Comparative Analysis of Resource Recovery and Reuse Business Cases and Models

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reuse makes sense.

sanitation/waste

leverage O&M costs

water

nutrients

organic matter

energy

less pressure on natural resources

service businesses can flourish

cheap resources for poor farmers or peri-urban communities
To you it’s Shit, To us it’s BREAD & BUTTER
Shit Business is Serious Business
... but ‘White Elephants’ don’t.

Courtesy of Pay Drechsel
how do we avoid ‘WE’?

how do we scale up*/out successes?

*either by expansion or replication
be ‘business-oriented’* …

*e.g. get the market and finance right

(Ostelwalder & Pigneur, 2010)
... make it safe and show the benefits.
~60 business cases
21 business models

(Di Mario et al., in Otoo and Drechsel, 2015)
energy recovery value propositions

(in Otoo and Drechsel, 2015)
nutrient recovery value propositions

(in Otoo and Drechsel, 2015)
wastewater recovery value propositions

(in Drechsel et al., 2015)
MSW (and FS)...

(Di Mario et. al. in Otoo and Drechsel, 2015)
human waste…

BM14-Urine and Struvite Use at Scale

BM11-High Value Fertilizer Production for Profit

BM13-Compost Production for Sustainable Sanitation Delivery

BM15-Outsourcing Faecal Sludge Treatment to the Farm

BM6-Onsite Energy Generation in Enterprises Providing Sanitation Service

Area Required by the BM

~ 1700 m²
~ 5,000 m²
> 1 ha

O&M and Revenues (USD yr⁻¹)

(Di Mario et. al. in Otoo and Drechsel, 2015)

* for 100k p.e.
capital vs. revenue – O&M

- MSW and FS to Electricity
- MSW and FS to Compressed Biogas
- MSW to Electricity
- MSW to Biogas (fuel)*
- MSW (+FS) Grinded Co-compost
- MSW/FS P-Enriched Compost Pellets Bag
- FS (+MSW) to Grinded Co-compost only
- FS to Fuel For Industry (@70% of DS)
- Raw FS Application on Land
- MSW to Compost Bag

Approx. Area Required ~m²

O&M and RRR revenue (USD yr⁻¹)
one vs. multiple revenues

**Revenues**

<table>
<thead>
<tr>
<th></th>
<th>RRR only</th>
<th>with tipping fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 yrs IRR:</td>
<td>-12%</td>
<td>+5%</td>
</tr>
<tr>
<td>NPV (10%): USD</td>
<td>-1M</td>
<td>-66,897</td>
</tr>
</tbody>
</table>

**Costs**

<table>
<thead>
<tr>
<th></th>
<th>RRR only</th>
<th>with tipping fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 yrs IRR:</td>
<td>-33%</td>
<td>+11%</td>
</tr>
<tr>
<td>NPV: USD</td>
<td>-290k</td>
<td>15k</td>
</tr>
</tbody>
</table>

**IRR and NPV**

- **RRR only with tipping fee**
  - 10 yrs IRR: -12%
  - NPV (10%): USD -1M
- **MSW only**
  - 10 yrs IRR: -50%
  - NPV: USD -100,000

**FS+MSW > AD > Electricity**

**MSW > Compost**

**Bar Charts**

- **Revenues**
  - Carbon Credits (Optional)
  - RRR-By-product Sales (Digestate) (Optional)
  - FS Discharge Fee
  - MSW Tipping Fee
  - RRR-Core Product Sale (Energy)

- **O&M**
  - Carbon Credits (Optional)
  - MSW Tipping Fee
  - Compost Sale
Energy; GWP; labour creation; N,P; hazards can be also discussed… but no time at this point!
enabling conditions: energy recovery

- High Demand for Energy;
- Partnership Arrangements;
- Innovative and Flexible financing;
- Management and Technology Expertise;
- Supportive Government Policies;
- Vertical and Horizontal Scale;
enabling conditions:

nutrients recovery

✓ Partnership Arrangements
✓ Diversified portfolio with multiple RRR revenues
✓ Market demand for Sustainable Agriculture and Waste Mgmt.
✓ Innovative financing and organisational arrangements
✓ Innovative marketing strategies
enabling conditions:

wastewater recovery

 ✓ Water Scarcity is driving wastewater reuse
 ✓ Government funding for wastewater treatment
 ✓ Strategic Partnership
 ✓ Government policy support for reuse
Thank you!

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wastewater recovery value propositions

(Drechsel et al., 2015)
financial benefits of ww reuse are hard to estimate...
GHG
direct job creation…

- 6: FS to Fuel
- 12: MSW to Biogas
- 12: Outsourcing FS Treatment at Farm
- 14: MSW to Electricity
- 16: MSW to Compost
- 18: MSW and FS to Electricity
- 19: FS + MSW to Grinded Co compost
- 22: MSW to Compressed Biogas
- 22: FS + MSW to Enriched and Pelletis
- 26: MSW and FS to Compressed biogas
financial benefits of ww reuse is hard to tell...
the value added seems clear!
Untreated WW

- Wastewater
  - Household & industries
- Water
- WatSan company
  - $ WW fee
  - Management, Technology
- Fodder, trees
  - $ (savings for treatment)
- Untreated WW
- Freshwater
  - Water
Secondary Treated WW

Wastewater from Household & industries flows through the WatSan company, where it is treated and managed. The treated wastewater (TWW) is then used for Irrigated farms, providing $ (savings in energy to pump the water from 100km). The fee for WW is $WW. Water from Freshwater is not used. Management and Technology component is also involved.
Tertiary Treated WW

WatSan Company

Wastewater
Household & industries

Tertiary WWTP

$ WW fee

$ (15 Rs./ m³)

Industry

Water

Freshwater

Management, Technology

$ $
FS Reuse in Agriculture

- Treatment: On farm FS treatment by drying. Long drying periods reduces health risks. Reverse cash flow: Truck drivers get paid instead paying to treatment plants for dumping FS
- Geographical Location: India, Ghana, Sri Lanka

Product: FS (nutrients, organic matter) ~100 Rs. Per truck load
Clients: Farmers
Co-composting model

Product: Co-compost (organic matter) ~20 USD t\(^{-1}\)
Clients: Farmers
150+ business cases (Asia, Latin America, Africa)

60 cases in-depth analysis

21 business models

Continuous interaction with local experts and stakeholders

City Specific

(Otoo et al. 2015)
many existing successes

Examples of value addition
(after Evans et al. 2012)

- Safer effluent (treatment)
  - Conveyance
  - Aquaculture maintenance
  - Conversion in energy

- Safe sludge (treatment)
  - Collection/Conveyance
  - Aquaculture maintenance
  - Conversion in energy

- Collection/Conveyance
  - Transformation in struvite

- Collection/conveyance
  - Safe conditioner (treatment)
  - Conversion in briquettes (energy)