Recycling of construction material through social businesses

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Agenda

- Introduction to Production Technology Center (PTZ)
- Scope of the project
- Reuse, Recycle and Downcycle
- Processes and Technologies
- Involving the community: Social Business
The proposal intends to foster the development of recycling centers which closes the loop of the construction materials’ lifecycle. Community is involved under a social business scheme in order to reactivate economy in catastrophe stricken areas.
Construction Materials’ Closed Loop Lifecycle

- **Raw materials** → **Production** → **Distribution** → **Use/Construction** → **Demolition / Dismantle** → **Disposal**
- **Multiple usage phase**
  - **Processing** → **Cleansing & Assessment** → **Separate** → **Recycling**
The Sustainability Challenge

**Environment:**
- Decrease of raw material consumption
- Reduction of CO2 emissions
- Reduction of energy consumption
- Land filling reduction

**Economy:**
- Reduction of land filling costs/taxes
- Reduction of transportation costs
- Reduction of energy costs
- Governmental subsidies/contracts

**Society:**
- Reactivation of local economy
- Community’s participation in its reconstruction
- Reduction of unemployment

Eco-efficiency

Environment

Economy

Society

Environmental justification

Company Ethics
Reuse

**Definition:** Reinsertion of a by-product or product’s element as an input into a manufacturing process without any physical/chemical changes.

- Little need for manufacturing reprocesses
- Possible processes to be undergone: Cleaning, painting, filtering, etc.
- Use in second life usually the same or at least similar as in the first one.
- Examples:
  - Recovered wood beams to be used as such in a new building
  - Water bottles.containers cleaned and disinfected
  - Another examples include: Steel beams & Studs, Light fixtures, Bathtubs, Toilets & Faucets, Bricks, Insulation, Windows, etc.
Recycle

Definition: Reprocessing of waste materials so that they can be used as input for manufacturing of new products

- Purpose is the recovery of materials with intrinsic value in order to reduce raw material consumption.
- Use in second life not necessarily related to the first life, but most physical and chemical properties remain the same.
- Examples:
  - Formwork for concrete piles using cardboard tubes
  - Insulation (Thermal/Acoustic) made out of car tires and newspapers
  - Grinding drywall scraps for use on site as a soil amendment

Workers sort construction materials to recycle
big groups of construction Material to be Reused/Recycled

Timber

- Huge reuse possibilities as structural and non-structural element
- Reuse/Recycling suitability depends on the type of timber used, some possibilities are presented:
  - Formwork and shuttering in concrete construction (Downcycling)
  - Chipboard for furniture and kitchens
  - Wood chipping for soil improvement

Masonry and fired clay

- Bricks, tiles made out of stone and clay.
- Reusing suitability depends the bonding mortar:
- Industrial waste materials such as pulverized fuel ash and slush can be recycled into bricks

www.lshrecycling.ie

http://sbarrkum.blogspot.com/2010/09

openfarmtech.org/weblog/2007/12/ceb-phase-1-done/

http://www.scrapmetaljoe.com
Seven big groups of construction Material to be Reused/Recycled (cont:)

Concrete

- Composed of aggregate (80%), cement (15%) and water (5%).
- Old concrete can be downcycled into aggregate for new concrete also for highways and roads.
- Research on how to recycle cement is been undergone at the PUC
- Extra motivation to recycle: reduce landfill

Glass

- Easy to recycle/downcycling but process is high energy demanding.
- Common downcycling uses are manufacture of glass containers or fiberglass insulation
- Other applications are manufacturing of “glassphalt” and construction blocks out of glass and foam
Masonry: Reuse/Recycle process description

**Reuse**
- Determination of load bearing strength.
- Cleaning and discoloration reverse (tiles and façade elements).
- Mechanical removal of mortar

**Recycle**
- Removal of efflorescent, sulfate attacked bricks.
- Crushing of bricks to get aggregate for lightweight concrete.
- Municipal solid waste bottom ash used as aggregate for concrete masonry use

*www.p-wholesale.com/*
Timber: Reuse/Recycle process description

**Reuse**

- Determination of Material assessment:
  - Softwood-Hardwood,
  - Age of timber
  - Moisture content
  - Dimensions
  - Presence of other materials

- Determination of Structural assessment:
  - Condition of connections and supports
  - Longitudinal splits in wood
  - Type of joints and connections

- Remedial work:
  - Removal of nails and screws
  - Removal of damaged parts
  - Removal of paints
  - Cutting to desired sized
  - Sanding as cleaning/finishing method

**Recycle**

- Removal of undesired elements
- Chipping of clean timber for the following purposes:
  - Panel fabrication
  - Equestrian spring bed
  - Bedding for farm animals
  - Bio fuel
  - Paper pulp
  - By means of wood chippers, (see “Machine tools”)

[Image of wood chippers and chipped timber]

www.lshrecycling.ie
Concrete: Reuse/Recycle process description

**Reuse**
- Refurbishing of concrete beams and floors through:
  - Cleaning
  - Surface coating
  - Restoration through mortar
  - Cathodic control to prevent anodic reaction to metals

**Recycle**
- Removal of efflorescent, sulfate attacked chunk blocks.
- Crushing of chunks to get aggregate for new concrete.
- Pulverized fuel ash can be combined with Portland cement into the concrete mix
Glass: Reuse/Recycle process description

Reuse

- Reuse of glass bottles through:
  - Cleaning
  - Disinfection
  - De-labeling

Recycle

- Glass can be recycled into aggregate for construction (glassphalt), in order to do so glass has to be turned into cullets by means of a glass crusher machine
Masonry-Concrete Crushing Machines

Compression Crushers

Impact Crushers

Capacity: 8-400 tons. per hour
Feeding size range: 180-800 mm
Typical output size: Feed Ratio 8:1 up to 20mm
Initial investment cost: 3,500 – 25,000 Usd

Capacity: 15-350 tons. per hour
Feeding size range: 250-500 mm
Typical output size: 0 – 80mm
Initial investment cost: 4,000 – 12,000 Usd

http://www.ecco.org/pdfs/Ev22.pdf
Wood Chipping Machines

Industrial Wood Chipper

- **Capacity:** 25-50 m³ per hour
- **Feeding size:** 225*680 mm
- **Typical output size:** 30-20mm
- **Initial investment cost:** 3,000 – 10,000 Usd

Domestic Wood Chipper

- **Feeding size:** Branches up to 3” diameter
- **Maximum output capacity:** 300 Kg x hour
- **Initial investment cost:** 900 – 2000 Usd

Glass crushing machines

- **Capacity:** 2-15 tons per hour
- **Feeding size:** Up to 16”
- **Typical output size:** up to .2mm (sand size)
- **Initial investment cost:** 2,500 – 6,500 Usd

[www.norcalcompactors.com/glass-crushers/]
Social Business Model

The approach proposes a social business model. According to the founder of the concept, a social business is the one covering following aspects:

- Pursues social objectives
- Owned by community
- Non-profit distribution

Muhammad Yunus and his Grameen Bank
Concept of Social Business

- Social business aims at balancing social, economic and environmental aspects.
- Alternative to profit maximization as sole objective.
- Rely on investors only in starting phase.
- Empowerment through automatic investment of benefits in company’s organic growth.

Source: Yunus, M., Moingeon, B., Lehmann-Ortega, L., 2009
Why Social Business into this project

HMW Aims

**Enabling Actors**

Collaboration with partners in developing countries (Governments, NGO and private organizations)

**Capacity Building through Learning Projects**

Bridging the very gap between knowledge and implementation

Social Business Model Functions

- **Local Value Creation Network**
- **Social Business / Microcredit NGOs**
- **Additional Investment Sources**
- **Selection and Training of Local Partners**
- **Principle of Co-Creation**
- **Social Target Costing**
- **Social Benefits Tracking**
Dynamics inside the social enterprise

**Aim:** Have a concrete presentation of activities organization depending on the experts input/outputs, and consequently the enterprise activity. Screen the costs.

Social Enterprise: Recycled Cement Production

Manufacturing

- **M**
  - Training
  - Production Line *wood*
  - Production Line *concrete*
  - Production Line *glass*

Stock Delivery

- **H**

Housing
Shareholders system: initial investment

Strategy 1:
- Banks
- Private Companies
- Government
- Social Enterprise

Strategy 2:
- NGOs & Microcredit cooperatives
- HMW Institution
- Church
- Government
- Social Enterprise

Strategy 3:
- Peer to Peer Microcredit
- P2P local agencies (referent)
- Social Enterprise Associate
- Social Enterprise
Redistribution of the profits: adapting to the output evolution

Company yearly profits: 100,000 US$

- Reinvestment in the company 80,000 US$
- Employees payback 20,000 US$

Capital investments: internal growth
Buy more machines in order to achieve higher output

Ensures motivation and follows social empowerment
Break Even Point, 1/2

Break even reaching output: 870,000 tons of material recycled
Date of break even point for Year 1: End of November
Break even reaching output: 1,400,000 tons of material recycled
Date of break even point for Year 5: End of June