

Trouble in Mawatubiki – Nanotech to the rescue of tropical island state?

An exercise in considering the ethical concerns connected with the public application of an emerging technology

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Introduction and expected outcomes:

This exercise can be performed with a group of scientists numbering between 4 and 100 or more, though certain parts of it are clearly more suited to smaller groups. It encourages participants to consider the consequences of the application of a new technology at various levels (ethical, economical, societal, philosophical, scientific) and from the perspectives of different societal groups. It was designed for life scientists, but its subject is rather technology from chemistry and physics. This scientific focus was chosen in order to take the life scientists out of their usual frame of reference, making it easier for them to open their minds to various societal perspectives on technology. The ultimate aim is that they then apply these perspectives to their own research, exploring possible applications and the way in which these might be viewed by different societal groups. The exercise has been run several times with considerable audience interest and engagement. Broadly speaking, it demonstrates that within a relatively homogenous group (e.g. all molecular life scientists between 25 and 35 yrs old, almost all from Europe) very different points of view on the application of science are expressed and defended with great conviction. Many of the scientists manage to be convinced and convincing defenders of all of the role-play types: scientist, environmental organisation representative, company representative, journalist.

Disclaimer: The scenario depicted in the exercise is fictional, and it is not intended to represent real events or prejudice readers in any particular direction. It is designed for discussion and exploration of opinions. Similarities with real people – living or dead – are coincidental. The name of the company, product and island state are invented: should they bear any resemblance to existing names, this is pure coincidence.

Scenario and exercises:

Trouble in Mawatubiki – Nanotech to the rescue of tropical island state?

As a result of climate change, the tropical island state of Mawatubiki has recently suffered a greater number and greater intensity of tropical storms than ever before in its recorded history. The agricultural economy is dependent on at least two annual harvests of the fast-growing bio-diesel

producing variety of Tappi-tappi plant. A volcanic island, Mawatubiki's most fertile land is on hillsides, and hence prone to erosion. Traditionally the fields are planted with a variety of crops, some of which are harvested only once a year. Twice-yearly harvesting of the shallow-rooted Tappi-tappi plants makes the soil particularly vulnerable to erosion by heavy rain-fall. In the past year, much agricultural land has been destroyed – literally washed down the hillside in tropical storms.

The Mawatubiki government called on international advisory agencies including the FAO (Food and Agriculture Organisation), but while the FAO was preparing a study of the situation, a US company "NanSolv" came forward with a possible solution. This involves a new, as yet untested, nanotechnology product that claims to be able to bind the surface of fragile soil into a semi-solid crust. SurfaceSave is a nanoparticulate combination of an organic moiety that binds to humus (decaying organic matter) and silicate particles in the soil. It thus forms an amorphous structure that is relatively water insoluble but easily broken up by physical means (such as ploughing or tilling the earth). Sprayed onto the surface of the soil as a mildly alkaline emulsion, SurfaceSave penetrates to a depth of only 1 cm, and upon moistening with rainwater catalytically binds the surface into a crust, hence reducing erosion. It has since emerged also that the Mawatubiki application of SurfaceSave might act as a pilot project for a larger scale use in California, USA, where hillsides are regularly made vulnerable to erosion as a result of deforestation by fires.

Environmental protection agencies, notably NGOs Greenpeace and Friends of the Earth, have reacted with horror at the news of the experimental use of a nanotechnology product in Mawatubiki. Residents of California are also "concerned" to say the least, after hearing of the plan to use their neighbourhood as a beta-testing ground for the product. Mawatubiki farmers are desperate to save their land, and are keen to try any solution, but as the NGOs point out, a short-term gain could be accompanied by a long-term environmental disaster. "If this is some kind of catalyst, that means that it can carry on reacting with the soil for as long as it survives, and we don't know how long that is, or where it might end up over that time span" said Nicola Alvares of Friends of the Earth, continuing "We don't even know much about its toxicity to humans and other organisms, especially in the Mawatubiki ecosystem. This is yet another example of unnatural interference with the environment – we have to stop the cycle somewhere and say 'enough is enough'." The Mawatubiki government says it is prepared to discuss the "aid" from NanSolv, which would be provided free of charge according to a company spokesman. Mawatubiki's minister for agriculture said "Agriculture *is* our economy on Mawatubiki's. If we do not act soon, we may not be able to grow anything, let alone Tappi-tappi. That said, we do not want to become slaves to western technology, and must try to find long-term solutions to the problem ourselves."

Whatever the situation in Mawatubiki, a public challenge is growing (mainly in

the developed world) to the use of SurfaceSave, and even to nanotechnology itself. Basic researchers and technologists alike are becoming concerned at what this could mean for the public image and hence funding of their work at a time when it already arouses fear and mistrust. Indeed, NanSolv funds research projects that are ongoing at certain university laboratories, which rely on such funding to keep their heads above water.

Choose a role to become. Imagine yourself with one of the following mind-sets:

1. Current affairs correspondent of a major international newspaper
2. NGO representative (pro-environment etc.)
3. Chief Scientific Officer of NanSolv
4. Eminent independent scientist (academic professor, whose research is totally publicly funded) working in area of nanoscience

Tasks:

1. Playing your role above, consider some of the issues:

A. The new crop (responding to western needs, and provided by a western biotech company) has inadvertently caused a problem in Mawatubiki – in combination with western-driven global warming. Are we justified in using one western technology to solve the problems caused by other western technologies? Some would say we have a duty, and that the world we live in today cannot return to the way it was anyway. Another point of view is that we simply wind ourselves and others up in a dependency upon new technologies, the consequences of which are never predictable. What do you think?

B. What is more important? The immediate needs of the Mawatubiki farmers, or the concerns of developed-world observers that something wrong and even "unnatural" is being done?

C. Can any situation, however severe, justify the environmental use of a product that has not yet been tested in the intended scenario? This refers to the precautionary principle or "PP". How much do you know about the PP? How could it be applied in the Mawatubiki scenario?

D. The situation with Mawatubiki is similar to a patient who is bound to die of a hitherto untreatable disease, but who has the chance to participate in a trial of a new potentially life-saving treatment (not cure, note!). If the medicine works, what are the responsibilities to the patient after the trial is over? What if the patient can't afford the new medicine, or regulatory agencies decide against its registration?

E. Would the perception of NanSolv's product be different if it were simply labelled as a product of "modern chemistry", and not a nanotechnology solution? The company was keen to use the "nano" cachet in its marketing and description of the product. What do you think about the re-labelling of science to follow fashionable trends?

F. Should the researchers working in the NanSolv-funded USCF laboratories have a say in how their research is marketed and to whom?

G. Mawatubiki's environment minister said she didn't want to become slaves to western technology. How can scientists help to work towards a future in which the distribution of knowledge and technical ability is more diffuse, and not just concentrated in rich developed countries?

H. How can the scientists working on nanotechnology protect fundamental research from the generalised bad perception that invariably occurs when one example hits the headlines?

Are there any other points on which you have an opinion, apart from the above?

After considering and discussing these stimulatory points, you might like to move on to the second part of the exercise:

2. Now, imagine that the Mawatubiki situation has just tipped the balance enough against nanotechnology to precipitate top-level discussions on an internationally agreed moratorium on nanotechnology applications. Public referenda will be held in the near future in many countries. Though the moratorium will not include basic (fundamental) research, the implications for basic research could be disastrous. Basic researchers rally to the cause, and organise public appearances in defence of their science. Some write to large newspapers offering articles setting the record straight. Most editors, wishing to be in control of what is reported to the public, prefer to get their correspondents to interview several sources, and write the article themselves. Participants in this exercise now have to play their roles as indicated above. The scenario starts with the independent scientist calling the newspaper correspondent and offering an article. The correspondent says that he will write the article, and that he will interview others as well. The interview proceeds (allow 2 minutes), then the correspondent interviews the others in the role-play (also each for around 2 minutes). In the following 10 minutes

each role-player separately makes a draft of how he/she thinks the article should read. After that, they all compare their versions with the one that the role-play correspondent has made. This should show that even among scientists, different slants and opinions can emerge when a topic is seen through different spectacles, so to speak.