Barriers and Opportunities for Delivery of Sustainable Solutions: Lessons from the Field

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Bohol Philippines
Implementing Sustainable Solutions

- Sustainability issues and solutions for them occur in all nations at all scales from macro to nano.
- The key is how needs are defined and how decision-makers at all scales identify and accept solutions, including technical ones.
The Challenge

• Can we solve a range of real problems at all scales – from global to local to individual to the smallest measurable?

• Human and Institutional factors are as important as scientific and technical ones.
Sustainable Solutions are Complex

- Sustainability in its broadest dimension includes:
  - the environment and economy
  - plus also social, cultural and governance framework

- What does sustainability mean to workers, peasants, end users?

- The person who carries out the bucket is the only one who knows what happened to the toxics!
Key barriers to implementation of sustainability

• Problem identification and problem solving
• Knowledge of solutions: access to facts and advice
• Tradition
• Institutional and regulatory barriers
• Understanding of risks and benefits
• Resources
• This also applies to – nanotechnology!

St George’s Bermuda - White roofs mandatory
While nanotechnology has immense promise, and is very likely to provide significant elements in solutions to a very broad range of problems, it is likely to be a challenge to make the most of the opportunities provided and to get acceptance and adoption at many levels. All new approaches engender opposition, and some of this derives directly from a lack of information.

Any sufficiently advanced technology is indistinguishable from magic - Arthur C Clarke
`Profiles of the Future 1961 (Clarke’s Third Law)"
Communication and Problem (opportunity) identification

• A key issue is that the actual users often do not know enough to understand how to ask for help or even where to go.
• Audit approaches
• Tree falls in forest analogy – if no-one knows about it how can they buy in?
What technology?

- Manager wants “best” or “most modern”
- Salesman pushing bio-reactors
- Local experts missed membrane technology
- Effluent contains toxic mix of many chemicals
- Receptor also is contaminated with other toxics

Haimen China
• Many of the providers of new technical solutions have a reductionist focus; this makes it difficult for many to communicate their results effectively to the public and to decision makers.
Nanotech and the Public

• Fear of “unnatural resources”
• The “Grey Goo” fable
• Opposition – e.g., call for moratorium on nanotechnology applications until risks clearly addressed (ETC and others)
• How much evidence is “enough”
• Any technology can be misused
Where there is insufficient understanding, risks are often exaggerated. Longer term benefits are often discounted. Fear of what you cannot see (like radiation, biotechnologies or nanotechnologies) may be the predominant reaction. There may be large gaps between the empirically documentable risks and the public perception.
Public reaction and risk: case of disposal of low level nuclear waste - Vancouver Canada
Dealing with public perceptions

• What they think they know: Club of Rome problem with difference between what was said and what was publicized.

• Public perception of scientific information is based on what they think they “know”

• They don’t know what they don’t know.

• Any dissent is read as uncertainty – e.g. climate change
Risk and Decisions

- Government and private decision-makers often have difficulty dealing with uncertainties and anything expressed in stochastic terms.
- They and their constituencies have problems dealing with differences between “all” and “some.”
- Regulatory regimes are often prescriptive, not permissive.
- Approving or supporting an action or technique may incur liability.
How do we get the best information across the institutional gaps?

- Our institutions have difficulty establishing creative forums where the decision makers and scientists get to communicate with each other – but there are some good models:
  - Industry, academia, government exchanges and integrated career paths (good example from Scandinavian model)
  - Integrated working groups
  - Applied placements and exchanges (out of the lab and into the fray)
  - Distance mentoring and support networks
  - Conferences – like this one
Institutional Barriers

• New approaches or technologies often meet regulatory or even legal barriers

• Forms of regulation are critical: do we ban everything which is not explicitly allowed, or allow everything which is not specifically banned?

• How does the precautionary principle really play out? … and in public?

Two decade gap between time solar panels commercially available and time they were authorized for on grid use
– Ottawa Canada
Accountability and Control

• Increased focus on accountability (public and private) makes decision-makers very risk averse

• From senior official in a high level training program: “how do we punish those who do not meet their environmental goals?”

• Public demand for “zero risk”
When you have them by their wallets, their hearts and minds will soon follow....

- For industry decision-makers the economics will always be the core focus,
- Cost effective technologies which respond to known problems will be the most attractive.
- Public commitment of many firms to environmental and social objectives.
- Growing concern with broad risk reduction may be a barrier to adoption
- Existing regulatory frameworks may not be flexible enough to permit new products or processes without amendment.

Cienfuegos Cuba
Corporate reluctance

- Barrier – corporate risk perception (investment, insurance)
- Venture capital wary
- Unlimited opportunity to design/speculate on the possible (no track record, no limits)

Hilton Hotel
Savannah Georgia
Property and Impact

- Issue regarding technology – “what if we provide one to China or India – won’t they just copy it and make millions of them” – yes if that is what we want (such as use of membranes, better air and water pollution cleaning technologies – how about clean coal, safe nuclear, advanced solar etc (issue is thinking global and acting at the local or firm level)
- We give away our indicators stuff – intellectual property – to make a difference.
Positioning scientific and technical advice

• Tactics from the advertising world – to get them to understand and adopt.
• Creating demand – what do they want or how do we get them to think they want it?
  – Clean and green, socially beneficial, efficient.
  – New, improved, powerful

(Note: to date “Nano” has positive spin)
Managing risk

- Life Cycle management (and accountability)
- Iterative audits/full risk audit
- Case by case review (all assumptions now challenged)
- Change all assumptions re what exists, what is possible, what can be changed
- Note that perceived risk is seldom the same as empirical risk
What is expected of managers of new technologies?

• Taking intelligent risks
• Anticipating impacts
• Preventing unacceptable outcomes
• Respecting “limits of acceptable change”
Supply or demand driven?

- Is nanotechnology supply driven – based on the evolving discoveries?
- Acceptance and realization of the potential will also have to be demand driven: that is – how can the new technology help solve the real problems.
- A key challenge will be to look at the menu of needs – from global to local – and ask how we can help.
- Some cases follow which illustrate a number of challenges from the perspective of implementing sustainable development.
The need for improved technological solutions to support sustainability

• The litany of issues of sustainability is also a list of opportunities. From work in many nations, it is possible to create a wish list – (and productive for all of us to create our own and begin to share it).

• Like nanotechnology, there is great variety – often each demand is unique

• Nanotechnology will not have all the answers – but may be a significant part of the solution to many – at a very wide range of scales.

Ebodje Cameroun
Can you build a screen which lets in air, not bugs?
A menu from the front lines of implementation

• Here are a few of the challenges which have been encountered in my own work on delivery of sustainable solutions: where there is likely to be a role for applications of nanotechnology.
Priority Sustainability Issues

• From participatory consultations on sustainable development in more than 40 communities on all continents worldwide some problems emerge as common priorities.

• While some involve human behaviour and access to information, most will need improved technologies for resolution.

• Most pressing are water supply, energy supply, solid waste management, liquid waste disposal, remediation of toxic sites, protection of health (notably food purity) improvement of air quality; noise reduction (from transportation and industrial processes), protection of fragile systems and endangered species, and provision of suitable health services.
If you can’t measure it you can’t manage it

• For environmental remote sensing – to make remote sensing equipment more durable and longer lasting, particularly those left in place to continuously transmit information such as water quality, radiation airborne contaminants or temperature. Can you drop it from a plane and will it continue to provide information?
• How can we trace the paths?
• New monitoring transmitters?
Monitoring Key Indicators

- Technology is dominated by two types of people: those who understand what they do not manage, and those who manage what they do not understand. - Putt’s Law

- Decision-makers seldom have the key information they need to make good decisions – the right level, at the right time in an understandable form
Clean water supply

• Key indicators: quantity, purity, cost
• Desired solutions: Suitable scale, easy to manage, low maintenance
• Challenges:
  – Access
  – Cost
  – Monitoring
  – Training
  – System integrity

Mexicaltitan
Mexico
Energy management is a near universal issue

- Many small communities are without feasible non-solar energy sources where improved solar storage and collectors can be critical.
- A solar system which would provide energy and power water desalinization supply for a 200 room resort is the same size as one which would sustain a 1000-2000 person village (and the global hotel industry is actively seeking this technology now for remote resorts and could be the catalyst for the work to make the technology economic).
There is an unsatisfied demand to be able to craft solar collectors which look like thatched or tile roofs for resorts and to produce effective energy storage systems which are more efficient than those presently available.
Can you design an R40 log?

Chateau Montebello
Quebec Canada
Liquid waste disposal

- Appropriate technology
- Fail safe mechanisms
- Ability to run and repair
- Durability
- Training
- Access to support

Mangalia
Romania

Beruwela
Sri Lanka
Solid waste management,

- Human and technological problem
- Need to change human behaviour
- Need to recover and reuse materials
- Need for efficient and safe incineration
- Need to reduce costs
- Concern for risks associated with any process
How do we deal with a legacy of unsustainable activities?

- New bio-remediation methods for industrial sites and contaminated rivers where the biota are not killed by other contaminants. Many sites have a toxic soup which defeats most current biotechnologies and industrial effluents are also often a mix of contaminants which may kill the biota in treatment systems.
Other important local or firm level issues in sustainable development

- Protection of health
- Improvement of air quality – indoor and outdoor
- Noise reduction (mainly from transportation and industrial processes),
- Protection of fragile systems and endangered species,
- Provision of suitable health services.
Technology and “soft” issues

• Several human issues are also key to sustainability
• Key issues are related to behaviour, crowding, participation in planning and control and governance
• Here the potential impact of nanotechnology is less clear although improvements in monitoring devices and communications products could contribute to solutions.
Can solutions be scaled to the needs?

- Affordability is a key – particularly where solutions are dispersed and smaller remote or developing communities and small enterprises are the delivery mechanism.
- Smaller scale applications may be the most effective in such circumstances.
Visible Progress

- Importance of accepted standards
- China now world leader
- Canada still awaiting approval
- ISO in development
Global solutions to local problems

• The overall challenge of future sustainability lies in reducing the human footprint in many ways - and nanotechnology can contribute.

• The crunch comes at the local level – in provision of basics, construction design, reduction of impacts of activities, conservation of species, reduction of risks to life and property, and ……

Lofoten Norway
Strategic Wish List for Sustainable Solutions (my top 10)

• Durable solar collectors which can be used in construction (roofs, walls, parking lots)
• Ambient temperature superconductors for long distance energy transport
• Inexpensive storage media for energy at dwelling or village scale
• Simpler filtration systems for water purification and waste management – particularly those capable of filtering complex mixes of contaminants
• Real time remote monitoring systems

Continued………..
My top 10 continued

- New toxic site and watercourse cleanup methods particularly for mixes of contaminants
- More robust crops which will survive a wider range of water regimes and temperatures—given climate change potential
- Light weight, portable, high capacity energy storage systems for vehicles
- Insect repellents which are medically safe and which will last for 24 hours or more without having to be replaced
- Safer methods to allow foodstuffs to last longer in storage without degradation

Tatras Slovakia
May you enjoy a long, productive and sustainable future.