

# Trattamento dei rifiuti nelle grandi città dei PVS: grandi impianti vs soluzioni decentralizzate

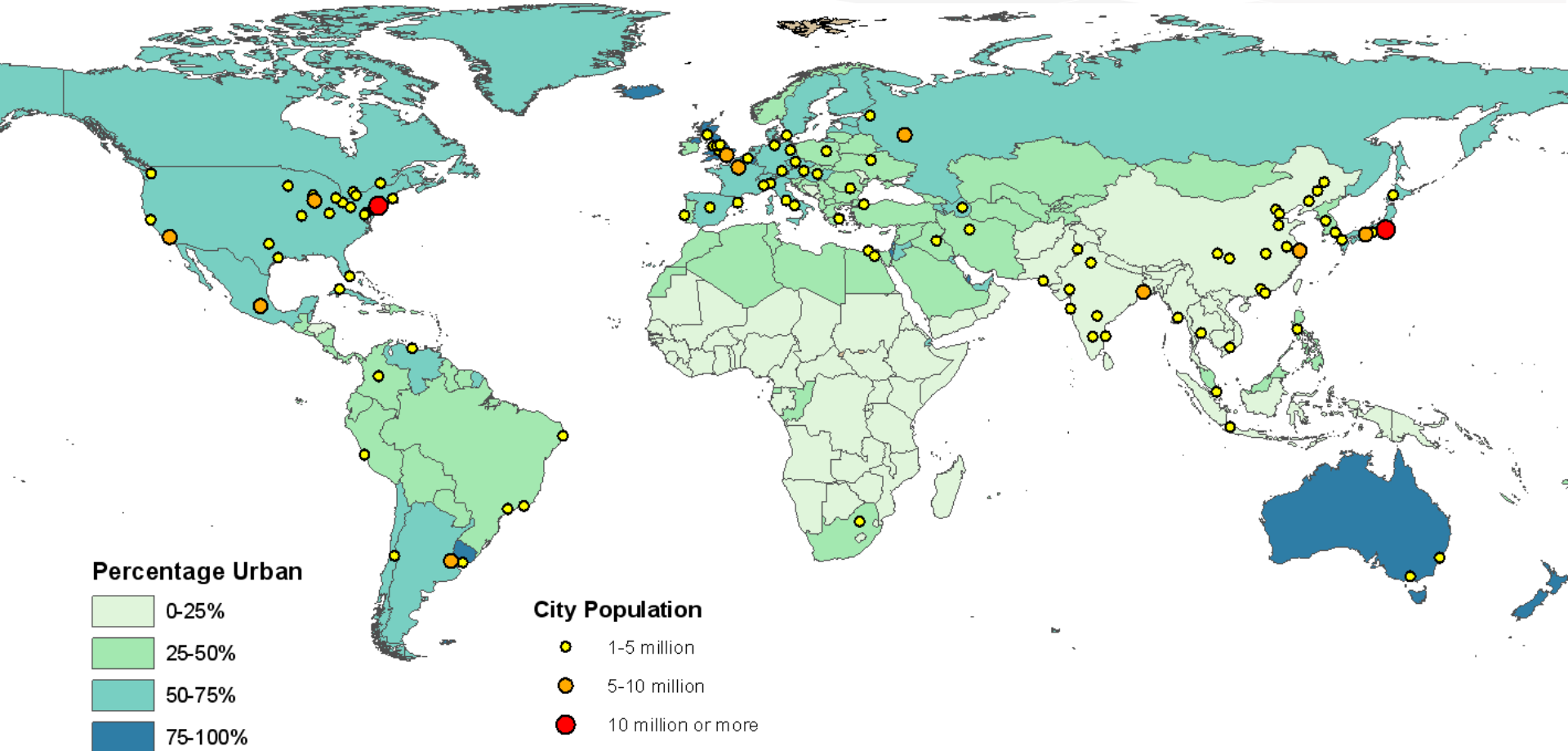
18 Maggio 2018, Fare I Conti Con l'Ambiente, Ravenna

**Fare i conti  
con l'ambiente**  
Rifiuti acqua energia  
➤ Ravenna  
16·17·18  
maggio 2018

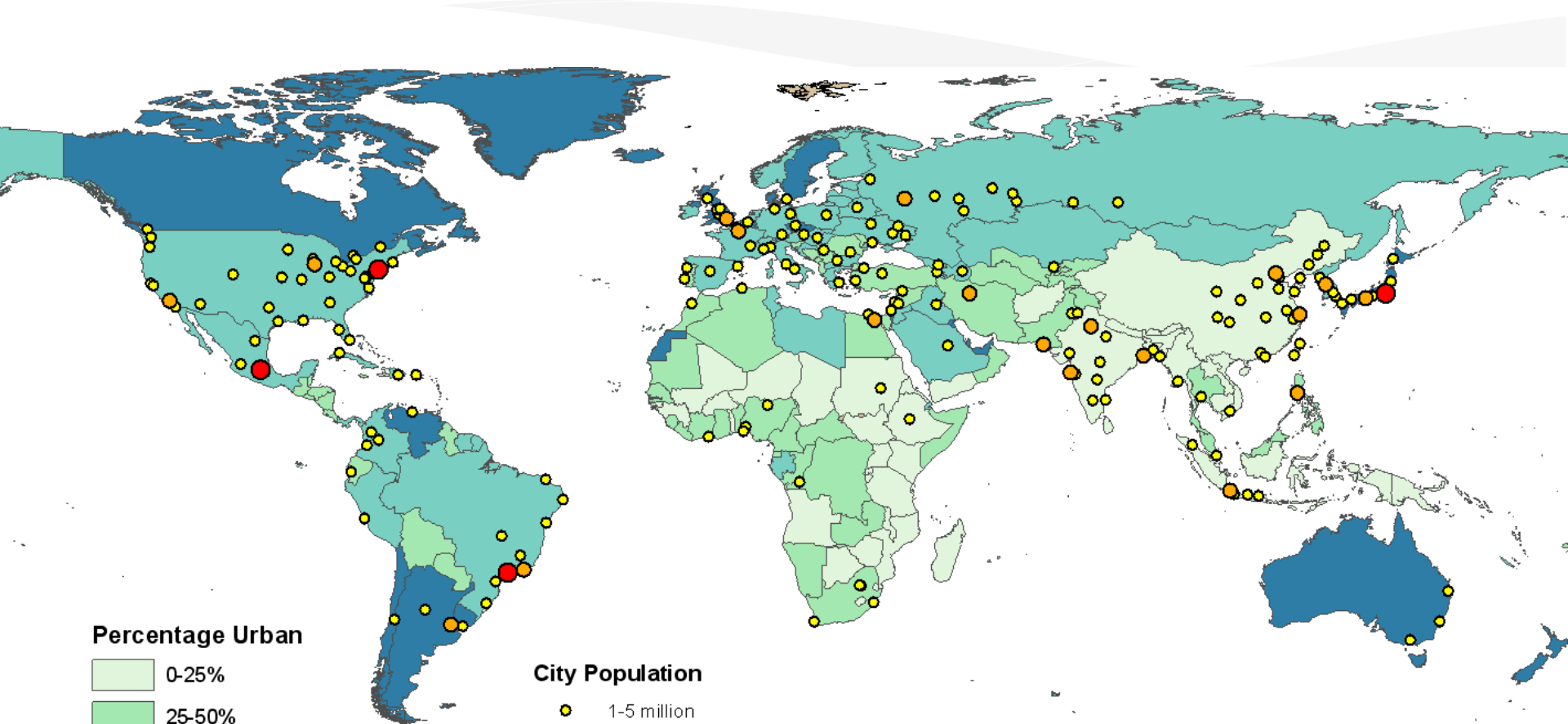
11<sup>a</sup>  
edizione

Michele Giavini – ARS ambiente srl

# Cosa sta cambiando?



1960



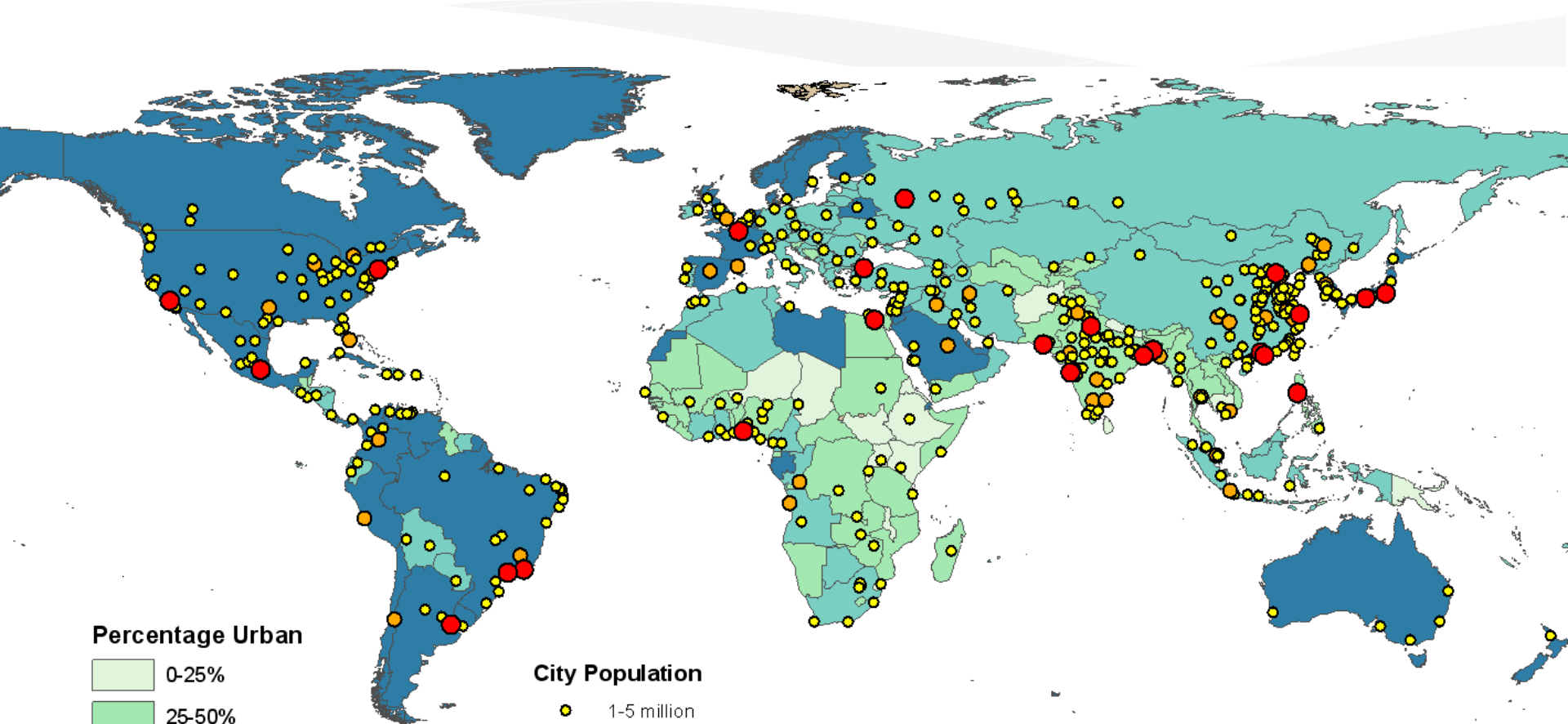
**Percentage Urban**

- 0-25%
- 25-50%
- 50-75%
- 75-100%

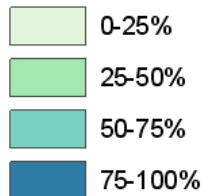
**City Population**

- 1-5 million
- 5-10 million
- 10 million or more

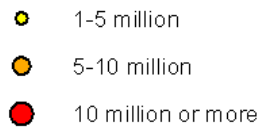
1980



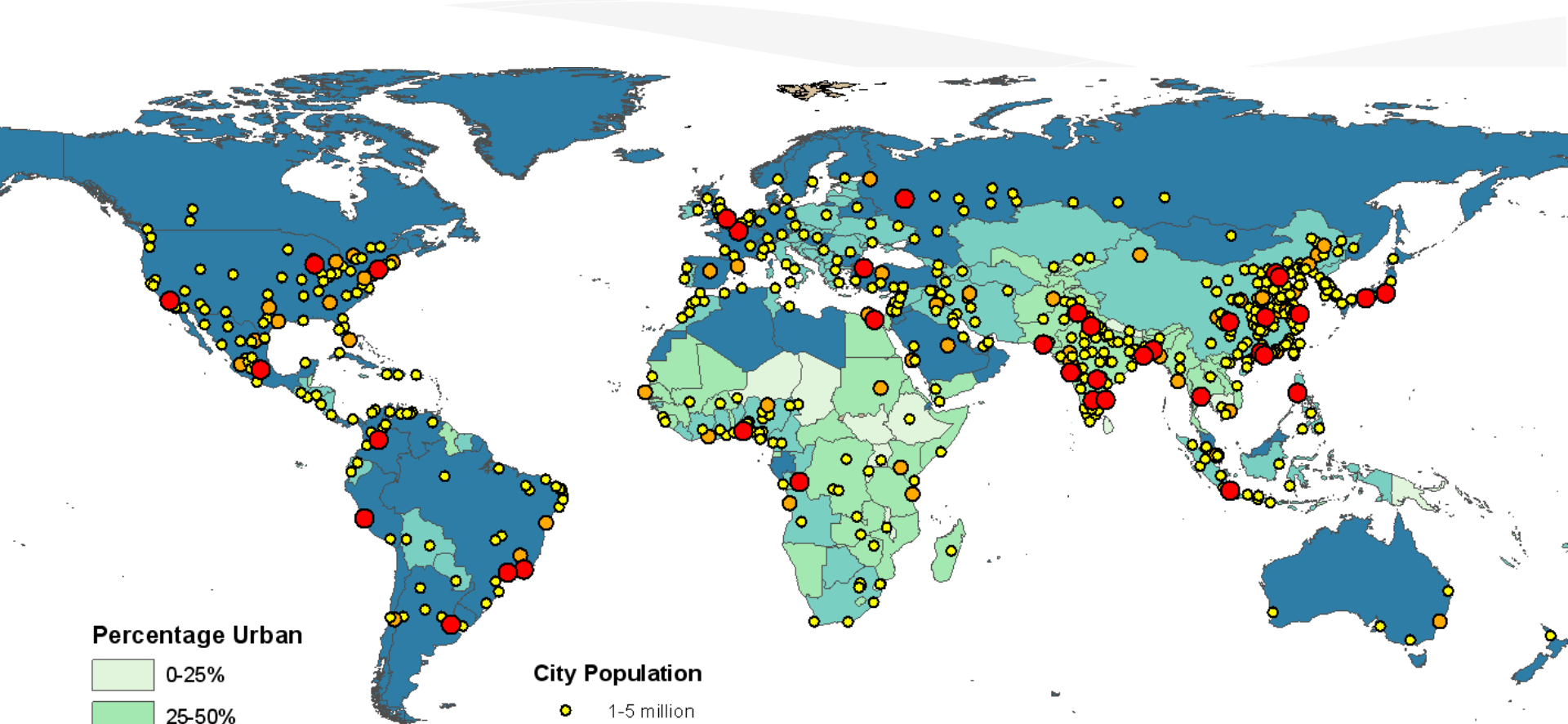
**Percentage Urban**



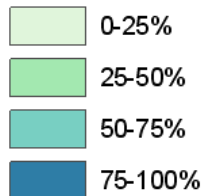
**City Population**



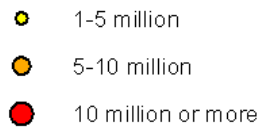
2011



**Percentage Urban**



**City Population**



2025

Source: United Nations, [link](#)

# Dar es Salaam, Tanzania



# Dar es Salaam, Tanzania

- Population: 4.3 million (2012 Census)
- Annual growth: 4.3 %
- 3<sup>rd</sup> fastest growing City in Africa; and among the 10<sup>th</sup> fastest growing cities in the world.
- Projected population in 2025: ca. 7 million
- 70% of the population lives in unplanned settlements
- The current collection coverage is approximately 50 % (**half of waste is either dumped in the streets / rivers or burned !**)





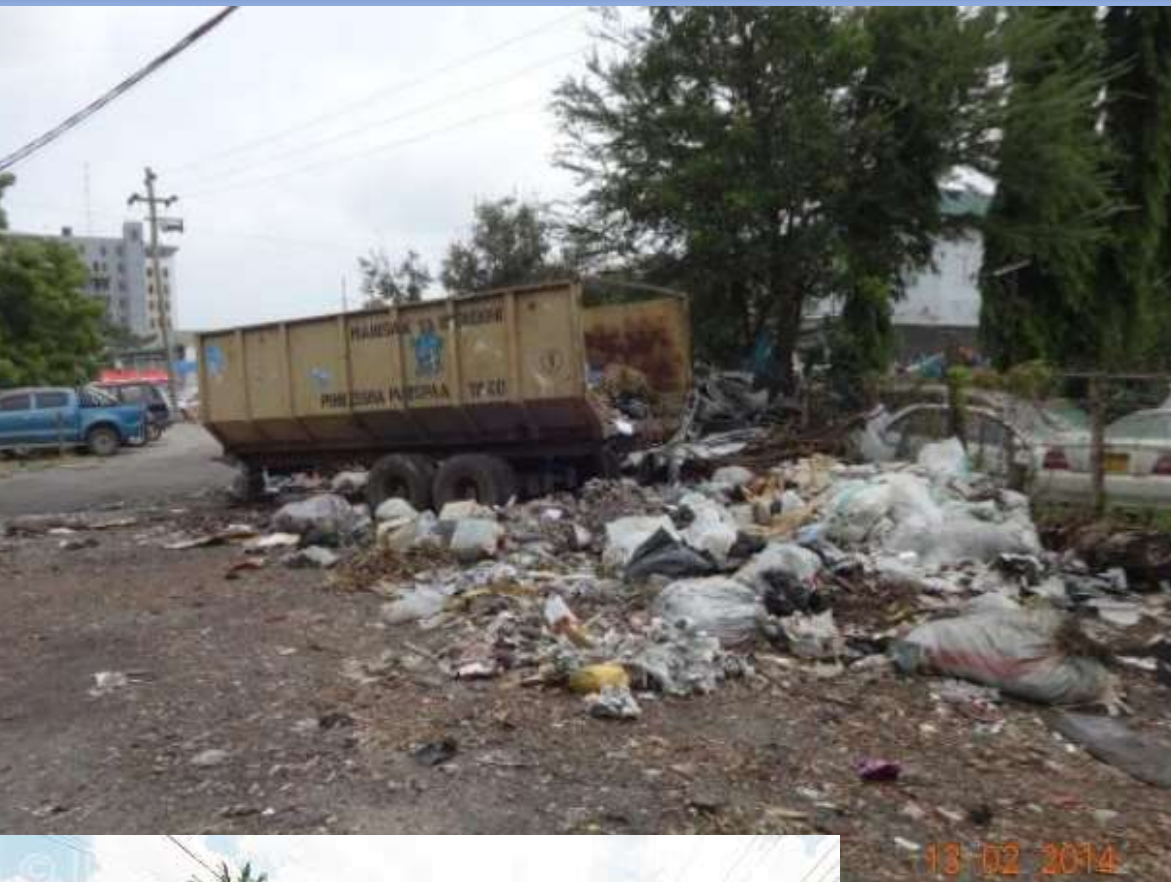




# Discarica

- Final disposal activities are carried out at Pugu Kinyamwezi dump site; 30km from the city centre.
- Solid wastes are disposed in an open dump without any engineered safety feature: no base liner, leachate and gas collection, soil cover, embankments and fence
- The current disposal practices are unhygienic and posing serious threat to risk occupational safety, environment and public health.







<b>Municipality</b>	<b>wastes generated per day</b>	<b>wastes collected per day</b>	<b>%</b>
Ilala	1,088	600	55
Kinondoni	2,026	810	40
Temeke	1,138	398	35
<b>Total:</b>	<b>4,252</b>	<b>1,808</b>	<b>42</b>

# Esperienze preliminari

- Micro impianti di compostaggio di comunità... fallite





# Nuove opportunità: carbon offset

- The City of **Hamburg**, Germany is willing to **offset climate emissions generated by air travel** of its staff. In order to do this, it started a project to support the construction of a **large scale composting facility** in Dar Es Salaam, Tanzania, and to use the certified emission reductions of this project, which is being developed as a Gold Standard CO<sub>2</sub> reduction project .
- The composting facility will be built in the district of Kinondoni, supported with more than 1,1 million € for the construction by the City of Hamburg and the German Federal Ministry for Economic Cooperation and Development (BMZ), through the program "communal climate partnerships".

# Insight: Centralized vs. decentralized composting

# Composting at different scales



Home composting 1



Home composting 2



Community based composting



Decentralized plants



Modular industrial plants



Centralized industrial plants

# Centralised vs. decentralised

- Centralised composting
  - Large scale: range 50 – 300 tonnes/day and more
  - Far from city dwellings, in low income countries usually close to the landfill
- Decentralised composting
  - Small scale: range 1-10 tonnes/day
  - Around 1,000 sq.m each
  - Inside urban areas
    - Examples: Surabaya, Dhaka

More information on decentralized: [urban in low income](#),



## Centralised / decentralised

- Various policies in middle-low income countries promoting both:
  - Decentralised composting
  - Centralised solutions (e.g. India, «City Compost» support)

# India: Solid Waste Management Rules 2016

## • Art. 15 (m,q,v) Focus on decentralised

### **15. Duties and responsibilities of local authorities and village Panchayats of census towns and urban agglomerations.-** The local authorities and Panchayats shall,-

- (m) collect waste from vegetable, fruit, flower, meat, poultry and fish market on day to day basis and promote setting up of decentralised compost plant or bio-methanation plant at suitable locations in the markets or in the vicinity of markets ensuring hygienic conditions;
- (q) transport segregated bio-degradable waste to the processing facilities like compost plant, bio-methanation plant or any such facility. Preference shall be given for on site processing of such waste;
- (v) facilitate construction, operation and maintenance of solid waste processing facilities and associated infrastructure on their own or with private sector participation or through any agency for optimum utilisation of various components of solid waste adopting suitable technology including the following technologies and adhering to the guidelines issued by the Ministry of Urban Development from time to time and standards prescribed by the Central Pollution Control Board. Preference shall be given to decentralised processing to minimize transportation cost and environmental impacts such as-
  - a) bio-methanation, microbial composting, vermi-composting, anaerobic digestion or any other appropriate processing for bio-stabilisation of biodegradable wastes;
  - b) waste to energy processes including refused derived fuel for combustible fraction of waste or supply as feedstock to solid waste based power plants or cement kilns;

# India, 2017: new policy supporting «City Compost»

MINISTRY OF CHEMICALS AND FERTILIZERS  
(DEPARTMENT OF FERTILIZERS)

## IMPLEMENTATION OF POLICY ON PROMOTION OF CITY COMPOST

"It has been targeted by MoUD that by the end of October 2019 all the organic waste generated in the cities is converted into compost/ biogas etc."

(RLOP Q37, Page 19)

- Subsidy of Rs 1500/- per MT (\$23/t) is provided to the marketing entities on sale of the **City Compost** which would be passed on to the farmers in terms of reduced MRP.

**Includes low grade compost from large scale MBT**

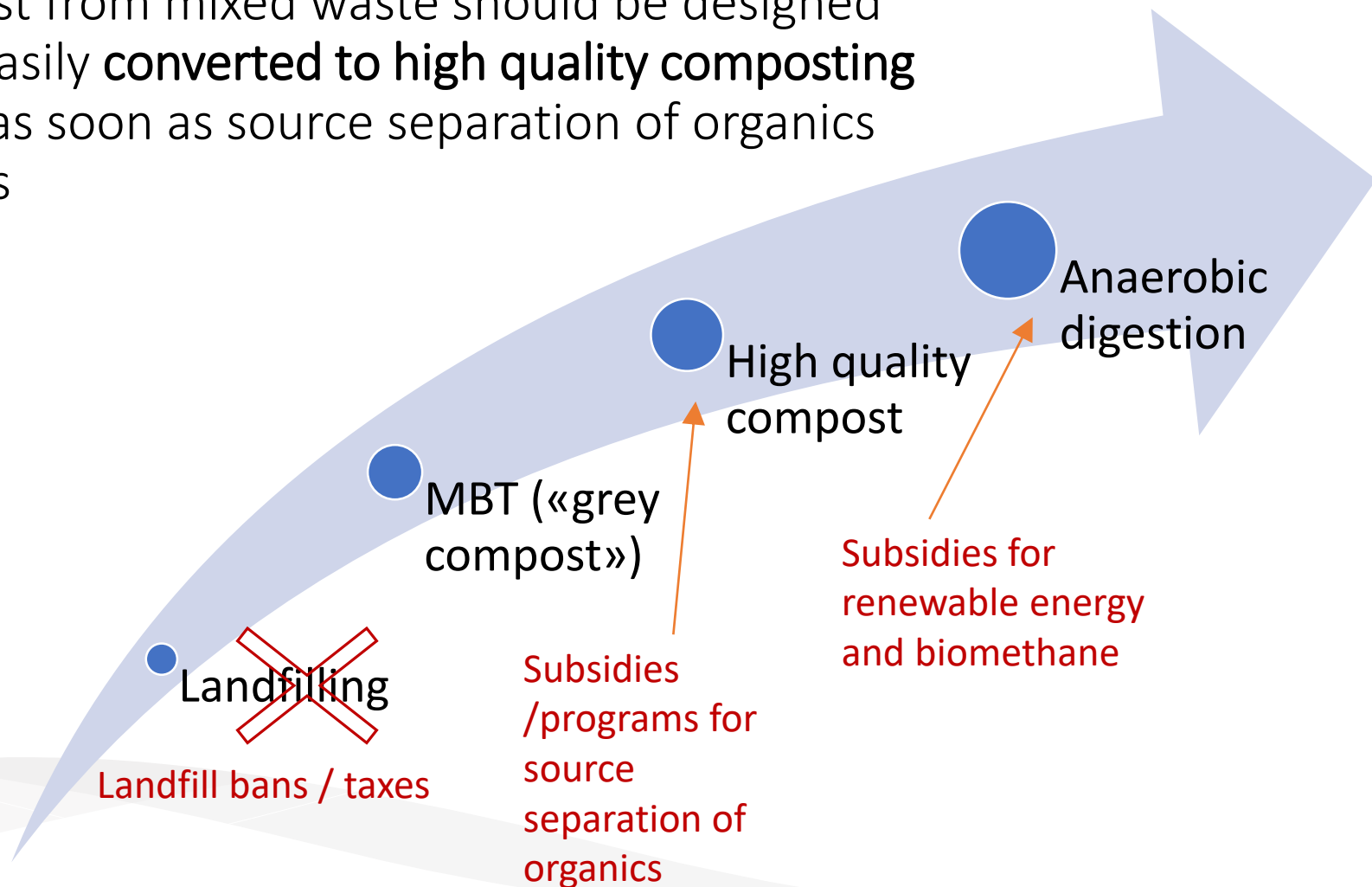
# City Compost report 2017: feedbacks

- «at the present price, farmers are **not very keen to purchase compost**, as by paying Rs. 50/- to Rs 60/- extra farmers can purchase a bag of urea which has an immediate impact on the soil.”
- “compost is considered as a soil conditioner and its impact on the soil would only be **visible after continuous use for 2 to 3 years**”
- “The Committee note that **segregation of waste at the household level is very crucial** for effective implementation of the policy on city compost as the quality of compost depends on quality of segregation by individual household.”



### 3) MBT should be transitional

- Large scale MBT Facilities designed to produce compost from mixed waste should be designed to be easily **converted to high quality composting plants** as soon as source separation of organics spreads



# Composting: the proximity conundrum

## Decentralized

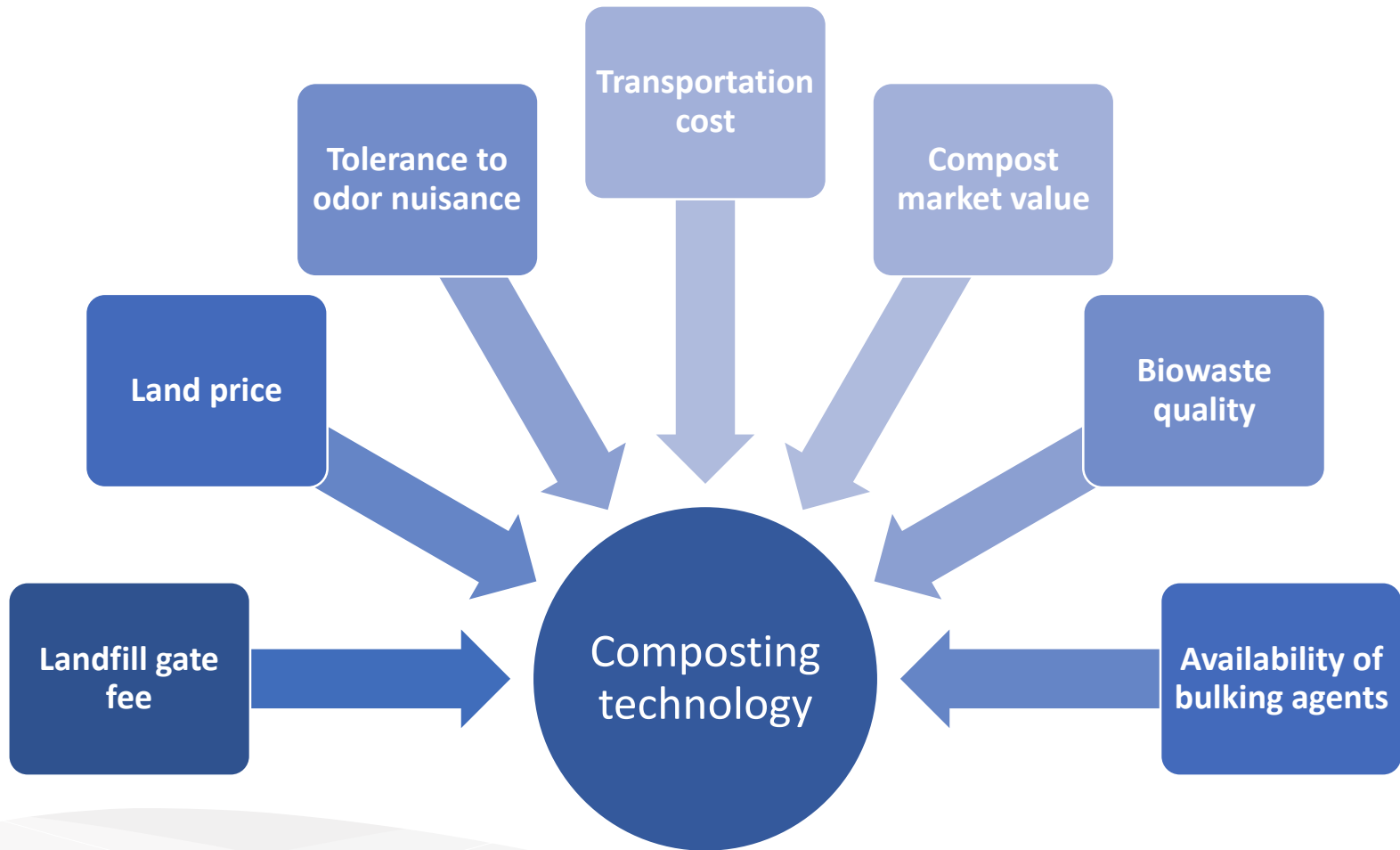
- Food waste is 75% water -> avoid high transportation costs
- Decentralized plants can be built quickly
- Community engagement
- Could help in changing the mindset of people towards waste management
- Local compost sale at higher prices (if high quality)
- Large scale plants need huge investments

## Centralized

- Economies of scale in pre- and post-treatment equipment (can accept feedstock with higher plastic contamination )
- Higher contribution to organics diversion from landfill
- Possible carbon credit support
- The 'Not in My Backyard Syndrome' may hinder the provision of hundreds of micro plants.

Source: PPP in MSWM. [Link](#).  
Additional information: EAWAG, [link](#) and [link](#)

# Composting technology: boundary conditions



# Decentralized urban composting in lower income countries: key factors

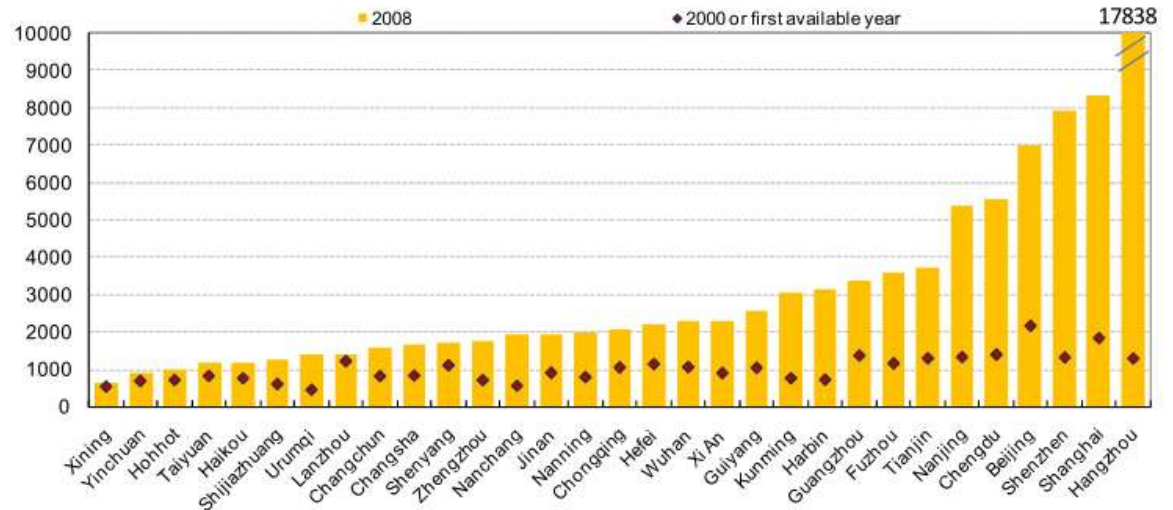
- Land price
- population density
- Compost value
- Informal sector involvement
- Competition with other uses: feeding animals, heating demand (especially green wastes).
- Legal requirements for facilities



# Key factor: land price

- Real estate markets are highly cyclical. The demand for land, and the price of land parcels, fluctuates violently, even in urban areas experiencing strong, long-term growth.
- **Land price can increase before GDP per capita raises**, hampering decentralized solutions before more technological centralized options become affordable

Figure 32. Average land price of 31 major cities in China, RMB/sq m



1 USD = 6,25 CNY

•2000: 100-150

USD/sqm

•2008: 200-2500

USD/sqm

# Land price

Questions	Country 1	Country 2	Country 3	Country 4	Country 5
1. City Name	Sao Paulo	Jakarta	Mexico City	Bangkok	Roatan
2. Country Name	Brazil	Indonesia	Mexico	Thailand	Honduras
10. What is the middle price range of residential land in formal/planned settlements in the well established suburbs near the urban fringe?					
	US\$ 147 per sq meter	Rp 15 million per sq meter	4,000-8000 per sq meter	15,000 per sq meter	US\$ 2.5 per sq foot
US\$ per sq meter	\$ 147.00	\$ 1,614.47	\$ 554.21	\$ 453.97	\$ 26.88

Country 6	Country 7	Country 8	Country 9	Country 10
Buenos Aires	Bratislava	Kyiv	Bucharest	Bangalore
Argentina	Slovak Republic	Ukraine	Romania	India
US\$ 250-300 per sq meter	US\$ 150 per sq meter	US\$ 100-300 per sq meter	400-2000 per sq meter	Rs 1,500 per square foot
\$ 275.00	\$ 150.00	\$ 200.00	\$ 475.20	\$ 409.47

Country 11	Country 12	Country 13	Country 14	Country 15	Country 16	Country 17	Country 18
Seoul	Ho Chi Minh	Cape Town	Guezon City	San Ignacio	San Salvador	Penang	Warsaw
South Korea	Viet Nam	South Africa	Philippines	Belize	El Salvador	Malaysia	Poland
KRW 3,000,000 per sq meter	US\$ 1000-2000 per sq meter	R5,000 per sq meter	P4,000 per sq meter	US\$98.34 per sq foot	US\$8.71 per sq foot	200 MYR per sq foot	200 Euro per sq meter
\$ 3,178.30	\$ 1,500.00	\$ 617.28	\$ 96.15	\$ 1,057.42	\$ 93.76	\$ 659.70	\$ 311.40

Source: [link](#) (year 2008)

# Key factor: compost value

- Explore all possibility of increased compost market value
  - Small bags for retailers
  - Enrichment, pelletizing...
  - Carbon credits (CDM etc.)
  - Comply with standards for ecological agriculture or the requirments of the final users
- **Compost market** need a particular attention. Calculating 150 kg biowaste /capita.year collected, this results in 35-50 kg/cap.year compost.
  - **It must be used very close to the production source** (i.e. the decentralized facility), otherwise transportation cost could make compost not appealing with respect to mineral fertilizers.
  - In some megacities, the production of this amount of compost could be too much to be used inside urban territory.



Additional information:  
EAWAG, marketing  
compost in low and  
middle income countries,  
[link](#)

# Case study: Dhaka, Bangladesh





# The Waste Concern model



In slums:



In other areas:

**Barrel Type  
Composting**



**Aerator Type  
Composting**



**Box Type  
Compost**



**WASTE CONCERN**

Also: centralized large composting facility, supported by Clean Development Mechanism (CDM) credits

Project based on carbon trading (CER/VER) between industrialized and developing countries

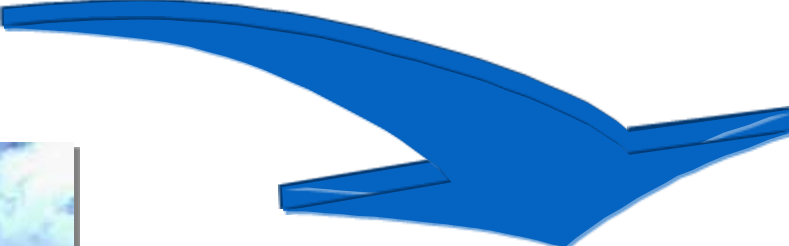
Dutch Company WWR and Banks, FMO and Triodos

CDM investment \$\$

Industrialized country



Emission reduction credits (CER)



Project Reducing GHG emissions in Dhaka





# The large scale facility

## Process Quality Control



Incoming waste in weighing bridge



Forced Aeration using blowers



Laboratory Testing



Forced Aeration and Leachate Collection System



Leachate water treated



Quality Product



Oxygen and Temperature Monitoring

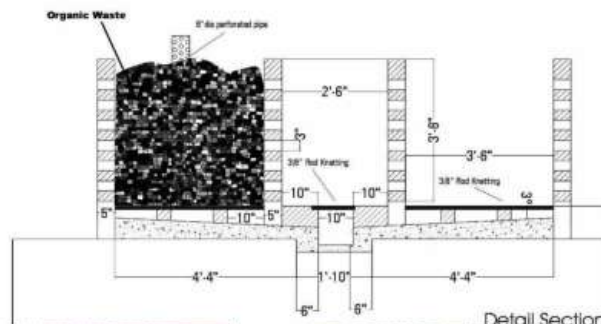
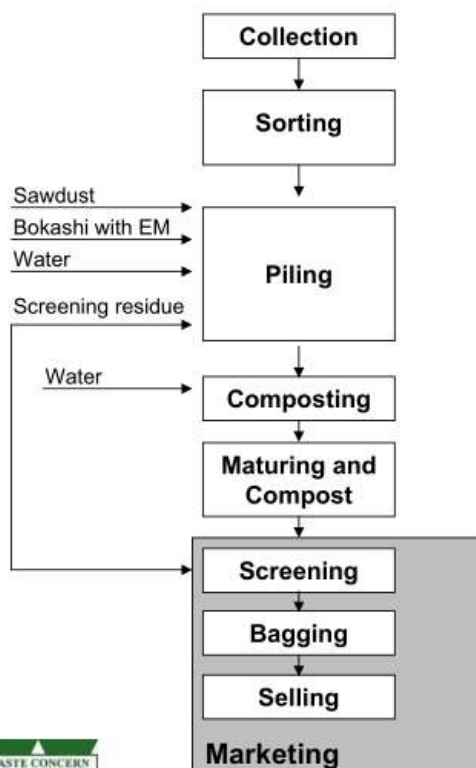
**130 tons/day (phase 1)**

Compost Plant Located at Bulta, Roopganj, Greater Dhaka

Investment: 2.5 million Euro

# The basic decentralized composting model

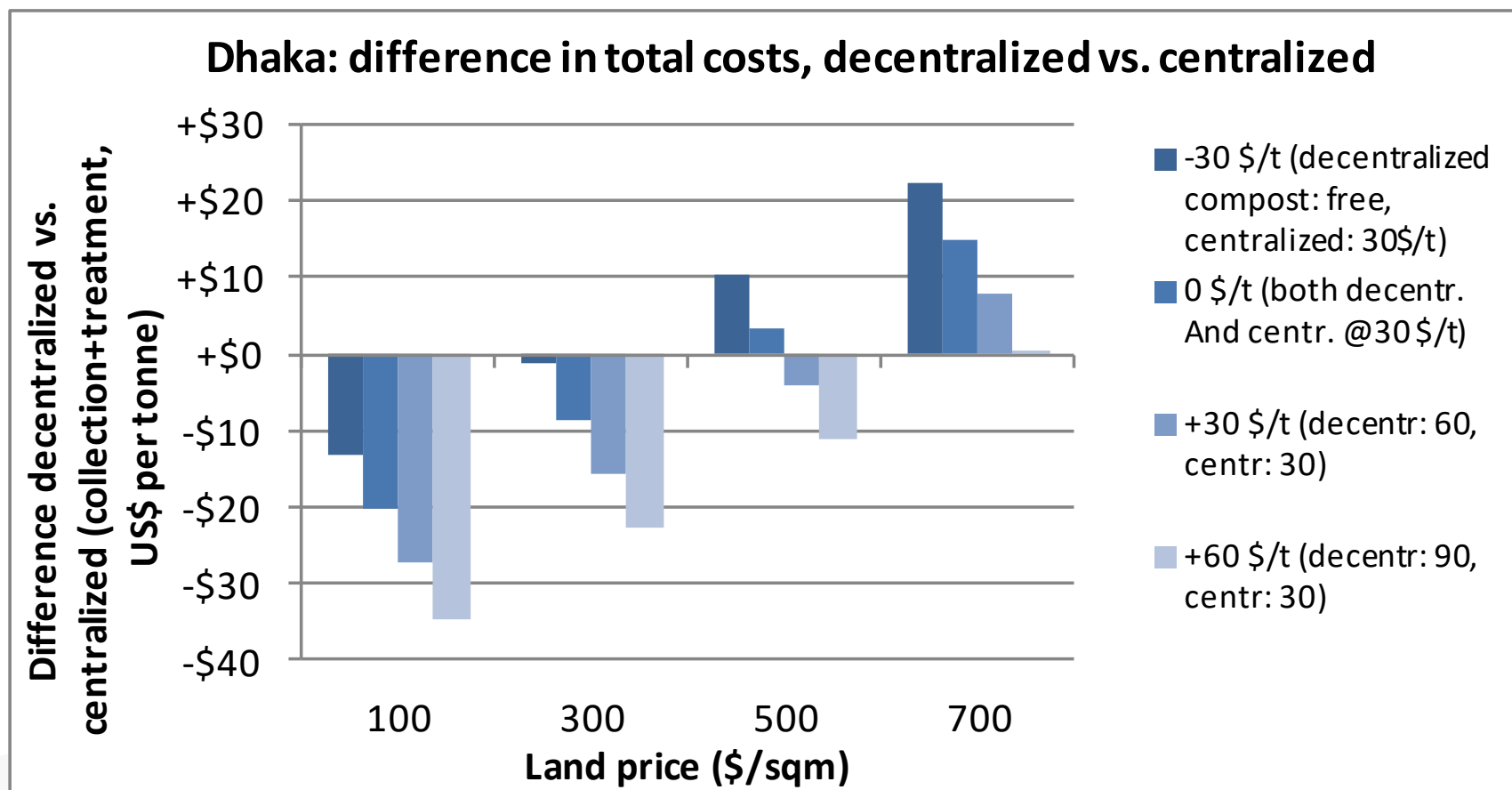
- Up to 3 / up to 10 tons/day (1,000-3,000 t/year)
- Box type composting system



Waste Concern Full presentation: [link](#)



# Dhaka - two key factors: compost value, land price



M. Giavini, personal calculations and elaborations on Waste Concern data. To be further improved.

# Conclusions

- Both decentralised and centralised composting could be feasible in megacities, but
  - Urban land price and compost market value as key factor
  - High political willingness in the case of many decentralised plants, high community involvement
  - Be careful to address **high amount of waste, not one-off solutions**
- Needed external funds to support the initiative

# Contacts

MICHELE GIAVINI

[giavini@arsambiente.it](mailto:giavini@arsambiente.it)

[www.arsambiente.it](http://www.arsambiente.it)

