EU 7th Framework Programme

Theme: (NMP.2013.4.0-5)
Deployment of societally beneficial nano and/or materials technologies in ICP countries.
Coordination and Support Action

NMP-DeLA

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

FP7-NMP-2013-CSA-7

Deliverable D1.7: 2nd Report on Ethics and Gender

Work Package:	WP1
Task number:	T1.3
Lead beneficiary:	MTV
Delivery date:	M24
Version:	M24
Submitted by:	Ineke Malsch

The work leading to these results receives funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under Grant Agreement n°608740

Document Control Page	
Deliverable Title	2nd Report on Ethics and Gender
Author (writer/editor and short name of the participant	Ineke Malsch, MTV
Short Description (e.g. abstract, summary, table of contents, free text etc.)	The present "Second Ethics and Gender Report" (D1.7) is foreseen in NMP-DeLA Task 1.3 Ethics and Gender Assessment. The task leader is Ineke Malsch from Malsch TechnoValuation and all other partners are involved. According to the Work Plan, "the Ethics Committee and the Gender Panel will be involved in overseeing that ethics issues are properly handled in the project activities and in the project resulting materials and assessing the promotion of gender equality in the project activities and in its results contents." This report covers the second year of the project.
Publisher (e.g. journal publisher or the consortium)	Consortium
Contributors (co-authors with participant short name)	Ineke Malsch, MTV
Nature (peer-reviewed article, technical report, table, prototype, demonstrator, etc.)	Report
Format (e.g. MS Word 2003, PDF etc.)	PDF
Language	English
Creation date	25-08-2015
Version number	1
Version date	25-08-2015
Last modified by (person and organisation name)	Ineke Malsch, MTV
Rights (e.g. IPR, copyright, such as copyright "NMP-DeLA consortium")	Copyright @ NMP-DeLA 2015
Dissemination level	☒ PUPublic ☐ PP Restricted to other programme participants (including the Commission Services) ☐ RE Restricted to a group specified by the consortium (including the Commission Services)

	☐ CO Confidential, only for members of the consortium (including the Commission Services)
Review status	Where applicable: ☐ Draft ☐ WP leader accepted ☒ Coordinator accepted ☐ Accepted for publication ☒ Date of publication
Action requested	☐ to be revised by Partners involved in the preparation of the document ☐ to be revised by all NMP-DeLA partners ☐ for approval by the WP leader ☐ for approval by the IPC ☐ for approval by the Project Coordinator
Requested deadline (dd/mm/yyyy)	

Revision history

Version	Date	Modified by	Comments
V0	11/08/2015	Ineke Malsch, MTV	First draft
V1	25/08/2015	Ineke Malsch	Incorporated contributions on ethics and gender in NMP-DeLA from other partners, updated summary and conclusions. Approved by coordinator.

Notes:

- Include a comment to all version of the document.
- The initial version must be "v0" and minor changes should be registered as "v0.1, v0.2…". Major changes should be registered as "v1.0, v2.0…"

Table of Contents

Index of Tables

1 Abbreviations and acronyms

Partner Acronyms:

ASCAMM	Fundaciò Privada ASCAMM, Spain
REDINN	Rete Europea dell'Innovazione, Italy
MTV	Malsch TechnoValuation, Netherlands
ZSI	Zentrum für Soziale Innovation, Austria
VTT	Technical Research Centre of Finland, Finland
RELANS	Latin American Nanotechnology and Society Network, Brazil
MINCyT	The Ministry of Science, Technology and Productive Innovation, Argentina
CIMAV-CONACYT	Centro de Investigación en Materiales Avanzados, S.C, Mexico
MEC	Ministry of Education and Culture, Uruguay
EUROCHILE	Eurochile Business Foundation, Chile

Abbreviations and acronyms used in this report

CoI	Community of Interest
LAC:	Latin American Countries
NMP	Nanosciences, Nanotechnologies, Materials & New Production Technologies
OIP	Open Innovation Platform
NMP-DeLA	Nanosciences, Nanotechnologies, Materials & New Production Technologies Deployment in Latin America

2 Summary

The report is structured as follows: after a brief introduction in section 3, section 4 explains how ethics and gender has been addressed in the NMP-DeLA project during the second year of its operation. Relatively more men than women have participated in the activities on water and energy. This is counterbalanced by the predominance of women in the consortium and in the health-related activities in the first year. Ethics has been addressed in all activities. NMP-DeLA community members have discussed ethical, legal and societal (ELSA) aspects of nanotechnology for health, water and energy. Section 5 highlights some opportunities for synergies with other initiatives, in the form of a review of current developments in global, European and Latin American discussions related to ethics and gender. In particular this includes the global discussion about the contributions Science and Technology may make to the successor of the current Millennium Development Goals (MDG) that are targeted in the NMP-DeLA original work plan. These are the so-called "Sustainable Development Goals" (SDG), with a time horizon 2015-2030. At European level, the relevant discussion focuses on incorporating Responsible Research and Innovation in the Horizon 2020 programme for Research and Technological Development, as a more encompassing successor of the European Commission code of conduct for responsible nano-research as part of the European Action Plan for nanotechnology (2005-2009). NMP-DeLA community members also recommended activities addressing ethical, legal and societal aspects of nanotechnology. Opportunities for synergies between the NMP-DeLA roadmaps with these three discussions were identified in the first ethics and gender report and have been monitored in the second year of the NMP-DeLA project. This report takes stock of these developments. This is followed by conclusions in section 6. A recurrent theme is the need for indicators to monitor progress in the implementation of the SDGs, RRI and societal and economic impacts of investments in (nano)science, technology and innovation. Targeting the SDGs helps to focus activities by policy makers, researchers, industry and other stakeholders on global priorities in sustainable development, including health, water and energy. Education and investment and cooperation in innovation and R&D are also among the priorities in the SDGs.

The present "Second Ethics and Gender Report" (D1.7) is part of NMP-DeLA Task 1.3 Ethics and Gender Assessment. The task leader is Ineke Malsch from Malsch TechnoValuation and all other partners are involved. According to the Work Plan, "the Ethics Committee and the Gender Panel will be involved in overseeing that ethics issues are properly handled in the pro-

ject activities and in the project resulting materials and assessing the promotion of gender equality in the project activities and in its results contents."

3 Introduction

The main objective of NMP-DeLA project[1]. is to develop a series of activities between European and Latin American countries, aiming to strengthen the local research and training potential as a way of facilitating the deployment of nano and advanced materials technologies in areas of major social challenge in Latin America: energy, water and health.

The objective of Work Package 1 is to manage the consortium, including consortium meetings, monitoring and evaluation of progress and results, financial management of the project plus the delivery of the periodic and final reports on the project to the European Commission as well as submission of project deliverables.
The goal of Deliverable D1.7 is to veil for the proper consideration of ethics and gender related aspects of the project activities and outcomes during the second year of the project.

Ethics and Gender aspects are at the core of the NMP-DeLA project. The project is intended to contribute to the UN Millennium Development Goals as discussed in the first report. An Ethics and Gender committee chaired by Ineke Malsch and consisting of representatives of each partner is overseeing the implementation and handling of ethics and gender aspects in all work packages of the project.
The present report (D1.7) presents how ethics and gender has been incorporated in the projects deliverables and activities during the second year of the project (1 September 2014 – 31 August 2015). It also includes monitoring of potential synergies with relevant initiatives of the EU and other global players during the second year of the project and prospects for how this could take shape afterwards.

[1] Nano, Materials and Production Technologies Deployment in Latin America www.nmp-dela.eu

4 Ethics and Gender in the NMP-DeLA project

The Ethics and Gender committee has been launched during the NMP-DeLA Kick-Off Meeting (KOM) as part of Work Package 1 (WP 1). During the second year, ethics has been explicitly addressed by all partners in the roadmapping in WP 2, the networking in WP 3, the education and training in WP 4 and the communication and dissemination in WP 5.

4.1 Ethics in the roadmap

Ethical, legal and social aspects of NMP were explicitly addressed in the NMP DeLA Roadmap. During the collection of qualitative data (interviews, focus groups, workshops) the involved persons were confronted with ELSA: e.g. ELSA was discussed as an issue of special concern in all focus groups. It was also intended to have gender equality in the focus groups and interviews. If this could not be reached, it was addressed as an issue by the moderators. The final roadmap includes explicit chapters on ELSA as well as impact indicators for ELSA.

4.1.1 Interest in ethical, legal and societal aspects of nanotechnology in the NMP-DeLA Community of Interest

The Latin American network for Nanotechnology and Society (ReLANS) is organising social and human scientists studying ethical and societal aspects of nanotechnology all over Latin America.[2] In addition to this established network, several projects funded by CYTED, the EU and others are or have in the past been stimulating research, networking and communicating about ethical, legal and societal aspects of nanotechnology, involving ReLANS members as well as other research groups. These include the recently finished network Jose Roberto Leite NANODYF[3] and an earlier nanotechnology network funded by RedCLARA.

Currently, the Ibero-American Network for Nanotechnology (RIN)[4] that started in 2014 already has members from nineteen Ibero-American and two other countries. It aims at communicating about nanotechnology to the general public.

National initiatives

While the Argentinean National Committee on Ethics in Science and Technology CECTE has organized an international conference on adapting the European code of conduct on nanotechnology research (EC, 2008) in 2008 this has so far not resulted in an Argentinean code of conduct for nanotechnology. Instead, it has published more general “Propositions for an socially responsible science and technology” (CECTE, 2013). This includes seven main principles as well as guidance for individual researchers and research organisations. The seven main principles are: respect for human rights, consolidation of democratic values and practices, contribution to peace and justice with special attention to the most vulnerable sectors, care for the environment, biodiversity and the biosphere as a whole, open access to knowledge and information, equal access to the benefits of knowledge, freedom of research and the development of the capacity for critical analysis and innovating creativity.

[2] www.relans.org

[3] http://www.nanodyf.org/

[4] http://www.rednano.org/

In Mexico, there is an ongoing study aiming for a revision of the existing regulations and incentives for creating new technologies, like public centres with proper brands (marcos propicios) for technology transfer targeting societal problems. The aim is developing a map for knowing how nanotechnology can be done and disseminated to the market and society, in which regions. This information is according to a participant in the workshop in Monterrey, Mexico.

In Chile, all FONDECYT grants make it obligatory to evaluate societal opportunities. Most consortia engage in public awareness (TV, newspapers, school), this stimulates multidisciplinary research involving natural and social scientists.

4.2 Ethics in networking

The workshop in Monterrey on Nanotechnology for Water and Energy on 10-11 November 2014 included a focus group and panel discussion focusing on the societal context surrounding the deployment of nanotechnology in Mexico and Latin America. The keynote lecture by Mike Roco (NSF, USA) included discussion of nanosafety and responsible innovation in nanotechnology. Several other presentations discussed nanosafety aspects, in particular related to water. The critical audience asked many questions about ethical, legal and societal aspects of nanotechnology.

The workshop in Santiago de Chile on Nanotechnology for Industry on 3 December 2014 included lectures on responsible innovation by Ineke Malsch, Malsch TechnoValuation, on nanotechnology for social challenges by Maria Lima Toivanen, VTT and on challenges of commercialisation by Françoise Roure, French Ministry of Economy, Industry and Digital Affairs. Nanosafety and responsible innovation were also recurrent themes in other presentations and discussions, in particular in the focus group.

The workshop in Curitiba on Nanotechnology for Water and Energy on 28-29 May 2015 included one lecture on Responsible Research and Innovation by Ilse Marschalek of ZSI. Potential contributions of nanotechnology to the Millennium Development Goals and the Sustainable Development Goals were a common thread in all presentations and discussions.

4.3 Training ethics

During the second summerschool on nanotechnology for water and energy, 10-13 November 2014 in Monterrey, several lectures on ethical, legal and societal aspects have been included including “A crash course on Do-It-Yourself ethics of nanotechnology” by Ineke Malsch, “the EC framework on nanosafety” by Lesley Tobin, and “How can nanotechnology solve the grand challenges related to water”, by Mona Arnold.

4.4 Communicating ethics

In WP 5, the main ethical issues are Privacy issues, data protection and IPR. Participants were asked for permission prior to filming and photography. All authors are asked for permission before Summer School and Workshop presentations are published on the web to protect sensitive information, data that should not be in the public domain, IPR and personal data protection. Focus group participants identities are protected on request: no filming or photographs. Comments are not attributed to individuals for reasons of privacy and data protection. The web platform has secured access and is password protected for certain areas. Registration and membership for access to these areas is granted only on request to the platform op-

erators (CIMAV).

Content for the newsletter (and other media communications) is provided by project partners as well as internal and external stakeholders. Newsletter items, including images, can be submitted via the NMP-DeLA website and can be emailed to the editor for any of the newsletter content sections. It is stipulated that all items must be permissible for inclusion in the public domain, i.e. no confidential or sensitive information will be published.

4.5 Gender aspects

Gender aspects have been addressed as follows. For gender representation in the engagement /dissemination activities Summer Schools and Workshops Balance of gender in terms of presenters and participants has been monitored and ensured, as represented in tables 1 and 2 below. As reported in the first ethics and gender report, more women than men participated in the workshop and summerschool on nano for health. As expected, water and energy attracted more male participants.

Gender balance in consortium	**Male**	**Female**
Project coordinator	-	1
Work package leaders	1	4
External Advisory Board	4	1
Consortium members	17	22
Gender balance in activities	**Male**	**Female**
Interviewees for roadmaps Nano for Water and Energy	12	7
Interviewees for roadmap Nano & Health	8	6
Focus group participants	6	6
Workshop presenters Nano & Health	10	9
Workshop participants Nano& Health	28	34
Summerschool lecturers Nano & Health	9	9
Summerschool participants Nano & Health	7	20
Focus group participants Monterrey	9	5
Workshop presenters Nano for Water and Energy Monterrey	12	7
Workshop participants Nano for Water and Energy Monterrey	443	272
Summerschool lecturers Nano for Water and Energy Monterrey	3	4
Summerschool participants Nano for Water and Energy Monterrey	24	17
Workshop presenters Nano for Industry Santiago de Chile	17	12
Workshop participants Nano for Industry Santiago de Chile	54	29
Focus group participants Santiago	7	5

Workshop presenters Nano for Water and Energy Curitiba	17	10
Workshop participants Nano for Water and Energy Curitiba	27	19
Focus group participants Curitiba	18	7

Table 1: Gender balance in the consortium and activities

Conclusion: Ethics and gender aspects have been integrated in all elements of the project and are an ongoing concern, both in the consortium and in the wider community of interest.

5 Opportunities for synergies with other initiatives

As the current set of Millennium Development Goals (MDGs) is expiring this year, the United Nations and its Member States, International Organisations and a wide range of Civil Society Actors are currently discussing a new Post-2015 Development Agenda that should be adopted by the UN General Assembly in September 2015.[5] This discussion started during the UN MDG Summit in September 2010 and received a boost during the Rio+20 UN Conference on Sustainable Development in June 2012, when UN Member States adopted "The Future We Want"[6]. This represents the UN and Member States commitment to sustainable development. This document called for "strengthened national scientific and technological capacities for sustainable development". In the first NMP-DeLA Ethics and Gender Report, the relevance of the NMP-DeLA roadmap to the new proposed Sustainable Development Goals (SDG) with deadline 2030 has been explained.

5.1 Recent activities of key stakeholders in Science and Technology for Sustainable Development

In the recent discussions on establishing these new Sustainable Development Goals (SDG), a network of international scientific associations and individuals has been advocating recognition of the potential contributions of Science and Technology in accomplishing them. Relevant activities to the NMP-DeLA project are discussed below.

5.1.1 Media

The online news site on science and technology for global development **SCIDEV.NET** includes a special section on the Millennium Development Goals (MDGs), including relevant news to the role of science in the new Sustainable Development Goals[7]. Recent relevant news for the NMP-DeLA roadmaps includes a story on the opportunities offered by S&T for water purification, in particular graphene for desalination. Another story reports on a new investment fund of US$ 20 million in renewable energy in Central American and the Caribbean, announced by President Obama in May 2015. On 20 July 2015, editor Inga Vesper highlights the need for more investments in science in developing countries as an attractive way to reach the SDG. She criticises the proposed Technology Facilitation Mechanism for supporting technology transfer of western inventions to developing countries while disregarding invest-

[5] Follow this discussion at http://www.un.org/millenniumgoals/

[6] http://www.uncsd2012.org/content/documents/727The%20Future%20We%20Want%2019%20June%201230pm.pdf

[7] http://www.scidev.net/global/governance/mdgs/

ments in research in developing countries themselves.

From the perspective of the development aid community, **The Broker Online** also covered the discussion on the SDG until March 2015.[8] In the last blog-post, Marcel Kok, Kathrin Ludwig and Paul Lucas plead for strengthening the opportunities for non-state actors to contribute to the implementation of the Post-2015 development agenda, including researchers, industry and civil society actors. Their plea is based on an article analysing these opportunities in Sustainability (Hajer et al, 2015). This recommendation appears to have been taken into account in the final draft SDG published in July 2015.

5.1.2 UN Secretary General's Scientific Advisory Board

Officially, the voice of science is incorporated in de SDG discussion through the **Scientific Advisory Board of the United Nations Secretary General**[9] **(SAB)**. This board consists of 26 eminent scientists from all over the world. Latin American members are Eugenia Kalnay from Argentina, who is Professor of Atmospheric and Oceanic Science, University of Maryland, USA, and Carlos Nobre, National Secretary for R&D Policies at the Ministry of Science, Technology & Innovation of Brazil. It has been established by the UN Secretary-General Ban-Ki-Moon on 24 September 2013 and held its inaugural meeting in Berlin, 30-31 January 2014. It is chaired by UNESCO Director General Irina Bokova.

Since 1 September 2014, the SAB has met several times in order to identify eight top challenges to the future of humanity. They have also discussed how ST&I can help implement the SDG. Key priorities include the global data revolution, improving the science-policy interface and risks of climate change. Their final recommendations mainly focus on improving the science-policy interface through strengthening the involvement of scientific advisors in the High Level Political Forum advising on the SDG policies, and through a more central and public role for the annual Global Sustainable Development Report, monitoring the implementation of the SDGs (SAB, 2015a). They also propose practical ways to utilise science, technology and innovation in implementation of the SDGs. They plead for investing in basic science as a public good leading to new knowledge, better integration of science and indigenous knowledge, increasing national investments in ST&I, focusing investments on "sustainable solutions that are co-designed and co-owned by the people at the bottom of the pyramid" (including water, energy and nano-enabled health solutions), and more attention for local implementation and local knowledge, as well as science, technology, engineering and maths education. STI can play a role in monitoring progress in the SDGs, but progress in STI solutions must also be monitored (SAB, 2015b).

5.1.3 UN System Task Team

In the period between 2010 and today, several UN institutions and international scientific associations have addressed ways and priorities in targeting ST&I towards the new SDG. For example, the UN SG has established the **UN System Task Team on the Post-2015 UN Development Agenda** in September 2011, engaging experts from 60 UN-bodies and international organisations.

[8] http://www.thebrokeronline.eu/Dossiers/Post-2015

[9] http://en.unesco.org/un-sab/

The **Sustainable Development Knowledge Platform**[10] is organising the discussion on the SDG. Recent discussions relevant to ST&I include a proposal for the abovementioned Technology Facilitation Mechanisms, in order to facilitate access to and exchange of information and knowledge to support the development, transfer, dissemination and diffusion of technologies for achieving the SDGs. This Technology Facilitation Mechanism is expected to be launched during the General Assembly in September 2015. Another related initiative is the Technology Bank for Least Developed Countries, to be operational from 2017. These are covered by SDG targets 17.6 and 17.8, respectively.[11]

5.1.4 UN SDSN

The UN Sustainable Development Solutions Network (SDSN)[12] is a network of research institutions that discusses and develops solutions for the Sustainable Development Goals. It is establishing a series of regional and national SDSN networks including in the Andes, Amazon, Caribbean and Brazil. These regional and national networks bring together "universities, research centres, civil society organisations, business and other knowledge centres around practical problem solving for sustainable development". The SDSN Caribbean was launched on 7-8 May 2014 and focuses on three themes including energy. The regional SDSN for the Amazon aims to identify and promote practical Solution Initiatives involving emerging technologies, business models, institutional mechanisms and policies. They are also building a web-based platform to share knowledge about solutions for the Amazon. The regional SDSN for the Andes includes Venezuela, Colombia, Ecuador, Peru, Bolivia, Chile and Argentina. It was launched in July 2015. The Brazil Sustainable Development Solutions Network (Brazil SDSN) was launched in Rio de Janeiro on March 17, 2014. The network will initially focus on the opportunities and challenges presented by sustainable cities.

On 15 May 2015, the global SDSN network published a final report on indicators and a monitoring framework for the SDG (SDSN, 2015). The framework consists of 100 indicators, some of which exist already, while others still need to be developed. The proposed indicators relevant to science, technology and innovation aspects of the SDG targets are included in table 2 in Annex 1.

5.1.5 International research community

Several international research organisations and networks are stimulating research on health, water or sustainable energy in cooperation with developing countries or targeting poverty related issues. These include the Global Fund to Fight Aids, TB and Malaria[13], the Global Research Alliance networking 50,000 scientists working on health, transport and climate change[14] and Engineers Without Borders[15]. Engineers Without Borders has member organisations in five Central and South American countries: Argentina, Bolivia, Honduras, Mexico and

[10] https://sustainabledevelopment.un.org/post2015

[11] http://www.un.org/esa/ffd/

[12] http://unsdsn.org/

[13] http://www.theglobalfund.org/en/

[14] http://www.theglobalresearchalliance.org/

[15] http://www.ewb-international.org/

Brazil, and a start-up in Panama. They engage in engineering projects in different areas including water and energy.

The Global Reporting Initiative GRI stimulates corporate social responsibility and reporting on sustainability.[16] GRI has focal points in several countries including Brazil and Colombia, offering support to develop sustainability reporting practices. Almost 40 Brazilian companies participate in the GRI Organisational Stakeholder Programme. The focal point is hosted by the Brazilian Institute for Corporate Governance (IBCG) with 1900 members.[17] The GRI focal point Colombia was inaugurated on 4 June 2014, to cover Colombia and Peru and gradually extending to the rest of Spanish-speaking Latin America. Already in 2013, 82 Colombian companies used the GRI guidelines for reporting on their sustainability practices. GRI is cooperating with the UN Global Compact and the World Business Council for Sustainable Development on the new Post-2015 business engagement architecture, in order to assist business in contributing to the SDGs.

On 12 February 2015, the **International Council for Science** (ICSU) and the International Social Science Council criticised the 169 targets specifying the 17 proposed Sustainable Development Goals. The 40 contributing scientists warned that only 29% of these targets are well-defined and based on the latest scientific evidence. Another 54% must be improved and 17% are weak or non-essential.[18] The report suggests concrete reformulations for targets including those to which the NMP-DeLA roadmap can contribute, as presented in table 3 in annex 2. It also urges the UN and its member states to consider the coherence of the different goals, to achieve synergy rather than competition.

5.1.6 Future Earth

The Science and Technology Alliance for Global Sustainability[19] recently established the international research platform Future Earth.[20] This aims to coordinate new interdisciplinary approaches to research on three themes: Dynamic Planet, Global Sustainable Development and Transformations towards Sustainability. A key priority is co-generation of knowledge in partnership with society and users of science. It's strategic research agenda 2014 for the first 3-5 years of the 2025 Vision includes one question related to nanotechnology as part of theme C on Transformations towards Sustainability. This question is: *"What opportunities and risks might arise from new technologies (e. g. nanotechnology, biotechnology, bioengineering and geoengineering)? What are the trade-offs and implications associated with new technologies, including their distributive social effects in the context of environmental change? How can the impacts of new technologies, products and services on global and local sustainability outcomes be assessed?"*

The platform appears to focus more on science aiming at knowledge production than at technology development and innovation to implement the SDGs.

---

[16] https://www.globalreporting.org/Pages/default.aspx

[17] http://www.ibgc.org.br/Home.aspx

[18] http://www.icsu.org/publications/reports-and-reviews/review-of-targets-for-the-sustainable-development-goals-the-science-perspective-2015/SDG-Report.pdf

[19] This comprises the International Council for Science (ICSU), the International Social Science Council (ISSC), the Belmont Forum of funding agencies, the Sustainable Development Solutions Network (SDSN), the United Nations Educational, Scientific, and Cultural Organization (UNESCO), the United Nations Environment Programme (UNEP), the United Nations University (UNU), and the World Meteorological Organization.

[20] www.futureearth.org

5.1.7 Selected scientific publications

An extensive body of scientific literature exists that analyses potential contributions of science and technology to the Sustainable Development Goals (SDG). Some recent publications discuss issues relevant to the deployment of nanotechnology, materials and production technologies for health, energy and water in Latin America. Earlier publications have discussed contributions nanotechnologies may make to the Millennium Development Goals, but targeting the SDGs is more novel.

Diallo et al. (2013) review potential contributions of nanotechnology to the Sustainable Development Goals, in particular through applications in water, sustainable energy and food. They also argue for the Convergence of Knowledge, Technology and Society (CTKS). Regarding the SDG on water, Malik et al. (2015) proposed a global indicator for wastewater treatment performance and used it to compare performance of countries. They suggest that the UN could use it to monitor progress on an SDG on waste water treatment.

5.1.8 Industry

The World Economic Forum established a Global Agenda Council on nanotechnology for the period 2014-2016.[21] In June 2015, this council started a blog raising international governance issues related to nanotechnology. Topics include geopolitical aspects, inequality, water purification, climate change, democracy and entrepreneurship and job creation.

5.1.9 Civil society

The annual conferences of the World Social Forum (WSF) have been featuring workshops on nanotechnology since 2004, according to one of the organisers, Paulo Martins of the Brazilian Research Network in Nanotechnology, Society and Environment (RENANOSOMA)[22]. Most recently, WSF 2015 featured a workshop entitled 'Civil society in action for the governance of emerging technologies: nanotechnology and synthetic biology,' on Thursday 26 March in Tunis, as part of the 4th World Forum on Science and Democracy.

5.2 European Initiatives

The European Union is stimulating **Responsible Research and Innovation (RRI) in Horizon 2020[23],** building upon earlier strategies such as the European Action Plan for Nanotechnology[24] including the EC Code of Conduct for Responsible Nano-Research. In addition, ethics, gender and ELSA aspects are incorporated in European Technology Platforms relevant to nanotechnology, in particular the ETP Nanomedicine's Advisory Group on Ethics and Social Impacts of Nanomedicine, Public Awareness[25] and in the Nanofutures horizontal working groups on communication, regulation, safety and skills and education[26].

[21] http://www.weforum.org/content/global-agenda-council-nanotechnology-2014-2016-0

[22] www.nanotecnologiadoavesso.org

[23] http://ec.europa.eu/programmes/horizon2020/en/h2020-section/science-and-society

[24] http://ec.europa.eu/research/industrial_technologies/the-policy_en.html

[25] http://www.etp-nanomedicine.eu/public

[26] http://www.nanofutures.eu

5.2.1 European Parliament

The Scientific and Technological Options Assessment (STOA)[27] Unit of the European Parliament organized a workshop on Graphene on 2 June 2015.[28] The aim was to discuss the potential of graphene based technology for European industry and society. Around 120 persons attended it. Speakers and panellists included MEPs, EC policy makers, a Nobel Prize winner and participants in the EU funded Graphene Flagship.[29] The aim is to stimulate cooperation rather than competition. The Graphene Flagship has been ongoing since 18 months. The programme will last ten years with a total budget of €1 billion (including €500 million from the EC). The budget for the first 2.5 years is €58 million, and it will be expanded gradually. It's advisory committee consists of four Nobel Prize winners and four industry leaders. The expected impact is translational nanotechnology with a broad range of applications. The programme spans Technology Readiness Levels (TRL) 1-9. Graphene based composites are the most mature materials, while molecular electronics is the most basic research topic. The flagship has developed science and technology roadmaps addressing the entire value chain. The flagship combines breakthrough science (academia), development of graphene technologies (this should be led by industry, but it must be developed in the future), and services including toxicology and standardisation (industry and academia). The development of the flagship is stagnating because of tight EU rules. The University of Manchester in the UK hosts the recently constructed national Graphene Institute. Many partners focus on fundamental science. The institute manages to attract private and extra-EU investments. Nanosafety, especially of workers must be integrated from the start. The time to market is crucial. Bringing together academia and industry in the whole value chain shortens the time to market. This is a prime example of translational research. It brings together a new community working in a new way along the whole value chain. The structure is light and flexible and open to the rest of the scientific community. External stakeholders should join and benefit from the flagship. More details on the discussion are included in annex 3.

Future activities

On 15 September 2015, STOA will organise a workshop on "Science meets Parliament" in order to foster better understanding of the scientific enterprise among members of the European and national parliaments, and to improve understanding of the parliamentary legislative process among the scientific community.

5.2.2 European Commission

In their future perspective, NMP-DeLA roadmaps should take into account the six keys in the EU strategy for Responsible Research and Innovation (RRI):

- Public engagement
- Gender
- Science education
- Open Access
- Ethics
- Governance.

[27] http://www.europarl.europa.eu/stoa/

[28] http://www.europarl.europa.eu/stoa/cms/home/events/workshops

[29] http://horizon2020projects.com/es-future-emerging-technologies-interviews/fet-flagship-graphene/

An EC expert group chaired by Prof Dr Roger Strand of University of Bergen in Norway has prepared a report on Indicators for promoting and monitoring Responsible Research and Innovation that was published the European Commission in 2015.[30] This is also discussed in the chapter on indicators in the final general NMP-DeLA roadmap. (EC, 2015)

The Horizon 2020 Advisory Group on 'Science with and for Society' (E03093) is advising the European Commission on the topics targeted in the Horizon 2020 calls for this specific programme. It is chaired by prof. dr. Arie Rip.[31] Recommended topics include international cooperation on responsible research and innovation.

5.3 Latin American Initiatives

Bioethics appears to be more established in Latin America than Ethics of Science and Technology. There are national or local bioethics councils in Mexico, El Salvador, Panama, Cuba, the Dominican Republic, Colombia, Brazil, Peru, Bolivia, Chile, Argentina and Uruguay. The Central University of Venezuela has a Unit for Ethics of Sciences and Technologies in the Faculty of Sciences. In Mexico, Venezuela, Chile and Honduras, Civil Engineers have a professional Code of Ethics. In Costa Rica, the federal association of engineers and architects has such a code, as well as the Dominican Republic's association of engineers, architects and surveyors. In Argentina, there are three professional codes governing physical, mathematical and engineering science professionals, scientist in general and medical doctors, respectively.[32]

An existing ethics committee oversees biomedical research in Brazil. Social scientists are pleading for a new committee overseeing social science research with humans, and developing a specialist ethics code, in a report to the CNPq (Chagas, 2015, Rial et al. 2015).

In Brazil, the Instituto Ethos supports Corporate Social Responsibility of its 1300 member companies. Innovation and sustainable development are among its topics.[33]

Some Brazilian research groups are investigating impacts of nanotechnology including the group "Nanotechnology, Society and Environment" at the Federal University of Parana (UFPR), coordinated by Noela Invernizzi and the group JUSNANO – aiming to build and develop regulatory frameworks for nanotechnology in Brazil. This is associated with the Vale do Rio dos Sinos University (UNISINOS), in Rio Grande do Sul and FIOCRUZ, in Rio de Janeiro, and coordinated by Wilson Engelmann (Arcuri, 2011).

5.4 Academic reflections on international cooperation in responsible research and innovation

Even though the global dimension in responsible development of nanotechnology has been incorporated in programmes and dialogue events since around 2002, academic reflections on

[30] This expert group organised a session soliciting comments and suggestions from experts and stakeholders during the S.NET conference 2014 in Karlsruhe, 21-24 September 2014: https://www.itas.kit.edu/downloads/veranstaltung_2014_snet_programme.pdf

[31] http://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetail&groupID=3093

[32] Source: Global Ethics Observatory: http://www.unesco.org/new/en/social-and-human-sciences/themes/global-ethics-observatory/access-geobs/

[33] http://www3.ethos.org.br/

responsible research and innovation going beyond the European, EU-US transatlantic or OECD context are relatively new.

McNaghten et al. (2014) report on an exploratory workshop on differences in the concept of responsible research and innovation between Brazil and the UK. The main outcome is that the different contexts and societal needs require further study. DeBlonde (2015) pleads for better integration of knowledge economies and responsible research and innovation in 'glocal sustainability research' (GSR) as she calls it. Wickson and Carew (2014) propose quality criteria and indicators for responsible research and innovation. They develop their approach in a case study on nanotechnology for remediation.

Federico Vasen (2015) criticises the concept responsible research and innovation for being still too European. The intentions may be good, including institutionalising governance mechanisms for emerging technologies and predicting controversies and improving social acceptance. However, developing countries should not imitate the concept, but critically assess and adapt it to their national context.

5.5 Recommendations by NMP-DeLA Community of Interest members

NMP-DeLA community members made several recommendations regarding the incorporation of Ethical, Legal and Social aspects in either the NMP-DeLA project itself, or in the roadmaps. These recommendation made in the second year are presented here.

NMP-DeLA COI members stressed the need for outreach events on nanotechnology to overcome the plethora of myths about it and show the societal opportunities. Education, awareness raising and communication to policy makers and the general public is also important and can build upon existing initiatives including the South and Meso-American Research Centres for Fundamental Research[34], NanoAndes[35], NanoDYF[36] and ReLANS[37].

Ilse Marschalek's presentation on the RRI-tools project highlighted the Report on the quality criteria of Good Practice Standards in RRI.[38] The quality criteria presented in the report may be used for thinking about how research and innovation practice should be designed in order to be more responsible. Consultation among 441 respondents in 27 European countries revealed that stakeholders have little knowledge on RRI, which is an abstract concept. Stakeholders attribute responsibility mostly to others, not to themselves. Attitudes are mainly risk averse and focused on the short term. RRI tools and training can help improve knowledge and skills of the stakeholders. They also need information on who to address. Opportunities include bringing science and society closer to each other and improving the quality of innovation. The conclusion was surprising: there is considerable enthusiasm and optimism about RRI. It should be a serious transformative activity rather than ticking boxes. It is an opportunity to take a long view and foster a paradigm shift towards normative goals and values. The web-based repository of promising RRI practices may also be used in EU-Latin American cooperation on nanotechnology, materials and production technologies from August 2015 onwards. An online self-assessment tool for researchers to support their reflection on responsible re-

[34] : http://www.ictp-saifr.org/ and http://mctp.mx/index.html

[35] www.nanoandes.org

[36] www.nanodyf.org

[37] www.relans.org

[38] For downloaded at www.rri-tools.eu/workplan-deliverables, WP1 Deliverables

search and innovation will also be implemented. [39]

According to Francoise Roure (during her presentation in Chile), nanotechnology is a platform technology for emerging nano-enabled and nano-enhanced products and systems. There are two game-changers for nanotechnology commercialisation:

1. a uniform description system for materials at the nanoscale, according to a white paper published by the International Council for Science (ICSU) and the Versailles Project on Advanced Materials and Standards (VAMAS), that is open to international cooperation. (CODATA-VAMAS, 2015)
2. going beyond the precautionary principle by introducing the RRI concept. A mandatory Sustainable Impact Assessment mechanism (SIA) is introduced before signing trade agreements to avoid commercial disputes.

Experiences which were collected in the focus group discussions showed that the duty to handle legal issues related to research activities is very time consuming and annoying for nanotechnology researchers in LA. In most Latin American countries there is a severe lack of (progressive) regulation in Nanotechnologies in all aspects (health, environment, safety, etc.) and current norms seem to be extremely outdated and/or not adapted to the national or specific case. Researchers feel that employees of national regulatory bodies in LA are often not well aware of the latest developments in nanotechnology regulation or that they do not have the capacities to keep track of international standards. Especially researchers in smaller countries, which rely heavily on import of equipment, feel overwhelmed with a lack of clarity of rules and regulations. High-quality periodic trainings might be a means to guarantee that regulatory organs are more responsive and well equipped with up-to-date information.

It was also considered important to include researchers/academia as well as social scientists in the development of up-to-date norms and regulations, and to acknowledge regulation as being a political and not just technical process It will, however, require special incentives to attract researchers for such an involvement, because according to current systems they are primarily evaluated by their publication output. Once norms are defined, the second challenge is to make them binding and introduce instruments to supervise their compliance.

It was suggested to make RATA (risk analysis and technology assessment) part of research programs.

Last but not least it needs to be stressed that LA countries are at very different stages concerning their progress in ELSA and ongoing efforts (such as Brazil being a partner in NanoREG) need to be acknowledged.

[39] C.f. presentation Ilse Marschalek, NMP-DeLA workshop Curitiba, Brazil, 28-29 May 2015, www.nmp-dela.eu

6 Conclusions

Ethics and gender have been integral elements in the NMP-DeLA project from the original proposal onwards. In the Work Plan, there is a strong focus on the relevance of nano, materials and production technologies and their applications for health, water and energy to the current UN Millennium Development Goals fighting poverty. During the second year of the project, all partners have contributed to implementing and monitoring ethics and gender aspects in all five work packages. Ethical, legal and societal aspects and safety assessment have also been addressed by NMP-DeLA community members.

Taking a broader perspectives, opportunities for synergies between the NMP-DeLA project and other initiatives identified in the first report have been monitored during the second year at three levels: at global and transnational level and in the NMP-DeLA Community of Interest.

At global level, the implementation of the Sustainable Development Goals to be adopted by the UN General Assembly in September 2015 will dominate the agenda of science and technology for development until 2030. Governments, research organisations, industry and civil society organisations interested in deployment of nanotechnology for health, water and energy in Latin America are well advised to target their activities to those goals and link up with the relevant global networks and platforms that are currently emerging. For governments, the Technology Financing Mechanisms to be established this year could be useful for coordinating their policies. For researchers, the UN Sustainable Development Solutions Network (SDSN) and the Future Earth platform could be most relevant. On the business side, the Global Agenda Council for Nanotechnologies of the World Economic Forum could play a coordinating role. Civil Society may build upon earlier discussions on nanotechnology during the annual World Social Forum conferences.

At transnational level in Europe and Latin America, the discussion on Responsible Research and Innovation (RRI) offers a good starting point for discussing the relevance of innovation to societal grand challenges. Care must be taken to allow for differences in context specific interpretations rather than merely exporting European norms and values.

Recommendations for ELSA and RRI initiatives proposed by NMP-DeLA community members should also be taken into account, in particular regarding education and outreach, and targeting science, technology and innovation to societal grand challenges.

A recurrent theme is the need for indicators to monitor progress in the implementation of the SDGs, RRI and societal and economic impacts of investments in (nano)science, technology and innovation. Proposals for such indicators have been made by the Sustainable Development Solutions Network in the discussion about the SDGs. An expert group has advised the European Commission on indicators for RRI. The OECD Working Party on Nanotechnology is working on socio-economic indicators for nanoscience and technology. Targeting the SDGs in roadmaps for NMP helps to focus activities by policy makers, researchers, industry and other stakeholders on global priorities in sustainable development, including health, water and energy. Education and investment and cooperation in innovation and R&D are also among the priorities in the SDGs, and can guide strategies of the decision makers and stakeholders interested in developing NMP for deployment in Latin America.

7 References

CECTE, Suggestions for Socially Responsible Science and Technology, 29-05-2013 (in Spanish) http://www.cecte.gov.ar/proposiciones-para-una-ciencia-y-una-tecnologia-socialmente-responsables/

Chagas, C. (2015) Brazilian social scientists call for ethics watchdog, in SCIDEVNET, 15-06-2015, http://www.scidev.net/global/ethics/news/brazilian-social-scientists-ethics-watchdog.html

DeBlonde, M., (2015) Responsible research and innovation: building knowledge arenas for glocal sustainability research. In Journal of Responsible Innovation, Vol 2, Iss 1, 2015, http://www.tandfonline.com/doi/abs/10.1080/23299460.2014.1001235#.Vb9jOvntlHx

Diallo, M.S., Fromer, N.A., Jhon, M.S. Nanotechnology for sustainable development: retrospective and outlook, in J Nanopart Res (2013) 15:2044, DOI 10.1007/211051-013-2044-0

EC (2008) Commission Recommendation of 07/02/2008 on a Code of Conduct for responsible nanosciences and nanotechnologies research, European Commission, Brussels C(2008) 424 final http://ec.europa.eu/research/industrial_technologies/the-policy_en.html#code

EC (2015) Indicators for promoting and monitoring Responsible Research and Innovation. Report from the Expert Group on Policy Indicators for Responsible Research and Innovation, EC - Directorate - General for Research and Innovation Science with and for Society, 2015, EUR 26866 EN http://ec.europa.eu/research/swafs/pdf/pub_rri/rri_indicators_final_version.pdf

Hajer, M., Nilsson, M., Raworth, K., Bakker, P., Berkhout, F., de Boer, Y., Rockström, J., Ludwig, K., Kok, M. (2015) Beyond Cockpit-ism: Four Insights to Enhance the Transformative Potential of the Sustainable Development Goals. In: Sustainability 2015, 7, 1651-1660; doi:10.3390/su7021651

Macnaghten, P., R. Owen, J. Stilgoe, B. Wynne, A. Azevedo, A. de Campos, J. Chilvers, R. Dagnino, G. di Giulio, E. Frow, B. Garvey, C. Groves, S. Hartley, M. Knobel, E. Kobayashi, M. Lehtonen, J. Lezaun, L. Mello, M. Monteiro, J. Pamplona da Costa, C. Rigolin, B. Rondani, M. Staykova, R. Taddei, C. Till, D. Tyfield, S. Wilford & L. Velho (2014) Responsible innovation across borders: tensions, paradoxes and possibilities, Journal of Responsible Innovation, 1:2, 191-199, DOI: 10.1080/23299460.2014.922249, http://dx.doi.org/10.1080/23299460.2014.922249

Malik, O.A., Hsu, A., Johnson, L.A., de Sherbinin, A. A global indicator of wastewater treatment to informs the Sustainable Development Goals (SDG), in Environmental Science & Policy, Vol 48, April 2015, pp 172-185 http://www.sciencedirect.com/science/article/pii/S1462901115000076

Rial, c. et al. (2015) Política de ciência, tecnologia e inovação para as áreas ciências humanas, sociais e sociais aplicadas, CNPq, 10-05-2015,

http://www.portal.abant.org.br/images/Noticias/Doc_GT_CHSSA20maioFINAL.pdf

SAB (2015a) Strengthening the High-Level Political Forum and the UN Global Sustainable Development Report, UNESCO, Paris, 9 July 2015, http://en.unesco.org/un-sab/

SAB (2015b) Science, Technology and Innovation: Critical Means of Implementation for the SDGs, UNESCO, Paris, 9 July 2015, http://en.unesco.org/un-sab/

SDSN (2015) Indicators and a Monitoring Framework for the Sustainable Development Goals, Sustainable Development Solutions Network, http://unsdsn.org/resources/publications/indicators/

UN (2015) Transforming Our World: The 2030 Agenda for Sustainable Development, United Nations, 30 July 2015, https://sustainabledevelopment.un.org/post2015

Vasen, F. (2015) 'Responsible innovation is already too European, in SciDevNet, 21-01-2015 (Spanish original 14-01-2015), http://www.scidev.net/global/innovation/opinion/responsible-innovation-european.html

Wickson, F., Carew, A.L. (2014): Quality criteria and indicators for responsible research and innovation: Learning from transdisciplinarity, Journal of Responsible Innovation, DOI:

10.1080/23299460.2014.963004 http://dx.doi.org/10.1080/23299460.2014.963004

8 Annex 1: table 2

SDG formulations in the text for adoption (UN, 2015)	**SDSN proposed indicators**
3.3 by 2030 end the epidemics of AIDS, tuberculosis, malaria, and neglected tropical diseases and combat hepatitis, water-borne diseases, and other communicable diseases	20. HIV incidence, treatment rate, and mortality (modified MDG Indicator) 21. Incidence, prevalence, and death rates associated with all forms of TB (MDG Indicator) 22. Incidence and death rates associated with malaria (MDG Indicator) 3.5. Incidence rate of diarrheal disease in children under 5 years 3.9. Percentage of tuberculosis cases detected and cured under directly observed treatment short course (MDG Indicator) 3.10. Percentage of children under 5 with fever who are treated with appropriate anti-malarial drugs (MDG Indicator). 3.15. Neglected Tropical Disease (NTD) cure rate 3.16. Incidence and death rate associated with hepatitis
3.d strengthen the capacity of all countries, particularly developing countries, for early warning, risk reduction, and management of national and global health risks	3.32. Public and private R&D expenditure on health (% GNP)
4.3 by 2030 ensure equal access for all women and men to affordable quality technical, vocational and tertiary education, including university	37. Tertiary enrolment rates for women and men 4.4. [Percentage of adolescents (15-19 years) with access to school-to-work programs] – to be developed 4.6. [Percentage of young adults (18-24 years) with access to a learning program] – to be developed
4.4 by 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship	
4.b by 2020 substantially expand globally the number of scholarships available to developing countries in particular least developed countries, small island developing states and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and	4.9. [Indicator on scholarships for students from developing countries] – to be developed

scientific programmes, in developed countries and other developing countries	
6.1 by 2030, achieve universal and equitable access to safe and affordable drinking water for all	45. Percentage of population using safely managed water services, by urban/rural (modified MDG Indicator) 47. Percentage of wastewater flows treated to national standards [and reused] – to be developed 49. Proportion of total water resources used (MDG Indicator)
6.3 by 2030, 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	47. Percentage of wastewater flows treated to national standards [and reused] – to be developed 48. [Indicator on water resource management] – to be developed
6.a by 2030, 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	6.8. [Indicator on international cooperation and capacity building in water and sanitation-related activities] – to be developed
7. 2 by 2030, increase substantially the share of renewable energy in the global energy mix	52. Implicit incentives for low-carbon energy in the electricity sector (measured as US$/MWh or US$ per ton avoided CO2) 7.3. Share of energy from renewables
7.3 double the global rate of improvement in energy efficiency by 2030	53. Rate of primary energy intensity improvement
7.a by 2030 enhance international cooperation to facilitate access to clean energy research and technologies, including renewable energy, energy efficiency, and advanced and cleaner fossil fuel technologies, and promote investment in energy infrastructure and clean energy technologies	96. Official development assistance and net private grants as percent of GNI 95. Domestic revenues allocated to sustainable development as percent of GNI, by sector 97. Private net flows for sustainable development at market rates as share of high-income country GNI, by sector 7.2. Fossil fuel subsidies ($ or %GNI)
9.5 enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including by 2030 encouraging innovation and substantially increasing the number of research and development workers per one million people and public and private research and development spending	63. Personnel in R&D (per million inhabitants) 17.4. Gross domestic expenditure on R&D as share of GDP 17.5. [Indicator on technology sharing and diffusion] – to be developed
9.b support domestic technology development, research and innovation in developing countries including by ensuring a conducive policy environment for inter alia industrial diversification and value addition to commodities	17.4. Gross domestic expenditure on R&D as share of GDP 17.6. [Indicator on the creation of / subscription to the Technology Bank and STI (Science, Technology and Innovation) Capacity Building Mechanism for

	LDCs by 2017] – to be developed
17.6 enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation, and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms, particularly at UN level, and through a global technology facilitation mechanism when agreed upon	59. Mobile broadband subscriptions per 100 inhabitants, by urban/rural 60. Index on ICT maturity 63. Personnel in R&D (per million inhabitants) 17.5. [Indicator on technology sharing and diffusion] – to be developed
17.7 promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed	17.5. [Indicator on technology sharing and diffusion] – to be developed 17.6. [Indicator on the creation of / subscription to the Technology Bank and STI (Science, Technology and Innovation) Capacity Building Mechanism for LDCs by 2017] – to be developed
17.8 fully operationalize the Technology Bank and STI (Science, Technology and Innovation) capacity building mechanism for LDCs by 2017, and enhance the use of enabling technologies in particular information and communications technology	17.5. [Indicator on technology sharing and diffusion] – to be developed 17.6. [Indicator on the creation of / subscription to the Technology Bank and STI (Science, Technology and Innovation) Capacity Building Mechanism for LDCs by 2017] – to be developed
17.9 enhance international support for implementing effective and targeted capacity building in developing countries to support national plans to implement all the sustainable development goals, including through North-South, South-South, and triangular cooperation	17.1. Total Official Support for Development 17.2. Country Programmable Aid 17.3. [Indicator on debt sustainability] – to be developed 17.4. Gross domestic expenditure on R&D as share of GDP 17.5. [Indicator on technology sharing and diffusion] – to be developed 17.6. [Indicator on the creation of / subscription to the Technology Bank and STI (Science, Technology and Innovation) Capacity Building Mechanism for LDCs by 2017] – to be developed 17.7. Average tariffs imposed by developed countries on agricultural products and textiles and clothing from developing countries (MDG Indicator) 17.8. Value of LDC exports as a percentage of global exports 17.9. [Indicator on investment promotion regimes for LDCs] – to be developed
17.16 enhance the global partnership for sustainable development complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technologies and financial resources to support the achievement of sustainable development goals in all countries, in particular developing countries	96. Official development assistance and net private grants as percent of GNI 17.10. Percent of official development assistance (ODA), net private grants, and official climate finance channelled through priority pooled multilateral financing mechanisms

17.17 encourage and promote effective public, public-private, and civil society partnerships, building on the experience and resourcing strategies of partnerships	17.10. Percent of official development assistance (ODA), net private grants, and official climate finance channelled through priority pooled multilateral financing mechanisms

Table 2: Suggested indicators for selected SDG targets relevant for nanotechnology

9 Annex 2: table 3

Zero Draft SDG formulations	**ICSU proposal**
3.3 by 2030 end the epidemics of AIDS, tuberculosis, malaria, and neglected tropical diseases and combat hepatitis, water-borne diseases, and other communicable diseases	By 2030 end the epidemics of preventable infectious diseases for which there are preventive measures, immunization or treatment and implement disaster risk reduction measures related to emerging infections and pandemics
3.d strengthen the capacity of all countries, particularly developing countries, for early warning, risk reduction, and management of national and global health risks	Strengthen the capacity of all countries, particularly developing countries, for early warning, risk reduction, and management of national and global health risks and increase the number of countries with national and local strategies. Specifically, reduce disaster mortality, reduce the number of affected people, reduce direct disaster economic loss, and reduce disaster damage to health and educational facilities
4.3 by 2030 ensure equal access for all women and men to affordable quality technical, vocational and tertiary education, including university	No comments
4.b by 2020 expand by x% globally the number of scholarships for developing countries in particular LDCs, SIDS and African countries to enrol in higher education, including vocational training, ICT, technical, **engineering and scientific programmes in developed countries and other developing countries**	… engineering and scientific programmes in developed countries and other developing countries, particularly the percentage related to sustainability challenges and the emerging green economy
6.1 by 2030, achieve universal and equitable access to safe and affordable drinking water for all	Safe drinking water should be measured both in terms of water quality and safe access to the water supply.
6.3 by 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and increasing recycling and safe reuse by x% globally	Consider reframing as follows: By 2030, halve the point and nonpoint pollution, and untreated waste water discharges into water sources, and double the recycling and safe reuse of waste water
6.a by 2030, 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	6.a could be incorporated into SDG 10
7.2 increase substantially the share of renewable	Specify as follows: Double the share of sustaina-

energy in the global energy mix by 2030	bly produced renewable energy in the global energy mix by 2030
7.3 double the global rate of improvement in energy efficiency by 2030	Specify as follows: Double the global annual rate of improvement in energy intensity of GDP, to 2.9%/year.
7.a by 2030 enhance international cooperation to facilitate access to clean energy research and technologies, including renewable energy, energy efficiency, and advanced and cleaner fossil fuel technologies, and promote investment in energy infrastructure and clean energy technologies	delete
9.5 enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, particularly developing countries, including by 2030 encouraging innovation and increasing the number of R&D workers per one million people by x% and public and private R&D spending	Make the target time bound and quantitative. An often mentioned target is that R&D should be 3% of GDP.
9.b support domestic technology development, research and innovation in developing countries including by ensuring a conducive policy environment for inter alia industrial diversification and value addition to commodities	Merge with target 9.5.
17.6 enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation, and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms, particularly at UN level, and through a global technology facilitation mechanism when agreed	Action to achieve the target should incorporate making all academic journals freely available to developing countries.
17.7 promote development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed	Needs a target date. An indicator for measuring progress could be the percentage of total technology transfer that is environmentally sound.
17.8 fully operationalize the Technology Bank and STI (Science, Technology and Innovation) capacity building mechanism for LDCs by 2017, and enhance the use of enabling technologies in particular ICT	No comments
17.9 enhance international support for implementing effective and targeted capacity building in developing countries to support national plans to implement all sustainable development goals, including through North-South, South-South, and triangular cooperation	Needs to be quantified
17.16 enhance the global partnership for sustainable development complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technologies and financial	Needs a reference to countries committing to start setting up these partnerships at national and sub-national level. Also should consider using partnerships, as there will be multiple and not one pana-

resources to support the achievement of sustainable development goals in all countries, particularly developing countries	cea partnership.
17.17 encourage and promote effective public, public-private, and civil society partnerships, building on the experience and resourcing strategies of partnerships	No comments
17.19 by 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement GDP, and support statistical capacity building in developing countries	This target lacks specificity and so is at risk of failing to motivate and achieve anything concrete. While it sets a timeline (2030), it does not give sufficient direction on what measurements of progress that complement GDP are appropriate indicators. At least one lesson learned from the MDGs is that indicators of progress should be feasibly and cost-effectively monitored. The target is also vague about what 'support for statistical capacity building in developing countries' entails. Herein lies an opportunity to set more specific direction about what i) 'support' demands, and ii) what 'statistics' are required, i.e. morbidity, mortality, immunization coverage, etc.

Table 3: Suggested alternative formulations of selected SDG targets relevant to nanotechnology

10 Annex 3: discussion during STOA workshop on Graphene

Q&A:

What is the unique approach offered by the flagship?

The EU has several public private partnerships (PPP), including on aeronautics etc. Large scale commercialisation of graphene has not started yet. The EU is at the forefront of developments. What we do well: the first graphene-based product was European, and we are leaders in graphene. Current manufacturing is European, there are a lot of spin-out companies and SMEs.

What is the key to transfer from the lab to society? Involving industry and academia including young researchers and education from the beginning, to ensure students can get jobs in industry. SME's manufacturing graphene must involve large end user companies to implement the material in their products. Advanced materials take many years to reach the market. They need help to overcome the hype cycle and the valley of death. The flagship strategy takes into account that the end user sees a range of possibilities. We will stimulate SMEs to enter the business where no companies are currently active. Other world regions are probably better in establishing start-ups and attracting venture capital. Set the right framework conditions and make sure they really work.

Chemical industry is looking for substitution of critical raw materials. Can graphene bring a solution to this problem? It offers opportunities for substituting Indium and other materials. Graphene can be won from Coal mines.

What must be done to drive uptake from the perspective of consumers and industry?

1) Consistent quality of manufacturing

2) Education and training of young scientists, also in industry

3) Identify what must be done for mass production

The next phase of the Graphene Flagship will start in 2016. The workpackage on industrial implementation will be coordinated by IMEC and another major Fab in Italy. Alcatel, Ericson and Nokia are going to be involved. The workpackage on production of graphene in large areas and volumes is already underway. Pencil-based graphene can already be produced, because the material is used in pencils in schools, permitted by the EU. Furthermore, the production facilities exist and can be adapted to graphene.

There is a regulatory issue: is graphene considered to be a nanomaterial? It can be macroscopic in two dimensions, with only one dimension in the nanometre range. This is a definition question, but there is absolutely no evidence that graphene behaves as a nanomaterial.

The Graphene consortium does not include NGOs, but there is an accompanying CSA looking at social aspects. Regarding societal aspects, an ethics board helps us to define ethics and behaviour guidelines for researchers. This includes a philosopher of science. They are currently elaborating an ethics guideline.

Funding comes from the EU, national, regional and private funding. Recent calls were funded by the EU and member states (FLAG ERA). Most member states are represented in this. A representative of the European Science Foundation (ESF) is talking to national funding bodies. Joint calls would be a major step forward for our funding strategy.

International cooperation is also pursued. Recently, there was a meeting is Washington, and we are planning meetings in Korea and Japan. An organising and structuring activity for international cooperation is underway.

‘The Graphene Flagship is not working on its own, but coordinated with other PPPs. Environmental aspects are among the key drivers for research. Many applications including energy harvesting and storage, fuel cells, may benefit the environment.

Criteria for success include that Europe should keep a large fraction of manufacturing industry. At the end of the 10 years, we should have a new wonder material for the scientists to pick up, replacing graphene. We should support excellence in university and industry through education including science, engineering and commercialisation.