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A FRAMEWORK FOR SUSTAINABLE WASTE MANAGEMENT SYSTEMS FOR DEVELOPING CITIES

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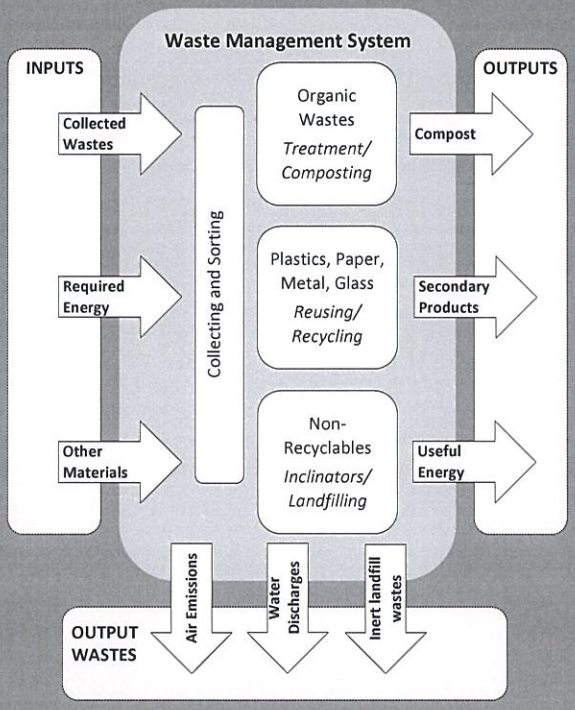
INTRODUCTION

Implementing an efficient solid waste management (SWM) system is a challenging task worldwide. With the increase in global population and consumption patterns, solid waste management systems has become of global concern. The current work presents a general long term vision and framework for sustainable municipal waste management in developing cities.

SYSTEM'S DESIGN

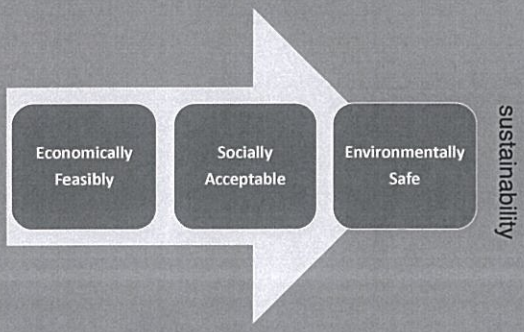
- The current research targets urban communities and developing cities wishing to improve their waste management practices.
- The research is based on unsorted wastes.
- It is different from most models surveyed in literature which rely on waste separation at source.
- Most surveyed literature present environmentally safe and economically justified models
- The current research incorporates the social aspects of SWM, in an attempt to achieve a sustainable system.

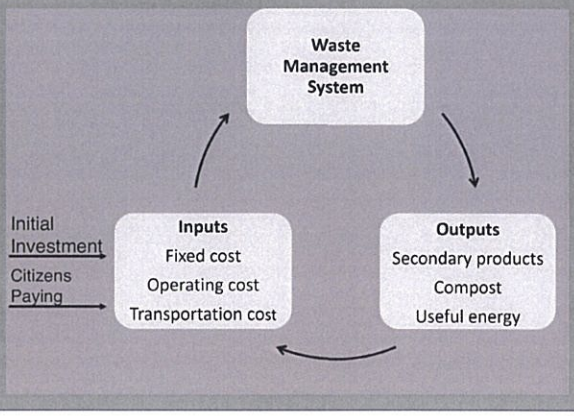
SYSTEM'S ARCHITECHTURE



SYSTEM 'S OPERATION

- To be able to maintain a clean environment, initial investments for reusing, treating, recycling and energy generation should be made.
- The research presents an economic, self sustainable system that quantifies the required investments.
- A mathematical model is developed to estimate the cost for service that citizens should pay for maintaining a clean environment.





BENEFITS vs COSTS

- A Cost benefit analysis is used as a base platform for the system.
- Optimization models such as linear programming (LP), mixed integer programming (MIP) and non-linear programming (NLP) are applied in the context of system analysis.
- An Input/ Output analysis including material flows, is developed to quantify and asses the performance of the system.

International Solid Waste Association Congress, Antwerp, 7-9 September 2015.

Challenges of waste management in cities of developing countries

The Urban Public Environmental Health Sector Development Project in Bangladesh (2009-2017)

Solutions on Municipal Waste Management and Food Safety in 6 City Corporations

- Solid Waste Management
- Medical Waste Management
- Food Safety and prevention of adulteration
- Improvement of financial reformation & ensure sustainability
- Institutional development
- Gender responsive pro-poor targeting

Efficient Waste management system in densely populated areas

- Infrastructural investment;
- Policy development and governmental empowerment;
- Social implementation and financial organisation

Climate Change Challenges

- Flood prone area
- Reduction emissions

Open dump site Tendazary, Chittagong, December 2012

Field visits and strategic planning, May 2012

Capacity building meeting, Dhaka, April 2012

Challenges

- No waste management history – starting from scratch;
- Large 'informal waste economy' - primary income for the urban poor;
- Scarcity of land, illegal occupants and resettlement strategies;
- Limited local knowledge on environmental solutions and technologies;
- Economic and financial barriers.

Ongoing project

Within the project of UPEHSDP Ecorem has a **team leader** role and has the responsibility of all project deliverables. Ecorem developed **program strategies, conceptual designs, detailed civil and mechanical engineering, cost-benefit analysis** and performed community based actions aimed at **capacity building, awareness-raising and education**.

Lessons learned

- Important to apply an integrated approach (i.e. definition of approach and thorough analysis of options)
- Instrumental to apply appropriate solutions that are adapted to local conditions : Flexibility in design!

Financial support – Partners
- The realization of the UPEHSDP project was supported by **Asian Development Bank**
- Many thanks go to the Client **UPEHSU** (Urban Public Environmental Health Sector Unit of Bangladesh) and our partner in the project **DDCL** (Development Design Consultants Limited).

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Electronic waste: a diagnosis of the processing chain in Brazil

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INTRODUCTION:

The electronic waste "business" has stimulated a complex production chain made up of companies who collect, separate, break up, recuperate, store and recycle these materials. In this interchange, various interactions occur between the companies and the society with a consequent social, economic and environmental impact. The present research has made a diagnosis of one part of this chain, as in the "waste processors", that means the companies which carry out the collection, storage, separation and transformation of the equipment.

SOURCE	PERCENTUAL
INDUSTRIES	41.25%
RETAIL BUSINESS	27.50%
HOUSEHOLD WASTE	18.75%
UNIVERSITIES	5.01%
GOVERNMENTS	4.99%
OTHER (NGOs, CAMPAIGNS)	2.50%

MATERIAL COLLECTED SOURCE

100%

WASTE PROCESSORS
(collected data source, companies in Brazil)

41.02%

DESTINATION (DISCARD)

DESTINATION	PERCENTAGE
WASTE DISPOSAL	34 %
OTHER RECYCLERS OR INDUSTRY	66 %

PRODUCTS SOLD

58.98%

PRODUCTS	PERCENTAGE
PCB	70 %
METALLIC MATERIALS	19.3 %
POLYMERIC MATERIALS	5 %
OTHER PRODUTCTS	5.7%

DESTINATION (PRODUCTS)

DESTINATION	PERCENTAGE
OTHERS RECYCLERS	75.39 %
INDUSTRY IN BRAZIL	24.61%

Within an economic context, 70% of the income originates from Printed Circuit Boards (PCBs). In Brazil, about 78% of the PCBs are exported for recycling abroad.

CONCLUSION:

The sectors that more generate this kind of waste are the industrial sector, with 41.25%, followed by the commercial and domestic sectors. The PCBs are the main product and contribute about 70% of income.

The main contributions resulting from this study are: create a vision of the volume flux of processed waste and allow for comprehension of the economical interactions between the various interested parties and the difficulties which the sector faces to achieve a sustainable management system for electronic waste.

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INNOSORT

Innovative sorting and recycling of solid waste

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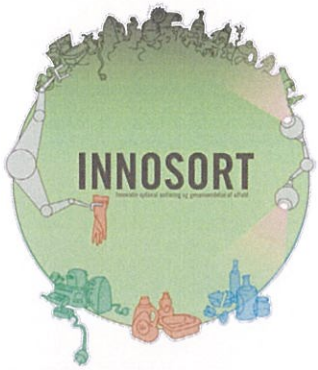
DANISH TECHNOLOGICAL INSTITUTE

Concept

Sorting, collecting and processing in two fractions



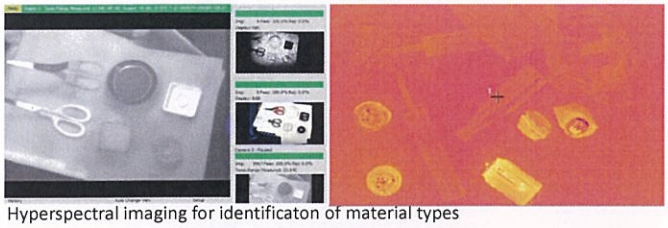
Optimizing exsisting sorting facilities by introducing new technogiles.

Plastic foil
Cardboard
Paper

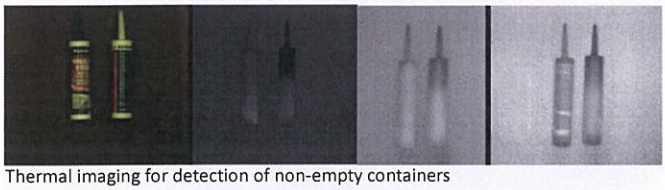
Plastic
Glass
Metal

Increasing recycling and decreasing labour intensive work

Technologies



Hyperspectral imaging for identificaton of material types



Thermal imaging for detection of non-empty containers

Sensor fusion for object classification; RGB (top left), NIR w. pattern projection (top right), Thermal image (bottom left), Thermal difference (bottom right)

Objective

To develop waste sorting technologies that can optimally utilise waste resources and to create new places of work by:

- Recognizing the chemical composition and shape
- Separating substances that are unhealthy and harmful to the environment
- Recycling of scarce resources
- Developing new environmental technologies by use of robots and increased automation

Goal

INNOSORT unites technology suppliers, research institutions and end-users of waste sorting techologies, to improve recycling of valuable ressources

Focus

- Dry fractions and central sorting from domestic waste
- Smart and user-friendly collection systems
- Ensure optimum properties of sorted materials by removing unwanted contaminants
- Replace manual sorting routines with robots
- Develop sorting concepts and environmental technologies that have export potential
- Develop tools to assess the best technology systems in consideration of the economy

Acknowledgement

INNOSORT is funded by the Ministry og Higher Education and Science. Additional information regarding INNOSORT can be found at: http://innosort.teknologisk.dk/

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