Nanosciences, Nanotechnologies, Materials and New Production Technologies Deployment in Latin American Countries

Addressing societal challenges:

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Nanotechnology Can Help To Solve Conflicts Over Mining

Mining activities in several Latin American countries have been surrounded by prolonged and at times violent conflicts between local populations and mining companies. Competition for scarce water resources and water contamination are key issues. We don't propose quick technological fixes. However, the introduction of innovative mining water and effluent purification solutions by a neutral third party in close consultation with all stakeholders may well change the dynamics in these conflicts. We sketch a potential scenario for such an intervention in the medium to long term.

Decision makers and stakeholders: local populations in mining regions and civil society, mining companies and their associations, governments of mineral-rich countries and international organisations, researchers, media and general public.

Introduction: water or gold?

While Frost and Sullivan report that overall use of freshwater by mining and other industrial sectors was only 10% in Latin America in 2011, regional differences are great. Several sources indicate that water pollution from mining activities poses problems in Northern Chile, Peru, Colombia and other countries. The World Economic Forum reports a flaring up of local conflicts over mining in 2012. This includes stakeholder protests against the proposed extension of the Yanacocha gold mine in Peru, increasing opposition from local communities - e.g. legal action in Chile - and provincial governors demanding larger shares of mines in Argentina. The Huffington Post analysed the conflicts over the Yanacocha mine, criticising in particular the role of investments by the World Bank and International Finance Corporation. This brief introduction gives a flavour of the magnitude and complexity of the issues at stake, often simplified in the trade-off: "Water or Gold."

Some proposed solutions

Several local and international stakeholders have proposed solutions to these conflicts. Main building blocks in these solutions include awareness raising, knowledge sharing and capacity building to achieve a common understanding of the issues, broad stakeholder dialogue facilitated by a neutral third party, monitoring of compliance and law enforcement and mediation in disputes. Apparently, there is a gap between the local stakeholders on the one hand and the mining companies on the other. Both sides appear to be talking more about than with each other.

Promising technological developments

Even though most envisaged solutions are social, some recent technological developments may contribute to breakthroughs in the existing stalemates, albeit in the medium to long term. In Chile, the national copper company CODELCO and BHP Billiton established a public-private collaboration in 2009, aiming to support 250 world-class local suppliers to develop innovative solutions for local mining-related issues including shortages of water, by 2020. This partnership includes universities and technology centres.

 The work leading to these results receives funding from the European Community's Seventh Framework Programme under grant agreement n°608740.

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In Colombia, the national nanotechnology network RedNanoColombia is targeting its research on monitoring and remediation of mercury contamination. A main contributor to this problem is the (artisanal) mining sector. The NANOSENS project developing diagnostics is in the starting phase. This aims to detect mercury and arsenic by a network of interconnected sensors: a "lab in a mobile phone".

In the long term nanotechnology offers innovative opportunities for desalination and water remediation. Nanomaterials including Graphene (single layers of graphite) offer opportunities for improved and more efficient membranes for desalination. Nanotechnology offers solutions for remediation of effluents containing toxic liquid waste of mining. Most research relating to mine water issues remains at laboratory scale, such as magnetic nanoparticles for recovery of e.g. gold from water solutions.

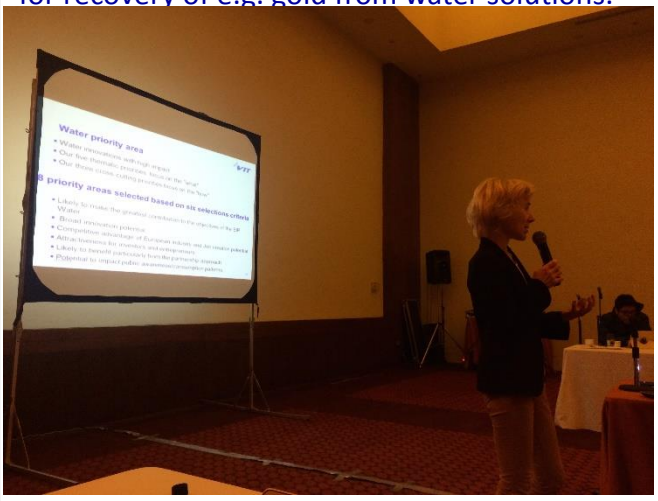

Figure 1: Mona Arnold (VTT) presents nanotechnology for water challenges in Monterrey, Mexico.

Organising the intervention - Short term (2020)

Within five years, results may be expected from ongoing initiatives such as the Chilean investment in innovative high tech suppliers to copper mining companies. The Colombian NanoSENS lab-on-a-smartphone network allowing local stakeholders to participate in water quality monitoring may also be established. Furthermore, the Latin American research community in cooperation with European and African partners may have established a stakeholder platform overseeing new innovative projects (www.baleware.org). It is important to engage other stakeholders than just nanoscientists, water technology producers and the local population.

Maintenance and powering needs of the systems and the local capacity for these must also be taken into account.

Medium term (2020-2030)

Within fifteen years, the UN Sustainable Development Goals set the following targets for water:

"6.3 improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and substantially increasing recycling and safe reuse globally.

6.a expand international cooperation and capacity-building support to developing countries in water and sanitation related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies."

Some nanotechnology applications for potabilisation and waste water purification that are currently in the beaker stage may be scaled up to pilot and industrial scale by then. The establishment of public-private partnerships engaging universities, applied research centres and industry in common R&D&I programmes in open dialogue with local stakeholders and government representatives would enable such development.

Long term (2030-2050)

In the long term, the World Economic Forum Mining & Metals Industry Partnership considers seven drivers of change, including a growing concern for the environment such as the protection and sustainable management of water. The partnership expects limited access to resources including water and higher costs derived from the introduction of "true cost internalization" in the late 2020s. This will lead to cooperation between companies, local governments and communities, developing mutually beneficial adaptation strategies and operating standards. More stringent requirements will exist for water reuse within operations and for post-use treatment.

Further reading

This fact sheet is based on literature and experts participation in interviews and events reviewed in the NMP-DeLA final roadmap and water roadmap. They can be downloaded from www.nmp-dela.eu