Leveraging Industry 4.0 Technologies for Construction and Demolition Waste Management in South Africa

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Introduction & Background

- C&DW forms 40% of global solid waste.
- SACI faces growing waste & sustainability pressure.
- Conventional approaches are inadequate.
- Study explores I4.0 adoption for C&DW in SA.

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Aim, Objectives, and Scope

Aim:

- Assess use of I4.0 for C&DW management in South Africa.

Objectives:

- Identify relevant I4.0 tools.
- Measure adoption levels.
- Highlight barriers & enablers.
- Recommend improvement strategies.

Scope:

- C&DW management in South Africa

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Research Design and Methodology

- Quantitative approach
- Likert-scale questionnaire with 102 valid responses.
- Simple random sampling
- Construction professionals
- MIS, SD, t-test analysis.
- Cronbach's alpha = 0.94

Results (1)

- **Top Adopted I4.0 Tools**

Technology	Mean	t-value	Sig. (1-tailed)
GIS	4.29	7.576	<0.001
GPS	4.19	6.269	<0.001
IIoT	3.99	4.220	<0.001
UAVs	3.87	3.405	<0.001
Cloud Computing	3.85	2.998	0.002

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Results (2)

- Low/insignificant adoption

Technology	Mean	Sig.
Mixed Reality	3.64	0.127
AI	3.60	0.198
Blockchain	3.57	0.267
Digital Twin	3.38	0.129
Robotics	3.08	<0.001 (negative t)

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Discussions

- Tiered adoption
- Driven by practicality & affordability.
- Hindered by cost & skill gaps.
- Leverage existing strengths (GIS, GPS).
- Launch pilot projects & incentives.
- Strengthen training & collaboration.

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Conclusions & Recommendations

- I4.0 enables efficient, data-driven waste management.
- Adoption remains uneven but progressing.
- Policy & training support.
- Pilot projects and industry partnerships.

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