

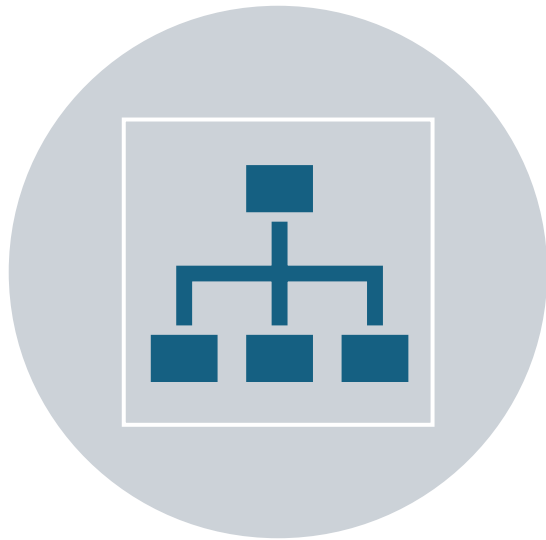
A close-up photograph of a person's hand dropping a green plastic bottle into a yellow recycling bin. The bin is partially filled with other plastic bottles. The background is blurred, showing more of the recycling area.

Drivers and Challenges for Recycling:

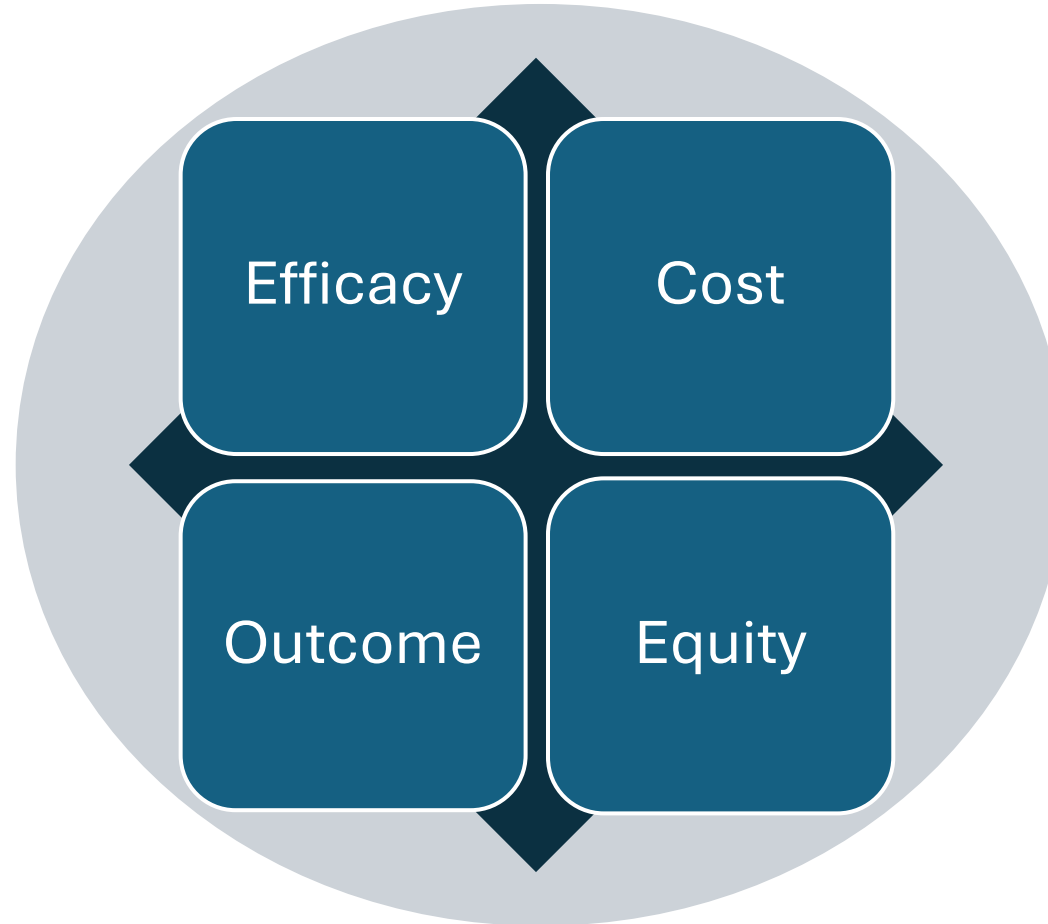
Arizona and Hawaii as case studies

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Overarching Considerations



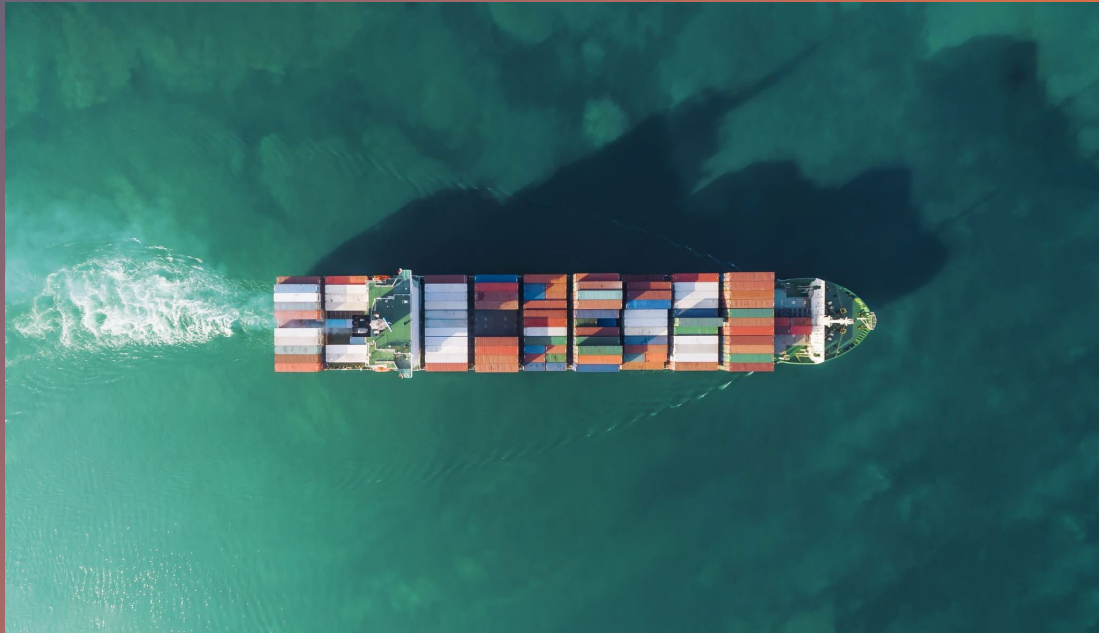
SYSTEM-WIDE
APPROACH



CONSIDER ALL DIMENSIONS



INCLUDE ALL
STAKEHOLDERS



On Cost

- Cost-effectiveness is critical
- Sparse literature
 - Key costs often omitted
 - Typically, retrospective
 - Only cost for implementer

Net Cost Equation

Net cost = (direct costs + indirect costs + non-monetary costs) –
(recovered costs + monetary benefits + non-monetary benefits)



Decision Framework

Intervention:

Objective:

Scale:

Stakeholders	Action and direct costs	Indirect costs	Recovered cost	Monetary benefits
→				
→				
Nonmonetary costs ^b				
Nonmonetary benefits ^b				
Equity:				

Murphy et al. (2022b). A decision framework for estimating the cost of marine plastic pollution interventions. *Conservation Biology*, 36(2), e13827.

Arizona



- Policy chair of Circular Arizona
(Previously Arizona Recycling Coalition)
- Publication: Murphy, E. L., Bernard, M. L., Helm, L., Hill, I., & Tuñas-Corzón, Á. (2020). Policy Recommendations to Reinvigorate Recycling in Arizona. *Journal of Science Policy & Governance*, 17(1).

Stakeholders

Government: ADEQ, Legislature, Maricopa Association of Governments, White Mountain Apache Tribe, Cities (Payson, Tucson, Phoenix, Kingman, Tempe)

2) Recycling businesses in the recycling sector: GlassKing, Resinate, Recycled City, Republic Services

3) Non-recycling businesses: Central Arizona Project, Mortensen, Wells Fargo, Crescent Crown, LocalFirst, Arizona Food Marketing Alliance;

4) Non-profit organizations: CHISPA, Azulita Project, Goodwill AZ, WasteNot, Arizona Forward, and Circular Arizona

5) Academia: Arizona State University

Recycling in Arizona

Locale	Population	Materials recycled	Collection	Description
<i>Phoenix</i>	1,660,272	Plastic (1,2,5), Glass, Cardboard, Paper, Glass, Metal	Single-stream, Curbside	City collects waste and contracts with a private company who sorts and sells. City owns their own capital assets (transfer station, MRF, equipment).
<i>Tucson</i>	520,116	Plastic (1-7), Glass, Cardboard, Paper, Metal	Single-stream, Curbside	City collects waste and brings it to Republic Services' MRF, who sorts and sells waste.
<i>Flagstaff</i>	73,964	Plastic (1,2), Glass, Cardboard, Paper, Metal	Single-stream (excl. glass), Curbside	City collects waste, brings glass to Strategic Materials, and the rest to privately-owned MRF.
<i>Casa Grande</i>	55,477	None	N/A	Cancelled program in July 2019 due to transport costs and decreasing profits
<i>Sierra Vista</i>	42,912	None	N/A	Cancelled program in 2020 due to transport costs and decreasing profits after switching to single-stream, drop-off
<i>Prescott</i>	39,843	Plastic (1,2), Glass, Cardboard, Paper, Metal	Single-stream, Curbside	Commingled recyclables are collected by the city and transported to Phoenix MRF.

<i>Kingman</i>	28,068	Plastic (1,2), Glass, Cardboard, Paper, Metal	Pre-sorted, Drop-off	City transports paper and glass to Las Vegas (Republic Service and Strategic Materials) and metal and plastic to a privately-owned, local MRF.
<i>Nogales</i>	20,188	None	N/A	Cancelled due to high costs
<i>Somerton</i>	16,120	Plastic (1-7), Glass, Paper, Cardboard, Glass, Metal	Single-stream, Curbside	City collects waste. Inmates sort waste. City stores waste until it can be sold in bulk.
<i>Payson</i>	15,520	None	N/A	Cancelled in 2019 due to too high contamination rates.
<i>Sedona</i>	10,336	Plastic (1-7), Glass, Cardboard, Paper, Metal, Styrofoam	Pre-sorted, Drop-off	Sedona Recycles (501c3) collects and processes waste and sells to U.S.-based companies.
<i>Bisbee</i>	5,575	Plastic (1,2), Glass, Cardboard, Paper, Metal	Pre-sorted, Drop-off	City collects waste, brings glass to Strategic Materials, and the remaining materials to Tucson.
<i>Holbrook</i>	5,053	None	N/A	Cancelled program because no private company found it profitable.

Arizona Statutes

Statute	Description
A.R.S. 49-703 ‘Joint operation’	Permission for municipalities to partner with other municipalities or the private sector to collect, process, or sell recyclables
A.R.S. 49-746 ‘Private enterprise recycling and solid waste management; definitions’	Prohibition on municipalities from requiring the use of public waste management services
A.R.S. 49-836 ‘Solid waste landfill disposal fees’	Requirement of parties to pay a fee of twenty-five cents per ton of waste disposed of in each landfill
A.R.S. 49-837 ‘Recycling fund; use; advisory committee’	Half of funds from A.R.S. 836 shall fund a recycling grant program, which helps municipalities implement recycling programs and educate citizens
A.R.S. 9-500.38 ‘Prohibition on regulation of auxiliary containers; state preemption; definition’	Prohibits regulation of the sale, use or disposal of auxiliary containers (e.g., bags, food packaging, and bottles) made from any product

Table 1 : Relevant statutory laws regarding waste management and recycling in the state of Arizona

Drivers and Challenges

- Drivers: Desires for local feedstocks, jobs, environmental benefits, position AZ as sustainability leader
- Challenges: Will (stakeholder, political, industry), greenwashing, improper recycling, capacity, limited infrastructure, contamination, economies of scale, population density, commodity pricing, lack of markets, and volatility.

Drivers:

- Policy
 - Bans/taxes, Deposit refund schemes, Recycling mandates/regulations, Recycled Content laws, 'Pay as you throw', Right to repair, Data collection, Design standards, Licensing more haulers/processors
- Voluntary programs
 - Tucson glass drop-off, providing coupon books, compost bins

Drivers:

- Partnerships:
 - Hub and spoke models, Private-public partnership, private-private partnership, non-traditional partners
- Funding
 - Fees, state and federal programs, Research grants
- Education
 - K-12 and communities



Arizona glass: A success story



Stakeholders

Strategic materials
Recycling companies
City governments
Local bottlers



Keys to success

Local processing
Community buy-in
Clean waste
Local market



Outcomes

Reduced costs
Increased value
Increased feedstock
More glass recycling



Hawai'i

- Research on plastic leakage and waste management in Hawai'i

Hawai'i

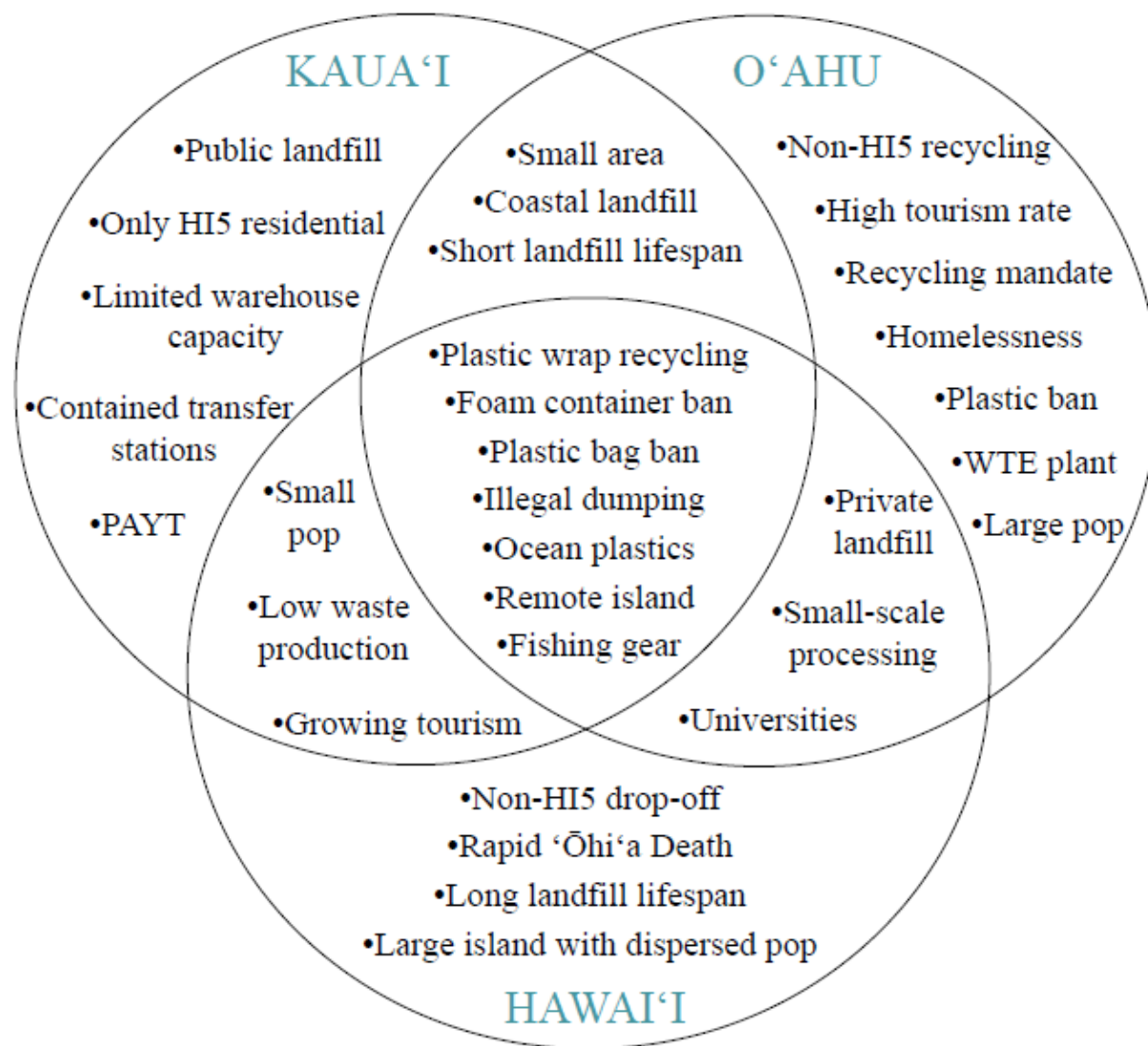
Key Considerations

- County level management
- Remote
- No capacity for local processing
- High transportation costs
- Global plastic sink
- Limited landfill capacity
- Small populations

Stakeholders

- County offices
- City of Honolulu
- WM
- NOAA
- U.S. EPA
- Parley for the Oceans
- Zero Waste O'ahu
- Atlas Recycling
- Hawaii Dept of Health
- Hawai'i Pacific University

Local context



Feasible interventions

