European Commission

Reaching Out to the Future

Outline of Proposals for Communication Outreach, Dialogue and Education on Nanotechnology

Report from a workshop held in Brussels, 28-29 March 2012

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Τί εὔκολον: Τὸ ἄλλῳ ὑποτίθεσθαι
(Θαλῆς)

What is easy? To advise others
(Thales)

Executive summary

This report stems from a dedicated workshop delivering a fresh perspective about nanotechnology communication to the extent that it ranked several possible priority interventions. It reviewed best practices developed by European funded projects. Different recommendations are summed up in this publication, offering an expert insight of in this field. Outreach, Dialogue and Education activities have been identified by the community of stakeholders (research community, NGOs, industry, policy-makers, media) targeting three social groups: young people, industry and civil society organisations, media and lay public.

Preface

It has been said that "image is to communication what gold is to a jewel". Indeed, communicating an image cannot evade a good, solid communication strategy underpinning this effort, as meaningful communication aims to create a dynamic relationship and exchange between stakeholders. This seems to be especially true in the case of promoting good governance on nanotechnology, where the public can be less deferential. In fact, good governance on nanotechnology depends on mechanisms for appropriate social dialogue based on an open-minded, consistent communication efforts aiming to foster inclusion. So, appropriate communication comes first, and we need to set up a sound and clever method to identify whom to reach out to, since audiences are many. Among them, youngsters, industry and civil society organisations, media and lay public are crucial: so, anticipating how to meet their communication needs is the key. Twenty-two communication experts convened at this workshop with the specific aim of outlining ideas and proposal for possible future actions of nanotechnology communication to target these three audiences across Outreach, Dialogue and Education. Valuable insights from this collaboration regarding potential forthcoming actions for the stakeholders' community on communicating nanotechnology are presented and discussed in this publication. Based, as it were, on a range of best practices developed by European funded projects, it delivers a fresh perspective on nanotechnology communication in that it ranks several possible priority interventions. The broad panoply of ideas stemming from this exercise is shaped in the form of different sets of proposals which can inspire stakeholders to face the corresponding challenges.

To all those whose trust outshines their fears

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1. INTRODUCTION: SETTING THE SCENE

The rationale of this work is to identify valuable ideas, proposals and relevant actions in the stakeholders' community dealing with communicating nanotechnology at the EU level. In this light, it aims at identifying which ideas, proposals and actions the ***community of stakeholders*** (e.g. research community, NGOs, industry, policy-makers, media) working on communicating nanotechnology *must, should or could* develop to promote responsible communication in this field. This work is carried out according to the relevance of these ideas for the EU society in terms of desirable outreach (people attained), dialogue (people involved) and education (people trained) to be achieved on nanotechnology research and innovation. Twenty-two communication experts on nanotechnology (listed in the appendix), many of them having participated in EC-funded communication projects, convened at a workshop dedicated to doing so, entitled "*Communicating Nanotechnology: actions, challenges and prospects for outreach, dialogue and education in nanotechnology*" held in Brussels on 28-29 March 2012. The initiative was part of extensive knowledge processes to make a valuable contribution to policy decision-making related to nanosciences and nanotechnologies. This effort has been structured in two parts:

(i) The presentation of selected EC-funded outreach projects on nanotechnology research and innovation (NANOYOU, NANOCHANNELS, TIMEFORNANO, NANOTOTOUCH, NANODIALOGUE) and others on nanotechnology in society (NANOCAP, NANOCODE, NANOPLAT, DEEPEN) has highlighted the main results achieved by the EC over the last seven years in communication, dialogue and education. The discussion has set the scene on the main frontiers attained so far in these areas, and provided recommendations on how to strengthen the future communication strategy;

(ii) The panel group discussions focused on three priority audiences (Youngsters, Media/Lay public, CSOs/Industry). Building coherently on previous experiences, they outlined needed actions for the future. So, the *Outline of Proposals for future Communication, Dialogue and Education on Nanotechnology* stems out from this structured effort as a key deliverable in shaping the debate.

The expert meeting placed emphasis on the endogenous model of technological development[1], aiming for a better interaction between society, science and

[1] Van Est R. And Brom F. *Technology Assessment, Analytic and Democratic Practice.* In: Ruth Chadwick, editor. Encyclopedia of Applied Ethics, Second Edition, 2012, Vol. 4, 306-320.

technology. Nano development is not isolated from society, and the social value of research-based innovation needs reflective critique. In order to improve regulatory certainty, we need to deepen the current debate. "Non-expert participation aims to improve the cognitive basis, credibility, acceptance and conflict-resolving potential of TA (Technological Assessment)"[2]; thus, by involving targeted groups (Youngsters, Civil Society Organizations, Media and Lay Public), the policy scrutiny can only benefit from a dynamic of perspectives.

In order to support a responsible nano innovation policy, the need to widen the participation of affected individuals and groups has become more and more prominent. Firstly, knowledge gaps must be tackled and overcome. Secondly, representative, participatory and deliberative processes must be employed. The proposed communication steps (outreach, dialogue and education) aim to improve access to information, to engage targeted groups in critical reflection and sharing and practices, and finally, to offer opportunities of choice-making. So, the expert meeting was deemed as an adequate opportunity to bring together key communicators, who have been previously involved in earlier EC workshops, consultations, projects and the development of the EC Nano-Communication Roadmap. Establishing an open-ended discussion ground for formulating future objectives, the experts had to present, benchmark, discuss and debate the main outcomes and challenges from their activities. Moreover, together with other experts and EC staff, they identified ideas and proposals to promote good governance in future policy-making, tailoring each communication process to specific audiences.

Starting with the afore-mentioned projects, the participants were encouraged to discuss how these best practice examples can be further improved. Firstly, the normative dimension of the expert meeting dealt with mapping public hopes, concerns and expectations, as well as criteria, indicators and methods of evaluation for the communication process. Secondly, the pragmatic dimension implies generating a set of options for real political action (Grunwald, 2003)[3]. The efforts of independent institutes working for Technological Assessment need to be complemented by EU-funded projects focusing on communicating with and engaging targeted groups of citizens, in order to:(1) critically diversify the

[2] STOA, Science and Technology Options Assessment, European Parliament (2008). *Technology across borders: Exploring perspectives for pan-European Parliamentary Technology Assessment*, Study of Directorate General for Internal Policies, Directorate G: Impact Assessment, IP/A/STOA/FWC/2008-096/LOT8/C1, PE 482.684.

[3] Grunwald, Armin (2003). *Technology assessment at the German Bundestag: 'expertising' democracy for 'democratising' expertise*, Science and Public Policy, volume 30, number 3, pp. 193-198.

complex debate around nano, (2) empower non-experts and (3) allow researchers, scientists and politicians to tap into the knowledge-based society.

The objective of their fruitful collaboration was to propose new ideas on how to proceed with communication actions, in accordance to the three main priorities of the strategy for smart, inclusive and sustainable growth[4]: *(1) Delivering Social Benefits*, *(2) Economic Relevance* and *(3) Concerns on Policy*. The present deliverable working paper will be a valuable input for future discussion on proposals, actions and activities on communicating nanotechnology, because strategically, the "alignment between technological and societal developments is the ultimate objective"[5] of technological assessment.

The experts interacted creatively and brainstormed to propose new ideas before engaging in discussions on how to reach consensus on actions, priorities and messages. The participants were divided into three groups according to their individual area of expertise. Each participant made significant suggestions across the whole communication spectrum of OUTREACH, DIALOGUE and EDUCATION.

The initial question of "*To whom should we communicate about nanotechnology*?" was the benchmark to organize the roundtables, on the basis of communication reports and previous EC workshops on nano outreach[6]. The workshop's three groups corresponded to the three target audiences, identified as priorities, namely:

(1) Youngsters

(2) CSOs (Civil Society Organizations) and Industry

(3) Media and Lay Public

[4]European Commission (2012), *EUROPE 2020*, Brussels.
http://ec.europa.eu/europe2020/index_en.htm

[5] STOA, Science and Technology Options Assessment, European Parliament (2008). *Technology across borders: Exploring perspectives for pan-European Parliamentary Technology Assessment*, Study of Directorate General for Internal Policies, Directorate G: Impact Assessment, IP/A/STOA/FWC/2008-096/LOT8/C1, PE 482.684.

[6] Bonazzi, M.(ed.), (2007A): *Working paper resulting from the workshop on: Strategy for communication outreach in nanotechnology,*EC, Brussels, 6th February 2007 (http:// cordis.europa.eu/ nanotechnology/src/publication_events.htm).
Bonazzi, M. and Palumbo, J. (eds.),
(2007): *Report from the workshop – Communication Outreach in Nanotechnology: from recommendation to action,* EC, Brussels, 24-25 October 2007
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Bonazzi, M.(ed.),
(2007B): *Working Paper resulting from: Open Web consultation on a Strategy for communication outreach in nanotechnology,* EC, Brussels, March-October 2007
(http://cordis.europa.eu/nanotechnology/src/publication_events.htm).

This work aims to find out what kind of activities can be developed for outreach, dialogue and education to address and engage these audiences, taking into account their different incentive mechanisms, dynamics, levels of participation and feedback loops between stakeholders.

2. MATERIALS AND METHODS: HOW DOES THIS WORK?

This section addresses the different methodologies and the ways they have been applied during the workshop.

2.1. OPEN SPACE WORKING GROUPS AND COMMUNICATION PRIORITIES

The three groups took part in a plenary Open Space session on the first day. Panellists admitted that fast and responsible deployment of nanotechnologies will play a critical role in addressing the major societal challenges identified by the EU 2020 agenda. These technologies could help building a smart, sustainable and inclusive growth. Balancing the potential benefits with the risks, the experts tackled the following priorities in communication ("axes of interest"), in need of careful formulation and consistency.

2.1.1. AXES OF INTEREST:

Increasing social reflexivity means that, besides stakeholders, citizens should be actively involved in the design of technology, in anticipation of possible effects of Nano innovations. Thus, for each target group (Youngsters, CSOs, Media and Lay Public), the common ground was to make the scientific Nano development *politically legitimate*, *economically viable* and *socially desirable*.

The following axes of interest have been identified across the societal, economic and policy areas:

A. SOCIAL BENEFITS. Personalized and more effective healthcare; Energy efficiency and sustainability; Information and Communication Technology.

B. ECONOMIC RELEVANCE. Boosting the EU's competitive potential and innovation; Boosting the EU's employment figures and high market potential; Bridging European skills, resources and infrastructure.

C. POLICY ISSUES. Proactive governance in political assessment of nanotechnology impacts by an open and inclusive public debate and a comprehensive, yet innovation-oriented regulation.

D. SAFETY RESEARCH. Assessing, managing and communicating risks.

E. RESPONSIBLE RESEARCH AND INNOVATION[7]. This overarching concept means that outcomes of the dialogue are fed back into both the institutional policy making and research processes: therefore, it addresses also the discussion on societally relevant aspects, so far identified as ELSA (Ethical, Legal and Social Aspects).

2.1.2. WORKING GROUPS:

On the second day of the workshop, the debate started with the need for a clear problem definition: How to effectively address, engage and empower key publics to have a visible impact on the governance of nanoscience and nanotechnology innovation?

It continued with issue framing and identifying information needs, opening-up the normative assumptions and visions that drive the process of decision making. Special attention was paid to culturally shaped expectations, the cultural appropriation of nano-technology and the need to take into account different normative systems across EU member states. The expert discussion modelled communication priorities, combining both citizen-driven and problem-driven approaches. Participants were divided into three groups:

(1) Youngsters (Outreach, Dialogue, Education)

In order to tailor the communication to young people's interests, knowledge, attitudes, opinions, specific values, concerns and expectations, curiosity on nanotechnology, youngsters were sub-divided into the youngest segment (children aged between 5 and 13) to stimulate their curiosity about science and nanotechnology; the middle segment (teenagers aged between 14 and 18) requiring information about nanotechnology's possibilities in the academic and professional world and a critical attitude allowing them to become responsible

[7] Sutcliffe, H.(2011): *A report on Responsible Research & Innovation*, MATTER Report, http://ec.europa.eu/research/science-society/document_library/pdf_06/rri-report-hilary-sutcliffe_en.pdf

citizens; and the upper segment, aged between 19 and 22, consisting of individuals who are gearing towards defining their career path.

(2) CSOs and Industry (Outreach, Dialogue, Education)

CSOs (Civil Society Organisations) are perceived to be the camp of opponents against specific nano innovations, while the industry is usually perceived as being pro-nano advancements because of a business rationale, at the possible expense of safety and responsibility. However, the panel discussion proved to be an opportunity to question and re-evaluate these polarised positions.

Both CSOs and industry are vital stakeholders in the policy debate on nanotechnologies. Since multi-stakeholder debates are often characterized by entrenched and divided normative views of the roles and aspirations of CSOs and industry (for instance, that CSOs resist innovation and that industry favours profits over responsibility), the panel discussions focused on more constructive ways to engage these stakeholders.

In communication activities aimed at CSOs, the main objective is to involve them directly in building links and information. CSOs can help build a mechanism to share information constantly, rather than just for crisis management, in the aftermath of events. They can include big CSOs already engaged in both communication and debate on nanotechnology, small CSOs whose action and sensitivity is focused on the local scale, and consumer associations. SMEs and start-up companies in nano-related industries and corporations are motivated by the search for a market in nano – they have strong motivation to seek out information on opportunities and risks associated with the nano-business. SMEs and start-ups are more likely to require support in communication activities, as well as dealing with safety and security issues and regulation – this should not be left to their own resources and initiative.

(3) Media and Lay Public (Outreach, Dialogue, Education)

In their position as very important multipliers, journalists are interested in reliable information on nanotechnology. The media they work with, ranging from newspapers to television to the Internet, have their own specific requirements. Providing credible information and building relationships based on trust are vital for effectively reaching the media. When addressing journalists, it should be emphasized that people need to be more critically informed about nanotechnology in order to increase their awareness of both potential opportunities and risks.

2.2. "OLYMPICS" AND "TRAFFIC LIGHT" RATINGS FOR COMMUNICATION VEHICLES AND MESSAGES

For each audience and communication objective across OUTREACH, DIALOGUE and EDUCATION, specific actions were identified for each vehicle ("Olympic medals method") and ranked in terms of priority.

Similarly, specific messages for each action were ranked according to their positive (desirable) or negative value ("Traffic light approach").

2.2.1. COMMUNICATION VEHICLES: "OLYMPIC" RATINGS

A shortlist of well-defined communication recommendations were classed as:

1) **Gold**: What the stakeholders' community *must* do right now. Proposals which are regarded as "urgent, well-defined and necessary" belong to this class.

2) **Silver**: what the stakeholders' community *should* do in the near or medium term future. Ideas belonging to this middle field are regarded as "useful rather than necessary, important but not crucial".

3) **Bronze**: what the stakeholders' community *could* do later. Suggestions in this field were deemed important by some, but not all the group members.

2.2.2. COMMUNICATION MESSAGES: "TRAFFIC LIGHT" RATINGS:

Specific messages ("What should we communicate about nanotechnology?") for each vehicle were identified and labelled as:

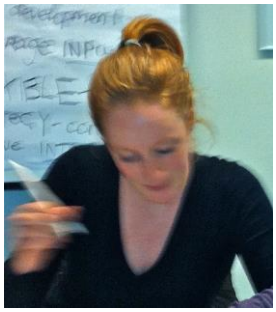
GREEN: **Say it!** These messages are highly recommended, and can be considered practically compulsory (such as the intensive collaborative effort for open and transparent research).

YELLOW: **Say it with caution!** A cautious approach needs to be taken for tackling controversial and uncertain aspects of nanotechnology (such as ELSA).

RED: Avoid saying it! These messages can harm the credibility of investment in nanotechnology, either by over-selling science or presenting dystopian scenarios.

Dr. Daan Schuurbiers (NL)
The Pilot Plant (De Proeffabriek)

CSOs and Industry group



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Warwick University (UK)

Youngsters group

The contributions of facilitators and rapporteurs of this workshop are gratefully acknowledged here above.

3. DISCUSSION: WHAT TO DO?

This section addresses the different works carried out by the discussion panels.

3.1 PANEL 1: YOUNGSTERS

Communication projects focusing on youngsters should give substance to the broader objective of activating citizens' role in shaping technological developments, guiding nano-based innovation towards socially robust outcomes. Experts agreed that lack of social clarity can be addressed by raising knowledge, help forming attitudes and encourage young people's engagement. The debate should take into account EU identified grand challenges (i.e. ageing society, climate change, energy security and so on), exploring the potential of nanotechnology and nanoscience to solve these multifaceted problems. The common ground of discussion unfolded a multiplicity of choices around nanotechnology from the perspectives of (1) scientific innovation, (2) market uptake of nano-based products and (3) regulation of Nano as an emergent technology.

Most importantly, experts outlined that all the products generated by the communication projects (i.e. a map of the European opinion or an educational programme on nanotechnology) should have their conclusions translatable into policy relevancy. In terms of educated the youngsters and the message multipliers that influence them (i.e. teachers), it was also found essential to diversify communication channels, combining offline events with digital-based communication.

3.1.1 USING NEW MEDIA VEHICLES

When addressing young people, one must understand their lifestyle and adjust to their communication patterns and habits of consuming, processing, generating and sharing information. Using creatively social media platforms, networking, augmented reality or apps has become a must for reaching this audience. Playing with a Nano-identification application for consumables, developing augmented reality games, or practicing virtual graffiti for nano-structures are just some of the activities considered to efficiently trigger enthusiasm.

A viral awareness campaign should address young people from three perspectives: as responsible citizens, as responsible consumers and as students considering multiple career options. The key strategy is to involve youngster by:

(1) offering them a stake in the issue under discussion, transmitting a feeling of ownership for developing original ideas on the potential of nanoscience and nanotechnologies; (2) creating real communities of thought that can actively shape real changes. With their architectures of participation[8] online communication tools such as interactive games or building apps can enhance the feeling of ownership, transforming communities of participants into nomadic collectors and creators of knowledge. Thus, besides formal educational activities, communication actions must take into account the "non-elite social contexts and communicative conventions" (Flew, 2003) which are actively shaping the cultural appropriation of nanotechnologies through active participation.

However, experts also pointed out three challenges for outreach. Firstly, online platforms are organically evolving, so the projects must constantly keep up with the most innovative media tools in use. Secondly, oversaturation of information on multiple communication channels should be avoided. Lastly, we must acknowledge the digital divides between youngsters that have access to and can afford these technologies and those who do not have access or/and cannot afford them. "Knowledge apartheids" must be identified, in order not to exclude certain groups of young people.

In what concerns the latter, strategic offline activities (such as a travelling science lab, street events and science festivals) must be given importance as well, by generating a critical mass of projects with a ***hands-on, minds-on, hearts-on***[9] approach. Offline projects should take into consideration hype venues (i.e. skateboard parks), interesting themes (i.e. sports and fashion, health, green lifestyles), and combine both professional time and leisure time.

3.1.2 A PLACE FOR CRITIQUE: THE "LIVE ARENA" OF DEBATE

Establishing dialogue is not only about communicating nanotechnology advances, but is also about producing spaces of reflection and debate (such as science festivals, scientific cafes, science theatre, performance and curatorial projects etc.). These spaces would benefit from an effervescent collision of opinions, attitudes and behaviours, combining cautious objectivity with less neutral stances, in a challenging attempt to push the boundaries of thought.

[8] Van Kerckhove, D. (2010): *The augmented Mind*, Kindle edition, e-book edition (English and Italian).

[9] Bonazzi, M., (2010): *Communicating nanotechnology: Why, to whom, saying what and how? – An action- packed roadmap towards a brand new dialogue,* EC, Brussels, p.56. http://cordis.europa.eu/nanotechnology/src/publication_events.htm

The first identified issue was the need to equip students with critical thinking skills, for an informed judgement. Science and technology should not be presented as a linear development; instead, youngsters must understand the co-evolution of Nano innovation, economy and society, in order to responsibly acknowledge their own roles in shaping the course of Nano development in socially desirable directions.

One of the proposed options was the "Live Arena" of debate, such as a series of Science Café events. Conceived as a live broadcasting dialogue event, its aim would be to build-up critical skills in youngsters, having as subject of discussion nanotechnology**.** Such an open approach calls for a deeply critical attitude about what is considered to be valuable knowledge, and how citizens can actively shape the socio-scientific evolution. In an ever more complex environment, this implies that a new approach in teaching science is needed as well. The focus should be less on offering an avalanche of information which is not critically processed and understood. Instead, students need to be equipped with critical skills to select from all the (often contradictory) information around them, filter the sources and constantly question assumptions.

On the same idea of a culture of inquiry, a second priority proposal was a Science Festival entitled "Nano: Breaking the Myths". Experts from key communities of practice (science, ethics, industry, arts) can join forces for developing workshops, interactive exhibitions, performances and debates. In this way, nano innovation impacts would be assessed from different (and sometimes unexpected) angles: firstly by exposing social assumptions ("myths", and secondly by de-constructing pre-conceived ideas about Nano.

3.1.3 COACHING SCIENCE TEACHERS

A knowledge-based society is one of Europe's major competitive advantages. Undoubtedly, there is a growing need for building capacity for the technological assessment of Nano. Therefore, experts strongly affirmed that selected education actions should receive wide support from the EC, as pan-European coordinated initiatives are of stringent need for enhancing mutual-learning and strategic intelligence in the EU.

A systematic communication approach requires an integrated, coherent perspective on how to open up the Nano debate towards the public, while synchronising it with the EU innovation agenda. However, terms such as

"curricula", "standardisation" or "pan-European" should be avoided – as national educational ministries could reluctantly respond to them.

To tackle this issue, workshop participants proposed a bottom-up initiative, with an incremental approach, aiming to train teachers in developing critical discussions in class: "Teaching Nano: a dedicated coaching programme for teachers". Identified by the experts as key multipliers in communicating nanotechnology for youngsters, teachers will greatly benefit from the coaching program, firstly in terms of career alternatives and specialization opportunities (for instance, as part of a Long Life Learning Program and professional reorientation programs). Thus, the coaching program would enhance their expertise and add a new dimension to their professional development. Once having trained teachers through peer coaching and expert coaching, elective science classes on nanotechnology will diversify the educational offer for students, improving the classroom practice. Such a program would actively support the knowledge and skills development of science teachers, helping them reflect upon their own practice and the social impacts of science and technology.

The panellists highly recommended the inclusion of industrial partners in the coaching program. This will offer opportunities to reflect and engage in professional discussions on: (1) what contributes to learn about nanotechnology in a critical way, and (2) which are the best methods to map debates on nano as an emergent technology, between high expectations and high concerns.

With an interdisciplinary approach, the program was thought to be modular, flexible, configured on specific subjects such as physics, chemistry or biology. Teachers could be coached to identify professional needs and thus adapt the programme accordingly. This is expected to encourage teachers to expand their expertise in a multitude of directions. As important supportive actions, the program could include:

a. *Virtual Learning Campus*, for centralising online main learning and coaching resources for teaching nanotechnology, including forums of discussion, as a platform for harnessing new initiatives, at the local, national or European level.

b. Designed *educational materials* for students (i.e. classroom-based teaching, game-based learning, thus using effective pedagogical approaches including cooperative learning, like Play-Decide games).

c. *European training Centres* for teaching nanotechnology (i.e. featuring stalwart institutions such as the Deutsches Museum and the Minateque Grenoble).

3.2 PANEL 2: CIVIL SOCIETY ORGANISATIONS (CSOS) AND INDUSTRY

Participation and engagement of civil society organizations (CSOs) and industry are indispensable elements of a responsive policy strategy for nanotechnology. The workshop participants agreed that broad stakeholder involvement enables robust policies and improves innovation efficiency. Participants therefore proposed the establishment of a multi-stakeholder platform involving CSOs, industry and policy makers to advance responsible European policies for nanotechnology. The two main activities to be undertaken within this platform are a series of stakeholder dialogues and training activities.[10]

3.2.1 STAKEHOLDER DIALOGUES

A series of stakeholder dialogues would form the core of this initiative, discussing foreseen advances in nanotechnology with the aim to establish an agreed European policy agenda. Starting from new technological developments (and focusing on concrete individual applications like a new type of coating or a filter for water purification), these meetings would consider the various questions of interest that emerge across the entire value chain (from research and development all the way through production and distribution to use and waste processing or recycling).[11] Importantly, the stakeholders are to collectively determine the types of questions deemed relevant for the policy making process: what are the determinants of a responsible innovation strategy for nanotechnology? The discussion cannot be limited to safety concerns or risks-benefit analysis only, since this limits the range of potential concerns that stakeholders can bring to the table. Rather, the dialogue should provide an opportunity for stakeholders to discuss the relevant interests and concerns from their own point of view. The key question involved in policy making for nanotechnologies is beyond the question of risk: it is about the roles that nanotechnologies are to play in our society. In other words, the dialogue engages participants beyond questions of acceptance, and discusses the key messages associated with nanotechnology as a socio-techno-economic project.

[10] The design of this platform and its activities should build on the findings from previous EU projects such as NANOPLAT, NANOCAP, NANOCODE, DEEPEN and Nanobio-RAISE.

[11] While noting that the question of labeling is a generic issue pertaining to the law and its doctrine, values, and perceptions, this could be an interesting topic for discussion: further research should be focusing on the most sensible and feasible ways of disseminating information on the use of nanotechnology. In fact, this is a complex and delicate issue, not only because it is difficult to identify the role of 'nanotechnology' in products. Another topic to be further explored is how to devise follow-up measures to implement the European Code of Conduct for Nanotechnologies. Effective stakeholder dialogue may solve some of these questions (Note of the Editor).

When agreement is reached on the relevant questions, the stakeholder platform can define a policy agenda for addressing them. This will entail various kinds of impact assessments, including (but not limited to) risk assessment and management. Assessments of how foreseen developments may affect values in different segments of the European population are equally relevant.

These assessments can then be used to define a shared vision on the ways in which European policies should seek to shape the effect of nanoscience and technologies on society. Crucially, measures should be put in place to ensure that the outcomes of the deliberation process are fed back into actual decision making. The notion of Responsible Research and Innovation implies that outcomes of the dialogue are fed back into the institutional policy making and research processes. In other words, the dialogue agenda needs to be connected with the research agenda. Effective dialogue thus enables a sense of *ownership*: the realization among stakeholders that the policies address their views and concerns.

In enabling wider participation to policy making, this initiative addresses the European Commission's commitments to an inclusive European society, identified by President José Manuel Barroso as an essential element of *Horizon 2020*, the new Framework Programme for Research and Innovation. In addition to providing robust input to responsible policy making for nanotechnologies, this multi-stakeholder platform is also a form of social innovation, functioning as a tester for new forms of governance.[12] Next-generation deliberative processes are built on the acknowledgement that policy debates are never interest-free. Yet by engaging in a dialogue about the various interests, it becomes possible to identify common interests as elements for a coherent European policy agenda. The key is to maximize synergies and minimize possible sources of conflict.

To establish this multi-stakeholder platform as a credible initiative however, a number of important methodological conditions need to be met. First, there is the question of motivation: there has to be a reason for stakeholders to join. Motivations may vary among stakeholders: the platform could serve as a "forum" for expressing one's interests and this is the reason why the questions cannot be limited to risks and benefits. This however invites the question of representation: who is invited to join in the dialogue, and on what terms? And importantly, what will happen to the outcomes of the dialogue? To be credible, the constituents of the stakeholder platform need to be seen as fairly representing the values and

[12] Notably the development of "third-generation deliberative processes", as suggested by the European project Nanoplat.

concerns from different segments of society.[13] This also implies that the members of the platform should be treated as equals. This may be difficult to implement given the differences in policy making and levels of funding, but is absolutely vital for success. Continuity is a final condition: a platform with a longer time-span can integrate and facilitate discussions over longer periods of time and allows for a proactive and adaptive approach that can cope with the dynamics of the research and innovation processes, changes of attitudes and needs. Dialogue processes cannot be rushed. These conditions (motivation, representation, equality and continuity) demand careful design of the platform and of the way the outcomes of the dialogue will be taken up.

Another important benchmark of success would be for the initiative to tie in with on-going European efforts, as for example the risk assessment and management initiative for nanomaterials as initiated by DG SANCO (Directorate General for Health and Consumers) and DG RTD (Directorate General for Research and Innovation) on differentiation, detection and interaction with living organisms.[14] In the panellists' view, these efforts towards building a regulatory framework point to another condition: they demonstrate that the regulation of nanotechnologies demands a global strategy. Questions concerning nanotechnology do not respect borders, particularly because some components for nano-based products may be produced and imported from countries where other types of legislation apply (indeed, with different value systems and priorities).

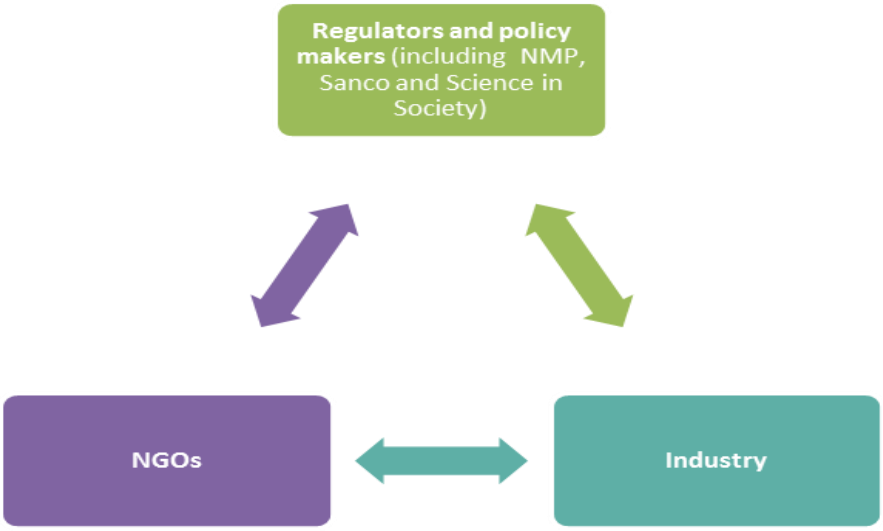
3.2.2 TRAINING SESSION TO ADDRESS KNOWLEDGE GAPS

While the dialogue process is intended to exchange views and concerns among stakeholders (in the sense of two-way communication), the exchange is expected to be more effective if participants are to an extent 'on the same wavelength' with respect to the available information. In other words, there will at times also be a need for the provision of information (in the shape of 'unidirectional' training or education). So in addition to the dialogue meetings themselves, the platform envisages a number of training events in which each of the stakeholders in turn "educates" the others, by addressing knowledge gaps. The figure below indicates the multilateral process thanks to which stakeholders may learn from each other.

[13] During the meeting, several CSOs were identified such as the BEUC, EEB, ETUI, EPHA, WECF and ECAS. One relevant question to be addressed in this respect is how to address possible needs of developing countries (Note from the panelists).

[14] A common approach from DG SANCO, DG RTD, DG JRC (Joint Research Centre) should be encouraged for this purpose.

Multilateral learning process for stakeholders



Regulators and policy makers can inform the industry about the state of the regulatory processes and provide a picture of the underlying issues at stake (such as safety concerns). Conversely, regulators can benefit from information sharing with the industry to assess the levels of knowledge already available within the industry and to align regulations to production practices.[15]

CSOs can in turn offer insights in the kinds of values and concerns within different segments of the population, and the way they are prioritized. In doing so, they may broaden the scope of the questions to be addressed during the dialogue meetings. Conversely, regulators and policy makers can assist by promptly providing information on the most updated regulatory and policy processes to date and "open up" the policy making process.

The success of these training initiatives is also dependent on methodological criteria. First, trust is crucial: who accredits the trainers? If the trainers aren't seen to be impartial and objective, opportunities for learning may evaporate. Also, the question of representation reappears.

To conclude, dialogue meetings and training sessions organized by a multi-stakeholder platform could facilitate the development of a shared vision on the ways in which nanotechnologies may affect Europe and the questions this raises for policy making. In doing so, robust European policies for nanotechnology might or could be enabled, also contributing the Commission's communication strategy

[15] Particularly here, the issue of equality needs to be kept to the fore. CSOs may be concerned about becoming unwillingly involved in an industrial lobby directed at policy makers. Information exchange needs to remain objective and impartial.

for nanotechnology. The continuity of the multi-stakeholder platform would also establish cross-links between the various partners and projects involved in outreach, dialogue and education.

3.3 PANEL 3: MEDIA AND LAY PUBLIC

3.3.1 MEDIA AND LAY PUBLIC AS TARGETS

The media, in their position as very important multipliers, should be among the primary audiences to be reached. However, this does not rule out the need to address the broad public directly with appropriate actions[16]. Journalists are interested in reliable information on nanotechnology, in an appropriate format. The media they work with have their own requirements, ranging from newspapers to television to the Internet. *Credibility of the information* provided and *building relationships based on trust* are key values concerning communication to the media, which are keen to inform the public about nanotechnology in order to increase awareness of both potential opportunities and risks. Similarly, building relationships based on trust is important when considering nanotechnology communication directed at the lay public: "The public trust and dialogue on nanotechnology will be crucial for its long-term development and allow us to profit from its potential benefits"[17]. Open and transparent communication is an integral part of the general culture of responsibility towards nanoscience and nanotechnologies, which the EC is trying to create.

The working group session began with a discussion of the definition of "lay public". It was clear that the term should not refer to an all-encompassing group of individuals - indeed, there exist many publics with a variety of needs and expectations; this is precisely what renders communication of nanotechnology to "The public" (understood as a homogenous entity) a real challenge. The ensuing discussion broached a range of outreach, education and dialogue activities in the hope of catering to a wide range of people in the public arena.

[16] Bonazzi, M., (2010): *Communicating nanotechnology: Why, to whom, saying what and how? – An action-packed roadmap to a brand new dialogue,* EC, Brussels. http://cordis.europa.eu/nanotechnology/src/publication_events.htm

[17] Bonazzi, M., (2009): *Knowledge, Attitudes and Opinions on Nanotech across European Youth*, EC, Brussels.

3.3.2 OUTREACH

Outreach actions should frame nanotechnology in culturally significant ways[18]. For example, the Observatory Nano project revealed that "nanotechnology" as a topic of communication may be too abstract for large-scale public engagement. There is a feeling that the "technology" aspect may have been pushed too far by communicative actions: as a result, nanotechnology may have become difficult for many audiences to comprehend and assess.

It may well be more fruitful to focus on specific issues and sensitive applications, such as "nano in food", "environment and sustainability" or "nanomedicine". The necessity of doing this is also indicated by the findings of TimeForNano[19]. The scenarios which were presented in this project should have been related to local concerns. For example in Germany, the topic of "Security", may be less of a public concern than in France[20].

A possible outreach action would be to hold a **festival bringing together key actors from the media, scientific and artistic circles, as well as members of the lay public.** The festival should facilitate collaboration between scientists, artists and journalists, as communities of practice which are strongly connected. As stated previously, a wide range of nano communication at this event should be framed according to the themes and the corresponding publics. The festival could include a round table moderated by journalists, involving scientists and representatives from CSOs. It is expected that the round table would encourage research scientists to consider the significance of nano communication not only to or with the public, but also within the scientific community. Such reflexivity would prompt scientists to consider the perceived "sci-fi" aspects of their work, which the public may find concerning.

The discussion on these dilemmas could then contribute to enrich a possible European strategy for responsible innovation governance. In fact, it seems important to move beyond the risks of nano and also envisage the kind of future we desire. Some participants felt that focusing on the risk-benefit framework only

[18] Reworked from publishable reports of project "Observatory Nano", at http://www.observatorynano.eu/project/catalogue/4/

[19] Publishable reports from project "TimeforNano"; more details at http://www.timefornano.eu/about-nanotechnology

[20] Results reworked from the exhibition "All connected" displayed at Cité des sciences CCSTI of Grenoble, October 2010-March 2011, developed also in the framework of project NANOYOU. More details at http://nanoyou.eu/lv/component/content/article/27-news/724-qall-connectedq-at-the-cite-des-sciences.html?directory=62&Itemid=62 and http://nanoyou.eu/lv/nanoyou-project/news/7-nanoyou-project.html

might be limited and inappropriate, as the notion itself of some benefits may be radically disputed. Rather, responsible innovation governance should become the focus of outreach, dialogue and education activities.

The festival event could also include sessions for simultaneous training of journalists and scientists in science communication. As a template design for these sessions, future projects could benefit from the experience of "Advanced Courses on Public Communication and Applied Ethics of Nanotechnology" at Oxford, part of the NanoBioRaise project[21].

The festival could also feature an art-science exhibition put together by an interdisciplinary team of scientists, curators, exhibition organisers and script writers. The festival event could draw on the idea of BIOPOP[22], whereby tents were set up for 2 days in the main squares of Bologna in Italy and Delft in the Netherlands. Within the newly created de-centralised space for debate, young scientists fielded questions and comments from members of the public.

In this light, the **collaboration between Art and Science is an opportunity to boost outreach:** "We especially need imagination in science. It is not all mathematics, nor all logic, but is somewhat beauty and poetry", said Maria Mitchell, an American astronomer from the late 19th century. Art-science collaboration encourages artists to explore the possibilities of the technologies of science and encourages scientists to fulfil their curiosities despite the constraints associated with scientific research[23]. This collaboration is a medium which holds enormous potential for the communication of nanotechnology. Displaying scientific data artistically is a way of making scientific concepts accessible and questionable to society at large, including people of non-scientific backgrounds who might otherwise be excluded from the process of decision making.

There is often an uncanny likeness between nano structures and structures in the macroworld which allows the viewer to identify with the artwork and gain an appreciation for the nanostructure: "The examination of nanostructures reveals fantastic images that transport us into fascinating worlds that are full of secrets.

[21] Reworked from publishable materials developed within "NanoBioRaise" project, more details at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2837214/

[22] More details at: http://biopop.pophealth.wisc.edu/wp/

[23] Bonazzi, M. (2008): "Communicating nanotechnology through art", in *Art and Science - creative fusion*, EC, Brussels, December 2008, ISBN 978-92-79-10879-2, pages 13-14, EC, DG RTD, re-printed in 2009.

In a mysterious way, the motifs are similar to macroworld objects"[24].

Another main discussion point was that a key objective of further funding should be to make reliable scientific information available to journalists at short notice. A proposed outreach action for doing so is to create an online database of scientific publications. These publications should be written in such a way as to be understood by journalists of non-scientific backgrounds- technological and field-specific references would be explained in lay terms.

3.3.3 DIALOGUE

The EC has moved from a top-down to a bottom-up communication approach to nanotechnology, promoting a "dialogue" model: that is, science communication is a multi-way exchange of information between specialists and non-specialists, rather than a one-way communication[25]. The "dialogue" vehicles should therefore enable each party to share, listen and be listened to while respecting the other party's point of view.

Another possible suggested dialogue action might be to podcast all nanotechnology presentations aired on the radio. The aim of podcasting would be to ***give members of the lay public the opportunity for increased reflection, thereby empowering them to engage in dialogue***.

Dialogue actions should also function to increase communication between EC-funded projects in the future. The projects should not be separate entities as they have been. Similarly, scientists working in the Open Laboratories, such as those featured in the TimeForNano project[26], should have the opportunity to travel to other sister locations. This would facilitate the communication of best practices in the Open Laboratories and further increase the synergies between projects.

Another participant pointed out that projects involving media partners require increased communication between journalists.

[24] November 2009. *Expedition Zukunft.* ArchiMeDes, Berlin.

[25] Bonazzi, M., (2010): *Communicating nanotechnology: Why, to whom, saying what and how? – An action-packed roadmap to a brand new dialogue,* EC, Brussels, pages 7, 9, 72-78. http://cordis.europa.eu/nanotechnology/src/publication_events.htm

[26] More details of project "TimeforNano" can be found at http://www.timefornano.eu/about-nanotechnology

3.3.4 EDUCATION

Setting up **cross-training media centres** for scientists and journalists would aim to ensure that scientific publications on nanotechnology can be easily and quickly accessed by journalists. It would include a session for scientists and journalists addressing referencing, teaching scientists to use key words in referencing their publications often used in searches by journalists. Also, cross-training media centres should be set up to include establishing a dedicated reference database resource. New reference systems may be needed for research on uncertain topics such as nanotechnology: it may be necessary to integrate them into an initiative for emerging technologies which includes biotechnology.

A further education action would aim to provide journalists with first-hand knowledge of scientific lab research, thereby facilitating communication between two communities of practice: scientists and journalists. One suggestion focused on a "Journalists in the Lab" Workshop, which could be based on the concept of the *SciArt10* programme[27] from the Wellcome Trust Foundation, supporting imaginative and experimental arts projects that investigate biomedical science.

4. CONCLUSIONS: SO WHAT?

4.1 THE EC VIEW

Communication activities should not associate "hype" with nanotechnology, over-selling promises. Indeed, panellists agreed that the hype has passed and we are now faced with the reality of the technology. The industrial reality is that European countries cannot be regarded as featuring among the big players in nanotechnology yet. Meanwhile, the Code of Conduct has been playing a pivotal role in kick-starting the debate between Member States. Current policy is driven by technology and innovation; however, a consensus within the industry regarding safety is now paramount.

Mr. Christos Tokamanis, Head of Unit for Nano Sciences and Nano Technologies, Directorate G, DG Research and Innovation (RDT) of the EC, defines nanotechnology as a political project based on social relations, the nature of which

[27] For more details on Sciart and Wellcome Trust, see http://www.wellcome.ac.uk/Funding/Public-engagement/Funded-projects/Awards-made/All-awards-made/WTX035067.htm. A summary of the Sciart evaluation report can be accessed on http://www.wellcome.ac.uk/stellent/groups/corporatesite/@msh_grants/documents/web_document/wtx057229.pdf

is now necessary to determine in order to establish a dialogue with various audiences, including youngsters, CSOs and Industry, media and the lay public, and act on their feedback. A participant expert advocated engaging the European public directly via dialogue actions, rather than focusing on building trust; this would ensure that the politics of nanotechnology better reflect European values. Advanced nanotechnology requires enhanced solidarity and common purpose based on these shared values but currently the European public does not consider itself as a part of discussions on nanoscience and nanotechnologies yet. This will require models to enable inclusive participation in political deliberation.

Member states and research scientists need to be offered an incentive to implement and abide by a new Code of Conduct. Instead of being perceived as yet another level of bureaucracy, the Code of Conduct must be appropriately translated into the various languages and should be extended outside of Europe to ensure fairness, as determined by the project NANOCODE[28].

The participants felt that the budget of about 10 million euros that has been spent on nanotechnology communication by the European Commission over the past 7 years is insufficient. They consider as necessary the development of a nanotechnology communication strategy with milestones up to 2020, as well as a clear implementation process. Concrete actions are needed in order to secure further funding.

4.2 ASSESSMENT OF PREVIOUS ACTIONS ON COMMUNICATING NANOTECHNOLOGY

Asked as to the ways in which the process of communicating nanotechnology could be improved, participants agreed that (1) nanotechnology has been subjected to vicious hype-disillusionment cycles (due to overpromising by some researchers in order to obtain funding); (2) communication occurred largely "downstream", with the purpose of enhancing acceptance: this leaves little room for feedback mechanisms into the actual innovation processes; and (3) a lack of acceptance was assumed to be the result of insufficient information (the deficit model of communication). This led to a strategy of (4) communication focused on risks and benefits of the technology, rather than addressing the broader question of how we want nanotechnologies to shape our societies. Finally, (5) the EC communication strategy tended to focus more on communication vehicles and messages than the underlying communication goals.

[28] More details at http://www.nanocode.eu/

The critical question therefore is how to enable a sensible debate in the absence of certainties regarding risks and future directions and also, at what stage of technological development we want to engage. It should be recalled that:

"Rather than blindly developing the technology and simply waiting for the magical appearance of benefits to society, we should define social goals and determine how science and technology may help to reach them. Social and natural scientists should start working together to ensure that science is in the service of society."[29]

4.3 OBJECTIVES FOR A NEW COMMUNICATION FRAMEWORK ALONG THREE PRIORITY LINES

Three priority lines were identified for future stakeholders' communication actions on nanotechnology, each characterised by a set of key objectives.

Education:

- General levels of knowledge to prepare young citizens to make informed choices in tomorrow's complex societies;
- Training new cadres of engineers / vocational training.

Competitiveness of the EU:

- Create a global playing field;
- Create opportunities for industry within the EU.

An inclusive European society:

- Responsiveness of policy making;
- Responsiveness of the research and innovation system.

4.4 STRATEGIC RECOMMENDATIONS

The focus should be on identifying what the likely public interests and concerns are and ensure that the research and innovation system takes these concerns into account.

[29] From the essay *Ethics in Action,* by Daan Schurbiers, which won the Mekelprize of TU Delft's Platform on Ethics and Technology in 2008. Available at http://www.tnw.tudelft.nl/fileadmin/Faculteit/TNW/Over_de_faculteit/Afdelingen/Biotechnology/Research/Awards___Milestones/doc/Mekelprijs2008_Ethics-in-Action_Schuurbiers.pdf.

Better policies for nanotechnology also depend on the collaboration between Science in Society and the Unit Nano Sciences and Nano Technologies of the Directorate Industrial Technologies within the new Horizon 2020 framework. This collaboration lies in a renewed focus on the reasons of *why* we communicate and how common efforts could be established. Communication and dialogue are intimately linked. Strengthening the consistency between going out to the public (through education and communication in different media) and ensuring that public views feed back into the policy process (through upstream involvement and scientist engagement) would both enable Unit of Nano Sciences and Nano Technologies and the Unit Science in Society to support each other and strengthen the communication effort by the EC itself. Admittedly, this will require some discussion between the representatives from both services, but it may be the key to reach an agreed view on the purpose of communication and dialogue.

By outlining a credible strategy that synergistically combines the communications of the Unit Nano Sciences and Nano Technologies with the overall vision of Responsible Research and Innovation from Science and Society (bridging communication and dialogue), this could presumably serve as a model for other programmes. The multi-stakeholder platform may well have a role to play in this endeavour.

4.5 AT A GLANCE: OUTLINE OF PROPOSALS FOR COMMUNICATION OUTREACH, DIALOGUE AND EDUCATION ON NANOTECHNOLOGY

Overall, the following recommendations stem as the main outcome from the workshop effort. Altogether, they frame a structured set of actions shaping the **"Outline of Proposals for Communication, Dialogue and Education on Nanotechnology"**. Full details expanding each different action are provided accordingly in the tables of Chapter 6: which illustrate which ideas, proposals and actions the stakeholders' community on communicating nanotechnology *must, should or could* develop to promote responsible communication in this field.

5. OUTLINE OF PROPOSALS FOR COMMUNICATION OUTREACH, DIALOGUE AND EDUCATION ON NANOTECHNOLOGY: KEY ACTIONS IN A NUTSHELL

YOUNGSTERS

Action 1. Outreach

Gold: Kick-start a viral campaign of nano-awareness, addressing young people as responsible citizens and consumers on three main topics: *Sports and Fashion*, *Food and Health*, *Environment and Sustainability*. Young people can be challenged to create open-sourced ICT applications such as: nano-identification app for consumables, augmented reality app for nano-based materials, virtual graffiti.

Silver: Set up an "Edu-Nano Forum" for creating awareness for the key multipliers and their contribution to building critical skills in assessing nano-technology. "Edu-Nano Forum" will include: online learning resources, teachers and students forum for collaborative learning.

Bronze: Organize contests as part of the viral online campaign.

Action 2. Dialogue

Gold: Set-up "Live Arena" events as a space for critical debate (i.e. Science Café);

Silver: Organize a festival/exhibit on called "Nano – Breaking the Myths", de-constructing social assumptions on nanotechnology development.

Bronze: Organize three cycles of Live Arena debates and "Breaking the Myths" festivals/exhibitions, for a consistent change in young public's perception.

Action 3. Education

Gold: Devise a "Teaching Nano" coaching program dedicated to teachers;

Silver: Organize a program for vocational skills, improving employability and connecting youth talent with industrial stakeholders;

Bronze: Set up a "Nano Parliament" for technological assessment, as a simulation of the policy decision-making process. Representatives of the Nano Parliaments would be young people with an active involvement in civil society and young scientific researchers. Real stakeholders (such as industrial players or national institutes for technological assessment) should be included as well, to ground the debate.

CSOS AND INDUSTRY

Action 4. Outreach

Gold: Assess the interests and concerns of CSOs and industry to prepare for a responsible research and innovation strategy for Europe;

Silver: Ensure international cooperation on risk and value assessment;

Bronze: Identify and assess public interests and concerns about nanotechnologies.

Action 5. Dialogue

Gold: Establish a multi-stakeholder platform involving CSOs, industry and policymakers;

Silver: Define a common identity for stakeholders' policy initiatives on communication and dialogue in preparation for Horizon 2020;

Bronze: Enable third-generation deliberative processes.

Action 6. Education

Gold: Hold training sessions for stakeholders within the multi-stakeholder platform;

Silver: Organize CSO-industry exchanges;

Bronze: Arrange visits of industry researchers and representatives to developing countries, and vice-versa.

MEDIA AND LAY PUBLIC

Action 7. Outreach

Gold: Create an online database of scientific references, to ensure that expert scientific information is reliable and readily accessible for journalists. This dedicated online scientific database on nanotechnology should be quickly referenced in lay terms for mainstream media use.

Silver: Organize attractive "Nano-Festivals" involving interdisciplinary collaborations between science and art, round tables with journalists moderating scientists, CSOs and industry representatives; include curators, exhibition organizers, script writers and podcasts.

Bronze: Organize festival street labs.

Action 8. Dialogue

Gold: Set-up podcasts of radio segments on nanotechnology.

Silver: Create regular journalist teleconferences or webinars.

Bronze: Host open lab exchanges to increase synergies between communication projects.

Action 9. Education

Gold: Set up cross-training media centres with master classes for both scientists and journalists without a scientific background; train scientists about ways to provide references for media.

Silver: Open up research laboratories for journalists, to receive first-hand experience of how the scientific work is set-up and to thereby facilitate communication between scientists and journalists.

Bronze: Organise open lab exchange schemes, bringing together scientists, journalists and artists.

Action 10. Integrated Communication, Dialogue Education

Make use of innovation and creativity to communicate and foster inclusion of all stakeholders.

6. OUTLINE OF PROPOSALS FOR COMMUNICATION OUTREACH, DIALOGUE AND EDUCATION ON NANOTECHNOLOGY: DETAILED DESCRIPTION

Table 1 - Outreach-Dialogue-Education Actions for Youngsters

Youngsters: Outreach actions	
Gold (Stakeholders' community must do)	**1. Awareness, Viral Campaign** Aiming to address youngsters as: • Responsible citizens • Responsible consumers • Vocational- career *Challenge: Digital divides = Identify the tough-to-reach young audience, or young audiences without access to digital expensive devices and services. Prevent the digital divide to generate a Nano-divide (knowledge apartheids) and exclude certain groups of youngsters.* *Vehicles:* • *Invite youngsters' creative input both online and offline* • *Combine professional time with leisure time* *Offline activities:* (1) Travelling event, (2) Street event/ skateboard parks or other hype venues for youngsters, (3) Train wagon/tube designed as an interactive, travelling science lab. *Online activities:* • A continuous campaign technology-oriented based on the ever-changing social platforms (rapidly changing) • Develop a Nano-identification application for consumables. • Develop applications for augmented reality devices. • Virtual graffiti for representing Nano. *Themes on Nano (simultaneous focus):* I. Sports and fashion II. Food and Health II. Environment and Sustainability

Silver (Stakeholders' community should do)	**2. Euro Edu-Nano Forum** *Aiming* to deliver innovative models including all relevant actors (ministries, vocational etc.), reaching key multipliers.
Bronze (Stakeholders' community could do)	**3. Contest** It can be part of the awareness campaign.

Key Messages

Green:

- Know more and better (message of critical empowerment);
- Question constantly!

Yellow:

- Beware of Nano!

Red:

- Incite "Nano-hooligans";
- "Nano is the hype!";
- Avoid stereotypical messages;
- Do not associate Nano with specific brands (product placement).

Youngsters: Dialogue actions

Gold (Stakeholders' community must do)

1. Live Arena of debate

Live broadcasting dialogue & debate event

- Frame the "Live Arena" discussion as a locus of critical debate, building a critical apparatus. Nanotechnology is just the subject to be discussed. The aim is to build-up critical skills in youngsters.
- Choose vehicles wisely: Select the media without being too intrusive
- Discuss heritage versus open innovation
- Example: Science Café

Silver (Stakeholder s' Community should do)

2. Dialogue Festival/Exhibition 'Nano: Breaking the myths!

- Start from dogmatic claims, open them up.
- Bring experts from science, ethics, industry
- Allow the opposition to be represented, allow divergent views to be discussed.

Bronze (Stakeholders' Community could do)

3. Three cycles of Live Arena and "Breaking the Myths" Festival

A <u>spiral, bottom-up approach</u> (building on layers of reflective debate)

The Live Arena and the Festival could succeed each other 3 times, in order to build-up ideas, and assess an evolution of the debate Agenda.

Key Messages:

Green:

- We are not intrusive!
- Student-based activities on Nano are not just another "boring". school activity.

Yellow:

- Nano kills/saves.
- Avoid definitive claims, leave them open and encourage youngsters to consider the grey zones.

Red:

- Nano-preach: do not use young people as promoters of Nano
- Association of nano research and communication with brands should be avoided.

Youngsters: Education actions

Gold (Stakeholders' community must do)

1. Teaching Nano: a coaching programme dedicated for teachers

Approach: First step for a possible future agreement on an EU curriculum for nanosciences and nanotechnologies is to train the teachers (key communication multipliers for youngsters). The coaching should to provide effective, on-going, **classroom-based** professional development for science teachers.

The need: Form teachers as skilled reflective practitioners.

Positioning:
Have a bottom-up, incremental approach, thus *avoid* terms like "curricula", "standardisation" or "pan-European" – as they can foster reluctance/resistance from MS Educational Ministries.

For teachers:

- Offer career alternatives, specialisations for science teachers (part of a Long Life Learning Programme and professional reorientation programmes).
- The programme will support knowledge and skills development.
- Cooperative and reflective coaching (combine **peer coaching** with **expert coaching**)

For students:
Optional science classes on Nano will diversify the educational offer.

For policy makers: Partnerships with the industry are recommended, as active partners in *education*, offering opportunities to observe, practice, reflect and engage in professional discussions about what helps their students to critically learn about Nano as a *complex socio-scientific emerging innovation.*

Content & Structure of *Teaching Nano:*

- Relevant for science teachers, adding a new dimension to their profile.
- Will improve the classroom practice
- Thus, the programme should be **modular, flexible, configured** on specific subjects (physics, chemistry, biology etc.), allowing the teacher being coached to self-identify professional needs *while* including an…

- … **interdisciplinary** approach, allowing teachers to expand their expertise in a multitude of directions => peer coaching
- Could include industry => expert coaching (i.e. teachers could include professionals in their classrooms).

Professional recognition (incentives):

i. Nano-teaching Certification
ii. Invitation to display the newly-acquired expertise and exchange experience with the teachers' community at the ***NanoEdu Forum.***

Support actions:

a. Virtual Learning Campus, for centralising online main learning and coaching resources for teaching nanotechnology (including forums of discussion) as a platform for new initiatives.

b. Design educational materials for students (classroom-based teaching, game-based learning, thus using effective pedagogical approaches including cooperative learning) i.e. Play-Decide games.

c. European training Centres for teaching Nano.
(Ex. Deutche Museum, Minateque Grenoble etc).

Gold (Stakeholders' community must do)

2. Programme for Vocational Skills

- Include in the European NVQ – National/Nano Vocational Qualification.
- Form technicians (in collaboration with the industry).

Silver (Stakeholders' community should do)

3. Nano Parliament

Argument: Exercises of foresight deliver narratives that can shape the policies aiming at improving "Europe's competitive position in the knowledge-based economy and society of the future." [30]

- Involve youngsters from political organisations, NGOs for social change and decision-making (e.g. European Youth Parliament)

[30] STOA, Science and Technology Options Assessment, European Parliament (2008). *Technology across borders: Exploring perspectives for pan-European Parliamentary Technology Assessment*, Study of Directorate General for Internal Policies, Directorate G: Impact Assessment, IP/A/STOA/FWC/2008-096/LOT8/C1, PE 482.684.

	• Meetings and exercises for simulating processes of decision-making for assessing nanosciences and nanotechnologies (i.e. Meeting of Young minds[31], organised by Rathenau Institute and iGem[32]) • Grasping opportunities to connect with real regional, national and European parliaments.
Key Messages: **Green:** • Train teachers and teach students in an interdisciplinary way. **Yellow:** • Too much information can be counterproductive for students; focus on building critical skills instead. **Red:** Avoid using the expression "nano-curriculum".	

[31] More information on "Meeting of young minds" project": http://www.rathenau.nl/en/themes/project/synthetic-biology/meeting-of-young-minds.html and http://2011.igem.org/Regions/Europe/Jamboree

Table 2 - Outreach-Dialogue-Education Actions for CSOs and Industry

CSOs and Industry: Outreach actions	
Gold (Stakeholders' community must do)	**1. Assessing the interests and concerns of CSOs and Industry to prepare for a Responsible Research and Innovation strategy for NMP.** ***Aim*:** To identify and integrate the various interests and concerns of stakeholders serving as input for a responsible research and innovation strategy for nanoscience and -technologies. ***Vehicles:*** • identifying interests and concerns through interviews, questionnaires and focus groups, building on knowledge gained in earlier EU projects • feeding these findings back into the policy process (particularly Horizon 2020) through policy briefings and internal meetings ***Outcomes:*** • integration of a robust, shared vision on the future of nanoscience and nanotechnologies in European policies.
Silver (Stakeholders' community should do)	**2. International cooperation on risk and value assessment** ***Aim:*** To enable a coordinated, global strategy for risk assessment, building on current initiatives. ***Vehicles:*** International meetings between policy makers and regulators to identify and carry out an agenda for risk assessment (EU, US, Japan, China, South-Korea, Brasil, etc).
Bronze (Stakeholders' community could do)	**3. Identify and assess public interests and concerns about nanotechnologies** ***Aim:*** Broadening the "Gold" and "Silver" outreach-activities above by gathering knowledge of public interests and concerns about nanotechnologies (insofar as not yet covered by the Eurobarometer and other EU-initiatives).

Knowledge of public concerns and attitudes should feed back into the policy making process (listed under "Gold" and "Silver") and provide input to future education and dialogue activities.

Vehicles:

- Review of previous EU projects (if possible also from other fields of research, such as genetics or biotechnology) and Eurobarometer studies;
- Questionnaires, interviews.

Key Messages

Green:

- Stakeholder participation and engagement are indispensable elements of a responsible research and innovation strategy for nanosciences and -technologies.

Yellow:

- Using "nanotechnology" in the singular manner.

Red:

- Resistance against nanotechnology stems from a lack of information - increasing levels of knowledge will lead to acceptance.
  (This view has become known as the "deficit model" of communication which is demonstrably incorrect).
- Consumer acceptance depends on their perception of the risks as against the benefits.
  (This reduces the question of acceptance to the juxtaposition of risks and benefits).
- Those who want to apply the precautionary principle are under the illusion that they can live in a risk-free society.
  (This denies the possibility that application of the precautionary principle may be rational under certain circumstances).
- Our bodies have learnt to live with nanoparticles for millions of years, so there is no reason to be concerned about the safety of nanoparticles.
  (This principle ignores the question of newly engineered nanoparticles and dodges the question of health risks).

CSOs and Industry: Dialogue actions

Gold (Stakeholders' community must do)

1. A multi-stakeholder platform involving CSOs, industry and policy makers

Aim:

Building a shared vision among stakeholders on the ways that nanotechnologies may affect European society, serving as input for socially robust European policies for nanotechnology.

Vehicles:

- Establishment of the platform;
- A series of dialogue meetings;
- Training sessions to address knowledge gaps among stakeholders.

(see subgroup report)

Silver (Stakeholders' community should do)

2. Establishing a common identity for stakeholders' policy initiatives on communication and dialogue in preparation for Horizon 2020

Aim:

To formulate a coherent policy programme for communication and dialogue, integrating the views of Science in Society (notably on Responsible Research and Innovation) with a responsive communication strategy of NMP.

Vehicles:

- Meetings among policy makers of NMP and SiS (Science in Society);
- Vision document, defining a coherent strategy for Horizon 2020;
- Synergistic process as a model for integration with other themes in preparation for Horizon 2020.

(See subgroup report)

Bronze
(Stakeholders' community could do)

3. Defining third generation deliberative processes

Aim:

To identify the characteristics of a new form of deliberative process, rendering cooperation and dialogue among stakeholders as a matter of enlightened self-interest.

Vehicles:

- Literature review and theoretical reflection: "Beyond Habermas";
- Expert meetings to prepare a methodology (building on Nanoplat and Nanocap);
- Followed by implementation:
    - Using the multi-stakeholder platform under "Gold" as a case study
    - Other case studies of good dialogue practice.

Key Messages:

Green:

- The debate on nanotechnology is about acceptability, not acceptance.

Yellow:

- It is about the range of acceptability.

Red:

- The debate on nanotechnology is about risks and benefits.
- "Responsible acceptance".

CSOs and Industry: Education actions	
Gold (Stakeholders' community must do)	**1. Training sessions to stakeholders in the multi-stakeholder platform** ***Aim:*** To address knowledge gaps among stakeholders that may impede constructive dialogue. ***Vehicles:*** Training sessions. (See subgroup report)
Silver (Stakeholders' community should do)	**2. CSO-industry exchanges** Industry and CSOs have strong presuppositions about each other's motivations. Bringing them together may evoke social learning - the idea should be to open up to each other's visions (knowledge and resources).

3. Visits of industry researchers and representatives to developing countries, and vice versa.

Bronze (Stakeholders' community could do)

Nanotechnology is often said to be effective in addressing challenges from Developing Countries (DCs). Current research endeavours are however far removed from the local exigencies. Site visits may help researchers to attune the functionality of nanotechnology-based innovations to local needs - conversely, representatives from DCs could be invited to Europe to facilitate uptake of nanotechnology-based innovations in DCs.

Key Messages:

Green:

- Dialogue is enhanced by well-informed participants.

Red:

- Policy should be determined by scientific knowledge. (Instead, different forms of knowledge, including lay expertise)[33].

[33] See Brian Wynne (1996), *May the Sheep Safely Graze? A Reflexive View of the Expert-lay knowledge divide*. Chapter in Bronislaw Szerszynski, Scott Lash and Brian Wynne (Eds.): *Risk, Environment and Modernity: Towards a new Ecology*. Sage Publications Ltd.

Table 3 - Outreach-Dialogue-Education Actions for Media and Lay Public

Media and Lay Public: Outreach actions

Gold (Stakeholders' community must do)

1. Create a system for on-line Scientific References

Aim:

Ensure that expert scientific information is not only reliable but also readily available for journalists. A data base for journalists should be very helpful, linked to the Online scientific references.

Challenge: To provide a bridge between the media's rhythm of consuming information- quickly, and at the last minute- and the relatively long periods necessary to produce scientific findings in research.

Vehicles:

- An database of scientific information, which can be found by journalists via an on-line search: online scientific references
- It should provide information which is scientifically correct and which is translatable into lay terms
- Possible resource for setting up such a database: *Open Knowledge Foundation's* Open Science working group for encouraging creative commons for publishable scientific research

Silver (Stakeholders' community should do)

2. Festival

Aim:

Bring together key actors from the media, scientific and artistic circles, as well as members of the lay public, at one large and "loud" event, attracting media attention.

Challenge: The festival should facilitate collaboration between scientists, artists and journalists, as communities of practice which are strongly connected. In addition, the communication of "Nano" at this event should be thematically framed: a variation of communication contexts will increase relevance to a larger number of publics.

Vehicles:

- A Round Table moderated by a journalist comprising scientists and representatives from NGOs

- Sessions for simultaneous training of journalists and scientists in science communication
- The concept of the NanoBioRaise "Advanced Courses on Public Communication and Applied Ethics of Nanotechnology" at Oxford could be used as a template for this session. Participants in these courses received training in writing, speaking, debating and preparing communication plans related to nanotechnology.
- Science-Art exhibition put together by an interdisciplinary team of scientists, curators, exhibition organisers and script writers
- The festival event could draw on the idea of BIOPOP, whereby tents were set up for 2 days in the main squares of Bologna (Italy) and Delft (the Netherlands) and young scientists fielded questions and comments from members of the public

Themes to frame Nano communication (interdisciplinary focus):

I. Food and Health

II. Environment and Sustainability

III. Nanomedicine

Bronze (Stakeholders' community could do)

3. Street labs/ Labs in motion

Aim: To bring together key actors from the media, scientific and artistic circles, as well as members of the lay public, at street lab events.

Challenge: These experiences should facilitate contact and collaboration between scientists, artists and journalists. At this event, the communication should be thematically framed.

Vehicles:

- Sessions of street labs for simultaneous communication to journalists and scientists in science communication;
- The concept is similar to that of the NanoBioRaise, which has proven highly successful;
- Science-Art exhibition put together by an interdisciplinary team of scientists, curators, exhibition organisers and script writers.

Themes to frame Nano communication (interdisciplinary focus):

I. Food and Health
II. Environment and Sustainability
III. Nanomedicine

Key Messages:

Green:

- Interest-driven communication (communicating Nano in a thematic frame).

Yellow:

- Addressing hypes.

Red:

The following terms are highly subjective, interpretative, thus they can increase the risk of biased expectations, over-selling scientific development:

- "Better future";
- "Benefits".

Media and Lay Public: Dialogue actions

Gold (Stakeholders' community must do)

1. Podcasts of Radio Segments on Nano

Aim:

To give the lay public time to engage in dialogue.

- Ensure that communication on Nano via the radio is pod-casted.
- Podcasts give members of the lay public the opportunity for increased reflection, thereby empowering them to engage in dialogue.

Silver (Stakeholders' community should do)	**2. Regular Journalist TCS (software developed) or Webinars** *Aim:* To facilitate the work of journalists involved in journalistic collaboration for EC-funded projects (such as Nanochannels). • Regular teleconferences or webinars, chaired by a representative of the project and attended by the journalists involved in the project. • This would ensure that each journalist is kept up-to-speed and that they have direct access to the project information they require.
Bronze (Stakeholders' community could do)	**3.Open Laboratory exchanges** *Aim:* To increase synergies between EC-funded projects (such as TimeForNano). • Scientists working in Open Labs in participating science museums could travel to other participating centres to visit their laboratories. • This would facilitate communication of best practices in the Open Laboratories. • It would also further motivate the participating scientists in their science communication work for the Open Laboratories.

Key Messages:

Green:

- Interest-driven dialogue.

Yellow:

- Hype and overstatements.

Red:

The following issues are highly subjective and could jeopardise the impartiality:

- "Better future"
- "Benefits"

Media and Lay Public: Education actions

Gold (Stakeholders' community must do)

1. Cross-training: Scientists & Journalists

Aim:

Aiming to ensure that scientific publications on Nano can be accessed by journalists.

Vehicles:

- Session for scientists and journalists addressing referencing, teaching scientists to use key words in referencing their publications often used in searches by journalists
- Perhaps new reference systems are needed for research on uncertain topics such as nano: it may be necessary to integrate them into an initiative for emerging technologies which includes biotechnology.

Silver (Stakeholders' community should do)

2. Journalists in the Lab

Aim: To provide journalists with first-hand knowledge of scientific lab research and to thereby facilitate communication between two communities of practice: scientists and journalists.

Vehicles:

- A "Journalists in the Lab" Workshop
- Such a workshop could be based on the concept of the Wellcome Trust SciArt10 project, where scientists and artists were brought together. In a similar manner, journalists and scientists can be encouraged to work together. The exercise would imply an effort to adjust to a different professional community, with its methods and specific language. "Translating" ideas and making them comprehensible for someone outside the scientific community would be a positive challenge.

Bronze (Stakeholders' community could do)	**3. Open lab exchange scheme** *Aim:* To provide journalists with first-hand education in scientific lab research and to thereby facilitate communication between scientists and journalists. *Vehicles:* • A "Journalists in the Lab" exchange scheme • Such a scheme could, again, bring scientists and artists together for a longer period of time.
Key Messages: **Green:** • Interest-driven education in a thematic frame. **Yellow:** • Overstatements. **Red:** • Any terminology that could lead to bias.	

7. ANNEX

7.1. LIST OF ATTENDEES

EXPERTS PARTICIPATING IN EC-FUNDED COMMUNICATION PROJECTS

- Dr. Yoel Rothschild, ORT (Coordinator of EC projects NANOYOU and NANOCHANNELS (IL)
- Dr. Luisa Filipponi, iNano (DK)
- Dr. Alessandra Drioli, Fondazione IDIS, Coordinator of EC project TIMEFORNANO (IT)
- Dr. Jurij Pavlica, Zavod za Sodobno Umetnost (SI)
- Dr. Sendi Mango, Art center Kulturni dom Nova Gorica (SI)
- Dr. Maria Chiara Aspden, freelance journalist (IT)
- Dr. Elvio Mantovani, AIRI/Nanotec Italian Centre for Nanotechnology, Coordinator of EC project NANOCODE (IT)
- Dr. Paul Hix, Deutsches Museum Coordinator of EC project NANOTOTOUCH (DE)
- Dr. Pieter van Broekhuizen, IVAM UvA BV, Coordinator of EC project NANOCAP (NL)
- Dr. Tom Kersevan, freelance curator artist, BridA (SI)
- Dr. Agueda Gras-Velasquez, European Schoolnet (BE)
- Prof. Phil Macnagthen, Durham University, Coordinator of EC project DEEPEN (UK)
- Prof. Marcello Cacace, Project Technical Assistant for EC nanotechnology projects (IT)
- Prof. Eivind Stø, National Institute for Consumer Research in Norway, Coordinator of EC project NANOPLAT (NO)

EXTERNAL COMMUNICATION EXPERTS

- Dr. Daan Schuurbiers, The Pilot Plant (*De Proeffabriek*), Coordinator of EC project NANOBIORAISE (NL)
- Dr. Yves Sacquin, CEA (FR)
- Dr. Antje Grobe, University of Stuttgart (DE)
- Julia Bankulevic, Lietuvos Mokiniu Informavimo ir Technines Kurybos (LT)
- Dr. Matteo Merzagora, TRACES (FR)
- Dr. Neelina Malsch, Malsch TechnoValuation (NL)
- Jennifer Millar, University of Sydney (AUS) and Zeppelin University (DE)
- Maria Neicu, University of Amsterdam (NL) and Warwick University (UK).

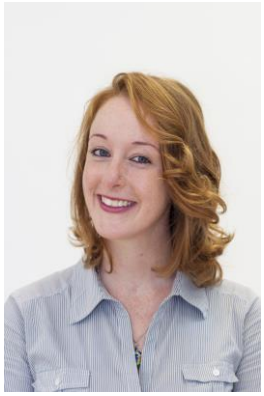
EC STAFF:

- Christos Tokamanis (EC, DG RTD, Head of Unit Nano sciences and Nano technologies)
- Pascale Dupont (EC, DG RTD)
- Anne-Marie Cuesta-Caso (EC, DG RTD)
- Cristina Gabellieri (EC, DR RTD)
- Philippe Martin (EC, DG SANCO)
- Philippe Galiay (EC, DG RTD, SiS)
- Matteo Bonazzi (EC, DG RTD).

7.2. ABOUT THE AUTHORS

Maria Neicu

After completing her bachelor in Communication and PR in Bucharest, Maria Neicu finished her first MA at Maastricht University (2009-2010), as a member of the Nuffic Huygens Scholarship Alumna. Her thesis investigated grassroots innovation and interactional expertise in technology design. Her second MA in 'International Performance Research' (MAIPR, Erasmus Mundus at University of Amsterdam and University of Warwick) focused on emerging technologies for human enhancement, and their representation in artistic practice through scenario-making; her scholar work refigures notions of disability and 'lack' in the context of technological enhancement, taking the aesthetic space as a potential catalyst for social change. Maria graduated with distinction from Amsterdam and Warwick. Maria is now working as a researcher and project developer for Casa da Cultura Digital in São Paulo, Brazil. Prior to this, she was a research assistant for European Climate and Energy policy at E3G Brussels, and a trainee at DG Research & Innovation in the European Commission, where she focused on communicating nanotechnologies. Her main interests are in ethics and responsible research and innovation for emerging technologies.



Jennifer Millar

Jennifer graduated with a Bachelor of Science majoring in Physics from Curtin University of Technology in Western Australia in 2007. She was awarded First Class Honours in Nanotechnology for her thesis which investigated the use of polymeric nanocapsules for drug delivery to the brain and received a research grant from the Western Australian government after developing a proof-of-concept study for the use of polymeric microcapsules for ocular drug delivery. Upon completing the final semester of her undergraduate degree at the Technical University of Darmstadt in Germany, Jennifer moved to La Rochelle, France, where she worked as an English assistant and lecturer in primary schools and at the Université de La Rochelle. She has been active in public science communication for the last 8 years at Scitech Discovery Centre in Australia and at the Deutsches Museum, Munich, Germany, and has developed and performed interactive science shows in both English and German. Jennifer received a grant from the Australia Germany Association to investigate nanotechnology communication in Germany and was invited to exhibitions at the Deutsches Museum in Munich and Bonn, the

Physikalisch-Technische Bundesanstalt (PTB) in Braunschweig, the Haus der Wissenschaft, Bremen and the Technoseum, Mannheim. Upon being awarded a scholarship by the German Academic Exchange Service (DAAD), she decided to undertake a Master of Communications at the Zeppelin Universität on the Lake of Constance in Germany. She has recently completed her Master's thesis and plans to venture into the pharmaceutical industry.

Dr. Daan Schuurbiers

Daan Schuurbiers is director of the Pilot Plant (De Proeffabriek), a consultancy for responsible innovation. Daan studied chemistry and philosophy at the University of Amsterdam and has a PhD in ethics of technology from Delft University of Technology. His research efforts have focused on the design of new forms of collaboration between social and natural scientists, with the aim of integrating socio-ethical reflection in early stages of research. He has published on responsible innovation and interdisciplinary engagement in both academic journals and the popular press. In his current work for the Pilot Plant, he advises on ways to encourage reflection in research and to strengthen stakeholder engagement with science and technology.

Dr. Matteo Bonazzi

Matteo Bonazzi has been programme officer in converging Nano-Bio-Info-Cogno sciences & technologies and communication outreach at the European Commission since 2003, where he has been managing about 30 research and outreach projects. He has authored 22 books and edited 5, written approximately 50 articles and 80 contributions in proceedings and seminars in the domains of science and technologies, nanotechnologies, sustainable development and culture. In addition, he conceived, designed and developed six exhibitions and 22 workshops, collaborating to develop various videos and softwares, has written articles for international newspapers and contributed to radio and television programs. Matteo has given lectures and speeches in various universities in Europe and beyond[34]. Graduated *cum laude* with honourable mention in Natural Sciences at the University of Turin, Italy, he wrote an experimental dissertation

[34] Nanoscholas of the University of Vilnius, Lithuania; Centro de Desarrollo Regional of the University of Seville, Universities of Oviedo, Madrid, Valencia, Jaén, Baeza and Barcelona, Spain; University of Surrey, England; Tyndall Institute, Ireland; Université Paris Diderot, France; University of Cologne, Germany; University and Polytechnic of Turin, IIT of Genoa, University Federico II of Naples, Italy; Tübitak and University of Ankara, Turkey; Hebrew University of Jerusalem, Israel; Kenya Marine Fishery Research Institute of Mombasa, Kenya.

on eco-ethology carried out in central Africa and at the Kenya Marine Fishery Research Institute of Mombasa (Kenya). Subsequently, Matteo was awarded the title and Medal of "Best in the School" for best curriculum and dissertation by the academic Senate of the University of Turin (Italy). He holds a European Master in Environmental Engineering, issued by the European Association of European Polytechnics of Chambery (France), and an International Master in Fats issued by the Centro Superior de Investigación Científica (C.S.I.C.) of Seville, Spain. He holds a PhD in Environmental Engineering issued by the University if Surrey (England), awarded with two honourable mentions issued by the Centre for Environmental Strategy (Guildford, U.K.) and the University of West Indies (Kingston, Jamaica). He possesses work and research experience in Europe, Asia, Africa and the Americas.

7.3. ACKNOWLEDGEMENTS

We are particularly grateful to all participants of the workshop, whose names are indicated in the Annex, whose precious contributions and collaborative spirit has allowed us to carry out this stimulating collective exercise: their inputs, efforts and enthusiasm have inspired and enabled us to conceive, develop and write this book. We are also very grateful to the Members of the NMP configuration of the Programme Committee 'Cooperation' and to the Members of the NMP High Level Group who had the opportunity to examine and comment the draft report of the workshop: their feedback has enabled us to refine and produce this final version.

European Commission

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This report stems from a dedicated workshop delivering a fresh perspective about nanotechnology communication to the extent that it ranked several possible priority interventions. It reviewed best practices developed by European funded projects. Different recommendations are summed up in this publication, offering an expert insight of in this field. Outreach, Dialogue and Education activities have been identified by the community of stakeholders (research community, NGOs, industry, policy-makers, media), targeting three social groups: young people, industry and civil society organisations, media and lay public.

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