



**Expert Group on Resource Classification (EGRC):
Ninth Session
Item 4: Workshop – UNFC for Sustainable Development**

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Challenges for anthropogenic resource
classification at a project level /
Recent developments in Canada on Zero Waste

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Transform Mining Towards a Zero Waste Industry

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Zero Waste Mining The Future

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MINING INNOVATION ECOSYSTEM

CMIC / Our Approach / Mining Innovation Ecosystem

The CMIC business ecosystem model is based on successful models in other industries including software engineering, microelectronics, defense, and pharmaceuticals.

The **open innovation ecosystem business model** is unique in the natural resources industry. We rely heavily on involvement, participation, and funding from multiple organizations across the supply chain. Participants include academia, startups and SME's to research, technology and innovation organizations and mining companies across Canada.

This approach reduces duplication of effort, leverages existing assets (e.g., expertise, knowledge, technology, intellectual property, resources), and focuses on industry challenges. The reliance on

- > Our Approach
- > **Mining Innovation Ecosystem**
- > Exploration
 - > Footprints Project
- > Mining
- > Energy – Processing
- > Environmental Stewardship

<http://cmic-ccim.org/>

Business eco-systems 1



Business Ecosystems – A Primer

- Business ecosystems are a constructed or hosted entity to harness innovation across a large number of diverse organizations globally to create business value
- They have been around for decades in industries such as aerospace/defence, software engineering, hardware engineering, microelectronics, manufacturing and now pharma

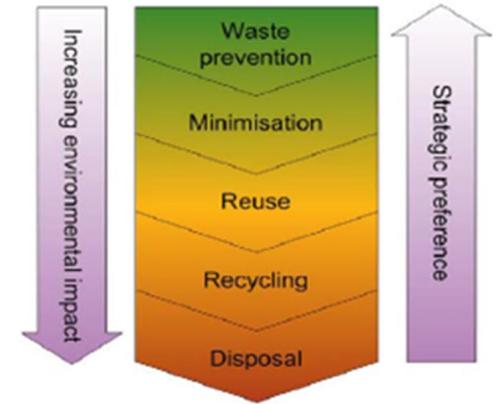
Business eco-systems 2



- They are comprised typically of groups of members working in a defined technology space (e.g. Exploration, continuous underground mining, energy in comminution) that target a specific need that is not possible for a single company to tackle
- A key aspect is that everyone puts “skin in the game” and provides value to the ecosystem and contribute to building the platform(s). This is money, resources, technology etc.
- Business ecosystems are never hosted by government although government plays vital role in the aerospace business ecosystems simply due to how the procurement process in this industry drives technology development.

What are the necessary and sufficient conditions under which a material can only and wholly be classified as a waste?

Waste prevention starts with not applying the term to materials which it is not necessary to class as waste. Hence anthropogenic (AR), or secondary resources (SR).



Challenge

Is the concept of redesignating waste as “anthropogenic resource”:

- a) simply “badge engineering” which remains anchored in the human-centered, teleological premise that it is waste solely because we have no use for it, or
- b) a response to the transformation of a linear industrial economy into a resource-centered circular sustainable economy in which waste can only be applied as a classification to materials that are inherently unusable?

In which case, is the phrase inaccurate and should be replaced by residual or secondary resource, because the fact that we cannot find a use now does not mean there will not be one in future?

Challenge

Do we have difficulty with AR classification because we are applying scientific classification principles to materials whose inherent attributes are not amenable to classification according to those principles.

ie Does the classification process begin with a flawed assumption that these materials belong in a single, highly diverse but nevertheless homogeneous materials class with a unifying, extrinsic attribute that we have no intention of reusing them?

Hence the real point is that their classification if conducted this way is fundamentally economic (E axis) not based on intrinsic materials properties (G and F axes)?

Waste – a modern construct

- Waste as inherent, value-neutral attribute: Latin/ Old French – typically land that is inherently “vast” (ie big) unusable, infertile or hard to cultivate, commonly associated with extreme climate conditions - icy or desert “wastes”
- Waste as outcome of inept human practice or behaviour “anthropogenic waste”: Evolves into land or other resources that have become degraded or infertile as a result of unsustainable resource management practices. But starts to be used to describe linear process outcomes, eg “waste paper” emerges in the 1670s
- The sense of waste as to “squander, spend or consume uselessly” is first recorded mid-14C – linkage to human behaviours and life-style choices
- Waste as [unavoidable] process output: Evolves during the industrial revolution into a term to describe the outputs from linear production and consumption processes for which no use could be foreseen.
- First appearance of the term “waste basket” in English recorded in 1850, in urban London... material discarded with no intention to reuse
- Leads to the “waste hierarchy”... “waste to energy”... (energy as anthropogenic resource?)

The “End of Waste” or the End of “Waste”

Waste Hierarchy - Linear

- Presumption of “waste”
- Disposal as least preferred outcome

Residuals and Arisings - Circular

- **No presumption of waste**
- Residuals are flows of solid, liquid and gaseous materials, and energy, that are discarded, discharged or emitted by establishments and households through processes of production, consumption or accumulation. (2.92, 3.73), **System of Environmental-Economic Accounting**



“Waste” – loose talk costs \$/€ billions

- Extractive industries commonly call the materials rejected or processed in the extractive procedure “wastes”
- Hence in a U or Au project 99%+ of mined and processed ore may become “waste” purely as a result of being mined
- On what basis are such materials classified as wastes?
- Is our sense of guilt or shame overlaid on the materials because we have squandered them? So we disavow them and bury them?

Examples

Portugal: Waste or Resource? EoL or Futureproofing?



Learning New Competencies: Future-proofing the mines

http://www.uxponline.com/resources/file/pdf/meet/uxp2013/UXP_NewsletterLisbonUraniumMineRemediationMarch2013.pdf

<http://www.iaea.org/OurWork/ST/NE/NEFW/News/2012/repository/2012-11-09-Uranium-Meeting-Lisbon.html>

MINEA Budapest Oct 6 2011

Jordan: Tailings – Waste or Resource? Disposal or The Next Stage in the Life-cycle of the Mine



Jordan:
Pressure
on mineral
and land
resources;
changing
priorities
for land
use





What story does the picture tell?

Waste or Resource?

What should these rail cars be shipping?

Where should they take it?



Does it go here?

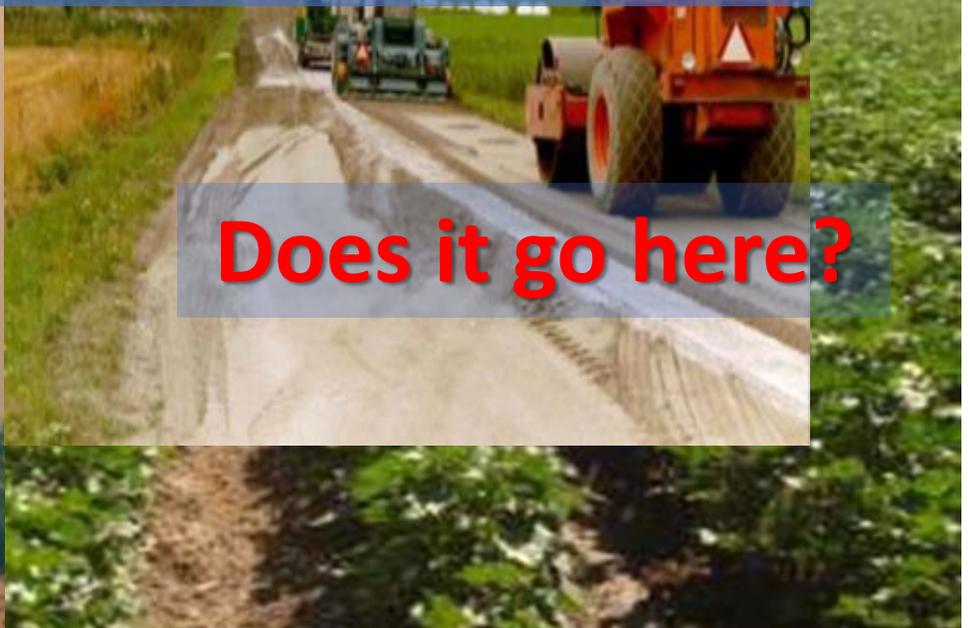


Does it go here?



Does it go here?

Phosphogypsum is an affordable, safe Soil Amendment, construction resource etc etc - not a Waste



Does it go here?

The new mining and processing economy

“Company behaviour has moved in recent decades from complying with regulations to corporate social responsibility.

In the next decades, it will need to move progressively to ‘closing the loop’ strategies to dramatically reduce the quantities of wastes.

The drivers for change have moved from being almost exclusively profit to include regulations, stakeholders and increasingly to changing social values.

In parallel, the materials cycle focus has shifted from a narrow focus on products towards including co-products. Increasingly, focus will shift to the entire materials cycle and, ultimately, to the entire economy.”

Rankin, W.J., **Towards zero waste**, AUS IMM Bulletin June 2015.

<https://www.ausimmbulletin.com/feature/towards-zero-waste/>