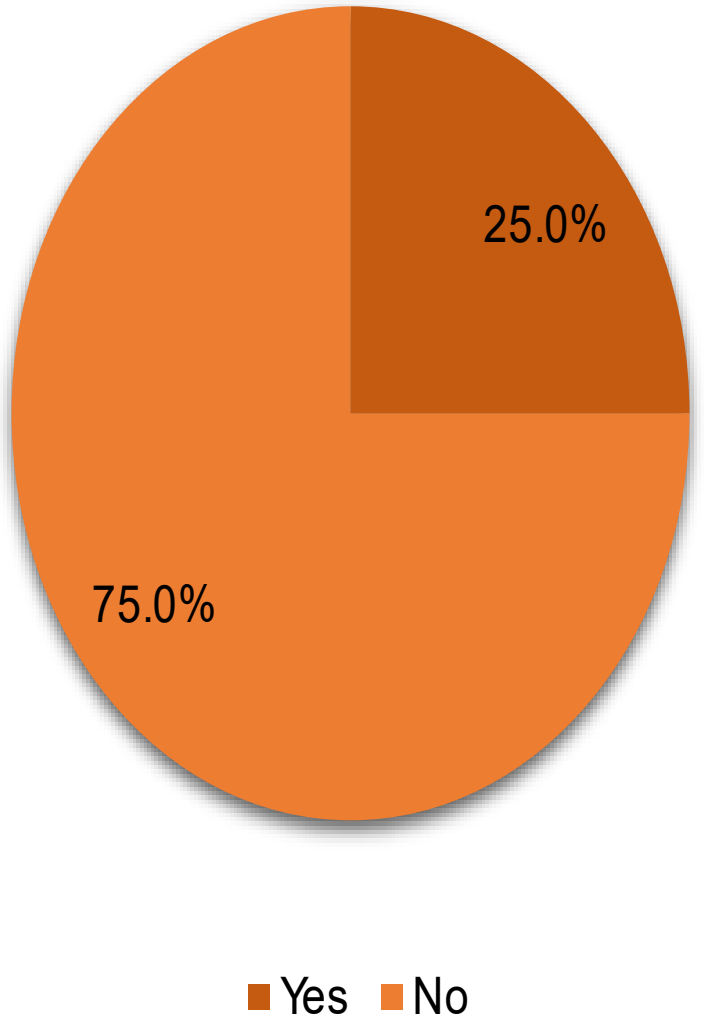
- The reclaimers (64.3%) that engage in the processing and dismantling of WEEE were asked to indicate whether they engaged in processing or dismantling only or both processing and dismantling.
- Most (55.6%) of the reclaimers engaged in both processing and dismantling WEEE, followed by those that only dismantled their WEEE (33.3%).

| Process | Dismantle | Both |
|---|---|---|
| 11.1% | 33.3% | 55.6% |

- The results of the study also indicated that the those who dismantle their WEEE use their hands and tools, such as hammers and screwdrivers, to carry out the process. While the most common method to process the WEEE is by burning.

# Results

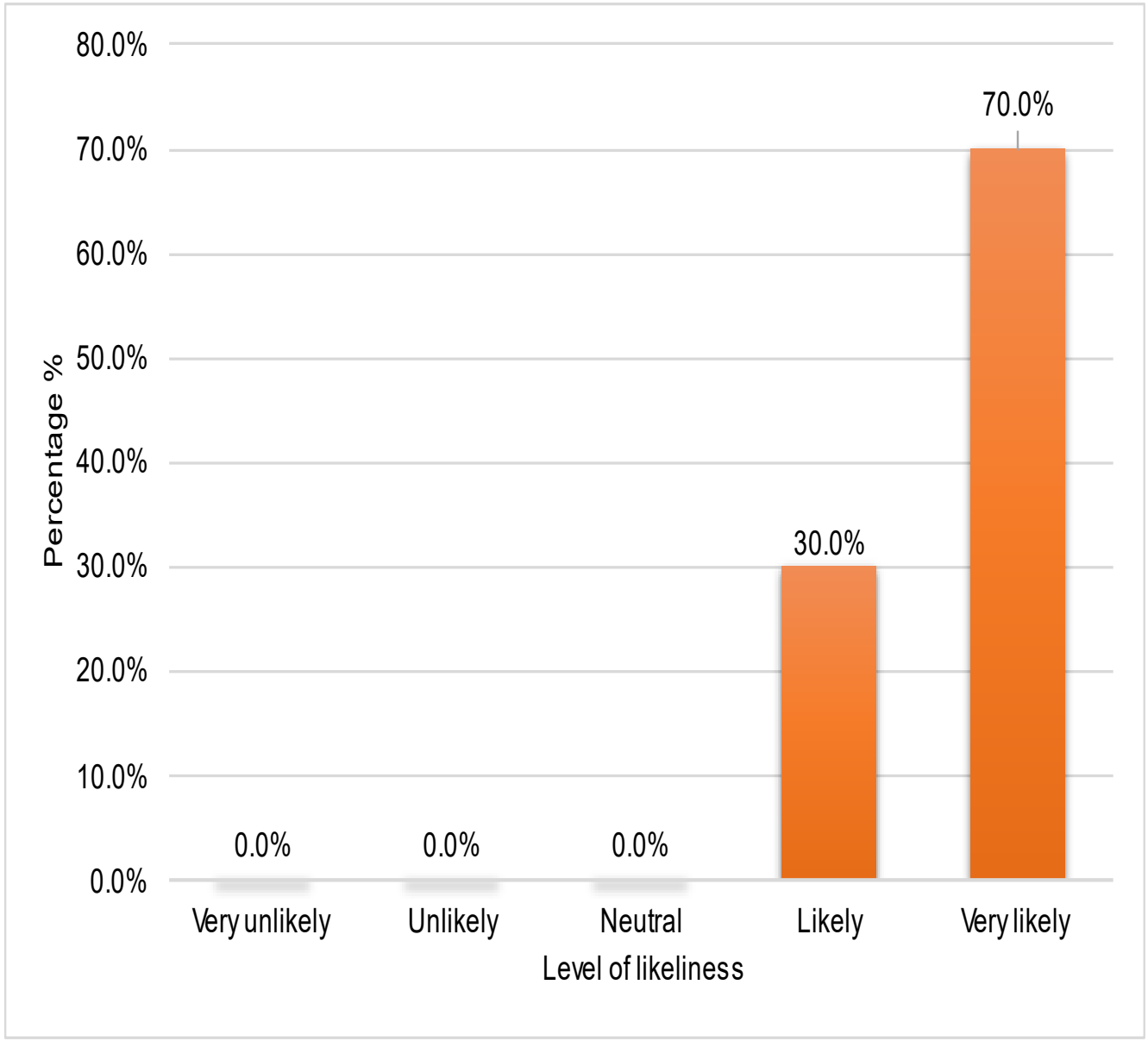
- Only a small portion of the reclaimers have repairing experience
  - Repair various small appliances, cell phones and IT components.
- Only two of the reclaimers indicated that they had received training in repairing WEEE.
  - One received training from a colleague at their previous place of employment, and the other from an educational institute.
- The remainder of the respondents were either self-taught or had observed the work of someone else.




Experience in repairing and refurbishing WEEE

# Results

- The results show that 70.0% and 30.0% of the participants were very likely and likely, respectively, to apply the acquired skills in their daily lives.
- All the reclaimers were willing to recommend the training to their colleagues.
  - "*To change how other reclaimers think about waste, particularly WEEE*".
  - "*To allow others to learn the skills I learnt and possibly collaborate in the future to open our WEEE repair shop*".



# Results

- The participants were asked to evaluate their overall training experience. The results indicated that all of them expressed that the training had been worth their while as they had acquired new knowledge and skills.
  - *“The training improved my skills in repairing WEEE. I learnt to fix WEEE such as microwaves and blenders and how to dispose of the components I do not need without harming the environment”.*
  - *“It taught me about the circular economy and how to treat WEEE in a manner that is safe for me and the environment”.*
  - *“I was exposed to tools such as a multimeter, which I did not know and use when repairing, and how to be safe when handling WEEE”.*
  - *“I learnt that selling repaired and refurbished WEEE will increase my income rather than when I sell some parts of it”.*
  - “*The training equipped me with skills and knowledge on repairing and making appliances look new after fixing them, so I can continue contributing to recycling and reusing”.*

# Results

- Trainers are an essential part of ensuring that training sessions are a success.
- *“I was very impressed with the techniques the trainers used during the training; I wish I could attend more training sessions conducted by them”.*
- *“The trainers were very nice and welcoming, made everyone comfortable to ask questions, and responded effectively”.*
- *“The trainers were very efficient and did their utmost best to ensure that we understood the daily tasks".*

| Statements | Strongly disagree | Disagree | Neutral | Agree | Strongly agree |
|---|---|---|---|---|---|
| Created a safe and respectful environment | 0.0% | 0.0% | 0.0% | 35.0% | 65.0% |
| Engaging and responded to questions | 0.0% | 0.0% | 0.0% | 30.0% | 70.0% |
| Related learning to what is relevant to trainees | 0.0% | 0.0% | 5.0% | 50.0% | 45.0% |
| Enabled trainees to be fully engaged in learning | 0.0% | 0.0% | 0.0% | 35.0% | 65.0% |
| Patient with trainees and facilitated their learning | 0.0% | 0.0% | 0.0% | 25.0% | 75.0% |
| Incorporated adequate practice and repetition | 0.0% | 0.0% | 0.0% | 50.0% | 50.0% |
| Trainers used various learning methods | 0.0% | 0.0% | 0.0% | 45.0% | 55.0% |
| Allocated their time effectively | 0.0% | 0.0% | 0.0% | 45.0% | 55.0% |

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| Allocated their time effectively | 0.0% | 0.0% | 0.0% | 45.0% | 55.0% |

# Results

- Rating competency levels in learning areas and in repairing and refurbishing certain WEEE items before and after the training using the following key:

1 -No level of competence - no knowledge in the skill area

2 -Low level of competence - little knowledge and skill in the area

3 -Average level of competence - some knowledge and skill in the area

4 -Moderately high level of competence - good knowledge and skill in the area

5 -High level of competence - extensive knowledge and skill in the area

| Area | Level of competency (%) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Before the training | | | | | After the training | | | | |
| | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| Value of e-waste | 30.0 | 35.0 | 30.0 | 0.0 | 5.0 | 0.0 | 5.0 | 5.0 | 5.0 | 85.0 |
| South African legislation on WEEE | 55.0 | 20.0 | 15.0 | 10.0 | 0.0 | 0.0 | 5.0 | 15.0 | 20.0 | 60.0 |
| The use and need of PPE | 25.0 | 5.0 | 15.0 | 15.0 | 40.0 | 0.0 | 0.0 | 0.0 | 5.0 | 95.0 |
| Good and bad practices in handling WEEE | 55.0 | 20.0 | 15.0 | 5.0 | 5.0 | 0.0 | 0.0 | 5.0 | 0.0 | 95.0 |
| Identify different electrical components | 40.0 | 20.0 | 35.0 | 5.0 | 10.0 | 0.0 | 5.0 | 0.0 | 10.0 | 85.0 |
| Knowing and using the correct tools for dismantling, repairing etc. | 40.0 | 20.0 | 25.0 | 10.0 | 5.0 | 0.0 | 0.0 | 0.0 | 10.0 | 90.0 |
| Soldering and testing equipment | 80.0 | 15.0 | 5.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.0 | 80.0 |
| Repairing and refurbishing a kettle | 60.0 | 15.0 | 15.0 | 5.0 | 5.0 | 0.0 | 0.0 | 0.0 | 15.0 | 85.0 |
| Repairing and refurbishing a blender | 85.0 | 10.0 | 0.0 | 5.0 | 0.0 | 0.0 | 0.0 | 5.0 | 15.0 | 80.0 |
| Repairing and refurbishing a toaster | 85.0 | 5.0 | 5.0 | 5.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.0 | 75.0 |
| Repairing and refurbishing a heater/microwave | 75.0 | 15.0 | 5.0 | 5.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.0 | 80.0 |

# Results

- The Wilcoxon signed rank test was used to determine the significance of the difference between the before and after training self-evaluation results.
- The test indicated that the results were statistically significant with a p-value of 0.01 at an α=5 level.

| Area | Level of competency (%) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Before the training | | | | | After the training | | | | |
| | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
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| Repairing and refurbishing a heater/microwave | 75.0 | 15.0 | 5.0 | 5.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.0 | 80.0 |

# Concluding remarks

- WEEE poses a danger to the environment and human health if not handled properly, however, if properly managed it presents several opportunities such as reduction in environmental pollution, greenhouse gas emissions and waste diversion from landfill, job creation, and reduction in the use of virgin resources for manufacturing.
- The informal sector is an important role player in waste management, taking various roles within the WEEE value chain such as collection, transportation, dismantling, processing and repairing often with little to no knowledge of how to handle it in a proper manner.
- The waste picker integration report by the DSI & DFFE highlighted the importance of skills improvement and training for waste pickers which influenced the need to conduct the study.
- The results show that the trainees benefited from the training and improved their knowledge and skills on WEEE management as well as its repair and refurbishment, respectively

# Acknowledgements


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Institute of Waste Management of Southern Africa

**Mbali Zwane, MSc Environmental Management**
University of Johannesburg Department of Geography
Environmental Management & Energy Studies
South Africa