periodica polytechnica

Social and Management Sciences
17/1 (2009) 3–16
doi: 10.3311/pp.so.2009-1.01
web: http://www.pp.bme.hu/so
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RESEARCH ARTICLE

Remarks on the emerging regulation methods of emerging nanotechnologies

Ágnes Fésüs

Received 2010-01-05

Abstract

Regulation of emerging issues needs new forms of governance. This new governance includes soft law approach, dialogues, public engagement, frames of research set by firms and ethics in forms of codes of conduct among other things and, in interaction with the recent dynamics of nanotechnologies, it integrates into a 'governance landscape'. This article first summarises and assesses the forms of and reasons for the turn to governance at different issues. Then it interprets both the frame jointly set by DuPont and EDF as well as the NanoCode recommendation worked out by the EC. Reflecting on some views that identify this recent development in the emerging regulation of nanotechnologies as a step in direction toward innovation governance in this field it expresses both the endorsement of this view and some doubts that may invite to paint a bit more differentiated picture of the recent dynamic.

"The regulatory challenge is" (. . .) "to ensure that society can benefit from novel applications of nanotechnology, whilst a high level of protection of health, safety and the environment is maintained." (Commission 2008, P. 4)

Keywords

Governance · frame of reference · code of conduct · soft law · emerging technology · nanotechnology · innovation governance

Ágnes Fésüs

Semmelweis Tender Services and Innovation Centre, H-1094 Budapest, Ferenc tér 15, Hungary, Hungary

e-mail: fesus.agnes@gmail.com

1 The turn to governance especially in the regulation of emerging technologies

This article is a reflection on the emerging governance efforts in the dynamic of emerging nanotechnologies. There is some widespread turn in regulation efforts to governance in different public policies. This is a shift from governing trials in regulation of different issues. Government is based on 'hard law'.[1] Command and control can be appropriate when the problems and solutions can be defined in advance and it is possible to design the rules to mandate those responses. Governance is based on 'soft law' and voluntary self-organisation.[2] Soft laws may play complementary role or may function instead of hard law as substitution, both mostly as temporary solutions or fully on their own merit. Governance approaches that mean soft law based regulations get a quickly raising role in regulation of many issues, recently. Turning to or including soft law based governance in complementary position is widespread already in rather different political and policy domains, not only in public policies but for example in international politics. The different issues may include different types of governance and may have a lot of different reasons. For example, soft law is a convenient option for negotiations that might otherwise stall if legally binding com-

[1] A 'hard law' is what we usually call a law in legal regulation. It sets prescriptions that are to follow and orders penalty to cases when they are transgressed. Both prescriptions and penalties are codified. Penalties are realised through application of physical coercion.

[2] 'Soft law' is a recently already very widely used term for all the sorts of regulation modes outside 'hard law'. 'Soft laws' are of very different sorts. They may be for example codes of conduct based on ethics. 'Soft law' also sets prescriptions just as a 'hard law' and menaces with penalties too. But neither the prescriptions nor the penalties are codified formally and its keeping unavoidably depends on voluntary action backed by some sort of public opinion. The literature is divided if these regulation modes are rightly called 'laws' at all. I have no place here to deal with this problem here. I simply use the terminology that is dominating in issues of emerging technologies and especially of nanotech. Inclusion of soft law has a long story already in late-modernity (coming back in regulation actually first with international law around thirty years ago) and, preceding formal regulation in history of mankind, actually it was ever present in human history. Soft law is such a rule of conduct which has in principle no legally binding force but nevertheless motivates to do something or to avoid another thing. Several times it can serve as early model for later legal regulation.

mitments were sought at a time when it is not convenient for the negotiating parties to make major commitments at a certain point in time for political or economic reasons but still wish to negotiate something in the meantime.

The need for providing for a regulatory answer in the case of governance of emerging nanotechnologies has mostly to do with uncertainties that are scarcely tractable differently. The reason is that the need to successfully manage different types of uncertainties constrains to think in dilemmas to which there is not any calculable best solution. The suggested solutions to the dilemmas inevitably embody and preserve some essential uncertainty. That makes these types of regulation essentially process based. Their main strength is that in that way they can flexibly and quickly accommodate to quickly changing regulation situations.

There are two 'temporal dilemmas' that especially constrain decision-making in the recent practice of emerging nanotechnologies. I indicate these dilemmas and what their temporality means. Nanotechnology (actually it is much more correct to say it in plural: nanotechnologies), a wide set of forefront technologies, is an unbelievable promising, so called enabling technology of which utilisation possibilities are believed to be found simply everywhere. According to some global visions it even provides for the possibility of progressing systematic reconstruction of our surrounding world starting from the atomic-molecular level and with this it provides technical basis for solution for most important Grand Challenges of societal and economic types. According to very strong expectations a nanotechnology-based biological, informatics and cognitive science (NBIC) revolution, revolution of converging technologies, will be in the centre of these changes.[3] These expectations provide for basis for strategic technology policy making.

The envisioned future is unbelievably bright, there is a multiplication in the efforts to get nearer but nanotech is still in its infancy. Meanwhile investment into nanotechnologies worldwide is already over USD 10 billion[4] yearly. Numerous dilemmas emerge, including the two basic temporal dilemmas, mentioned above. First, there is not any well-identifiable path to the market for any nanotechnology even when some sorts of nanotechnology especially in electronics are nearer to this status than others.[5] This situation makes supporting nanotechnology a highly risky issue with incalculable uncertainty because you may risk to engage with the process to support it too early, and loose quite a lot, or too late and will have no share from the expected extra return.

Second, the promises of nanotechnologies are connected on the deepest level with the strongly different behaviour of nanoparticles in comparison to materials made from the same sorts of composition.[6] This awakes precaution concerning the implications for environmental and health issues too as possibility of adverse effects in unknown directions and magnitudes. There are different other adversarial problems such as with the possible abuse of some nanotech development by its utilisation in issues of controlling. This presentation reduces its interest to the regulation problems of environmental, health and safety effects (EHS), and to the question, how, in this respect, governance efforts are developing in this early period already. The reader will find pieces of information and considerations on regulation of the EHS issues in literature but, surprisingly, won't find reflection on a possible third 'temporal dilemma' in the literature. This is that quite a lot of expectations for solving societal Grand Challenges, for example meeting of problems of ageing, are already attached to the expected quick development of nanotech. (The challenge is that this commitment may have been made too early.)

For 'insiders', those who concentrate on developing and utilising the potentials of the coming nanotech based revolution, concerns about the adverse effects that are not impossible in unknown directions and magnitudes, are 'obstacles to innovation' because of the hypothetical nature of fears recently. So these visions are to be somehow ignored or abolished as soon as possible because they keep back the exploration and utilisation of the envisioned immense potentials. Additionally it is often said that it will be enough to deal with adverse EHS effects when the technologies will be riper. But beside this still strong attitude there is already emerging a different one that starts to get strong position not only with concerned groups but with states and firms as well. This is formulating a task of 'getting the solution right this time, and from the very beginning', concerning also exploring and meeting the alleged unknown possibilities of adverse effects in the nanotechnology field. According to this emerging new attitude there is a commitment to balance the utilisation of such an immensely promising enabling technology as nanotechnologies are and avoid as early as possible its risks, simultaneously.

This profound attitude change may be seen as a historical learning from some previous clashes between 'the industry' and environmental and other groups as it happened with the GMO debate. Nanotech does not have the same public mobilising ca-

[3] Find explications of what the expected converging technological development will be in the National Nanotechnology Initiative in the USA and those writings that try to envision what the social and economic effects may be and what and how governing and governance efforts should be realised to further this dynamic. Especially important is the pioneering book written by Michael Roco and William S. Bainbridge in 2001 [13].

[4] 10^9

[5] Principal researcher of MANCEF (Micro and Nanotechnology Commercialisation Education Fund) roadmap, Steve Walsh reported with appealing openness how naively, based on the presumed strong analogy to microelectronics, the task of foresighting for nanotech first had been tried to be realised until several years of concerted efforts they reached the vision of nanotech as multitude of possible pathways [20].

[6] As the Royal Commisssion of the UK states about engineered nanoparticles (ENP): „the very properties that make ENPs attractive from a product and investment point of view may have the potential to give rise to unintended health and safety consequences." (Royal Commission on Environmental Pollution 2008 p. 7.) [15] We are at the very beginning even to recognise and explore the manyfoldness of this different behaviour that is often envisioned as mostly caused by unusual surface properties on this level of the material structure of nature.

pacity and this thing also helps to believe that early commitment to regulation efforts of potential adverse effects may solve the emerging problems differently from the GMO debate. With the new attitude, you want to avoid regulating neither 'too early' nor 'too late', just in a balanced way, in cases of uncertainties. To ban some products or production processes too early is too harsh, not to speak about a ban for the whole branch of industry, while to act when the consequences are already with us is too late, may be because some effects already are realised or because the patternisation of the dynamic is already too much progressed and became in some respects irreversible, meanwhile menacing with some catastrophic consequences in the future.

There is a willingness to regulate in the appropriate time but the uncertainty is so complicated that it is impossible to foretell with some exactness, in a justified way, when the intervention should be made. As it is well-known, doyen of history of economics, Nathan Rosenberg thought that even the functions and applications any emerging technology will acquire in its historical development, the winner alternative(s), are literary unforeseeable. This way, according to his argumentation, only blind experimentation is possible with new technologies. More exactly, he drew the historical lesson of impossibility to forecast what from the early forms of some technology will develop later.[7] Adverse effects, adverse implications would occur in some or many or all of the various application possibilities, most of them impossible to foretell. This multiples the difficulty Rosenberg spoke about, because it makes a 'double fictitious' problem the endeavour of investigating into the possible adverse effects of possible technologies that may be commercialised.

What about engaging in exploring the adverse effects already in the early phases? It is only possible to say that with them it is possible to experiment just as with the application possibilities, even when this is engaging in a 'double fictitious' effort. The received view is that not any new technological alternative should be seen as menacing with quite new adversarial effects. So search methods of the 'similar' issues should be utilised and extended as trials. Mostly, in the case of nanotechnology, this is utilising knowledge of searching for and managing adverse effects in case of dangerous chemical substances. But surface characteristics may cause bad surprises and there is an ethical requirement, as driver that urges to behave differently. This is to strongly apply the precautionary approach. This ethical driver is the rights of those who would have been adversely effected, without realisation of the early EHS researches in a precautionary mode. But it is scarcely possible to formally prescribe what and where should be looked for. It is better to put regulation efforts first on the metalevel, and base on voluntary commitment for a while. When patterns of the technology dynamic will already somehow be developed and solidified, when the dynamic is already in its normal phase, than formal legal regulation is much more possible already and can be realised than in the phase of emergence when too many unknowns hinder formal regulation. This article presents some pieces of information about the historical state of the voluntary engagement and makes some speculations about its future.

May some sort of systematic (searching) behaviour develop in the phase of emergence of new technologies and may be made partly responsible for the dynamic emerging technologies will take or is this phase unavoidably to left to random experimentation as Rosenberg suggests? As we may recognize in rudimentary forms in some emerging recent practice and may learn from complexity studies, self-organization as reflexive practice shows the way to solution to this problem.[8] There is in principle possibility of some ways of modulation of evolution both in respect of the envisioned purposes and to avoid the possible adverse effects as far as possible.

2 Some historical learning

What about some already available historical learning concerning possible EHS effects of new technologies? In nutshell we can say: repeated clashes around environmental issues among industrial firms and environmental movements were realised in a 'two tracks' dynamic at least from the 60s in the 20th century. (Two tracks dynamic means that firms and environmental groups simply realised oppositional relation, simply mutual distrust in the dynamic.) A turn to a discursive dynamic of 'outsiders' and 'insiders' to develop the process into a sustained dialogue was made from the early 80s, first especially in The Netherlands and Denmark. Embodiment of this was the appearance of the constructive technology assessment approach (CTA), the inclusion of the citizens, local communities into technology assessment in The Netherlands and similar approaches in Denmark, later in the UK or Germany.

It is important to mention that regulation of the behaviour of industry (and research institutions) in presence of the certain and uncertain adversary environmental, health effects was tried in this historical period, from the end of the 60s, by the states by extending the existing administrative regulation to handle technological risks. First institutionalisations in this approach led to the foundation of the Office of Technology Assessement (OTA) and the Environmental Agency (EPA) in the USA in 1972. Realisation of formal regulation required quantitative knowledge of risk as measure of uncertainty, the quantitative risk assessment (QRA).[9] The very basic assumption concerning knowledge of uncertainty started from the presumption that uncertainties are nothing but not uncovered risks, calculable in the situations to regulate and this provides for sufficient factual knowledge base to regulation. QRA calculations realised by experts and exploration of the 'subjective' risk perceptions of the adversary agents or the public in general in the uncertainty arena together pro-

[7] Rosenberg (2001, p. 8.)[14]

[8] Ralph D. Stacey's Complex responsive processes in organizations is a uniquely important guide in many respects to this issue [16] .

[9] QRA has steadily been improving, for example by introducing fuzzy set technique and extending considerations to more uncertain situations.

vided for knowledge base for risk management and government, for the normalisation of uncertainty based on calculation of risk.

Four main problems grew out with this approach.

- The first is its lack of discursivity with the different publics, the rigid top-down regulation.[10] (As in other issues in modernity simply experts were legitimised to investigate into the problematic situations of non-experts and tell them the needed solution.) This was a strong factor for citizen groups, local communities often experienced that they are interested in different sorts of risks then the experts who provided the risk knowledge for the public administrations.[11]
- The second is that the multiplicity of uncertainty in decision making was tried to be reduced to quantitative risk assessment problems.
- The third is that the multiplicity of quantitative risks surrounding some issue was often only partially, from one or another aspect, taken into account and this way, contingent choices in methodology permeated the calculations with strong policy and political effects, unacceptable for the effected local communities.
- The fourth is that it was not seen that emerging issues are not enough patterned to be able to simply submit them to calculation. As shortage of this historical period one can say that values, aspects of uncertainty were chosen without justification discourse by all the stakeholders, including the different publics. Especially ignorance aspects of the uncertain situations were neglected and with some reminiscence to well-calculable situations it was also expected that simply calculations can provide for the sufficient factual knowledge ground for managing/governing the EHS risks in the emergence phase of new technologies.

All these aspects have had their role in the ongoing and sustained clashes, in the continuing and several times even amplifying public distrust in several technologies. Effects of massive irrationality by wide masses accompanied in numerous cases these processes. But in this period of history acceptance of new technologies even enthusiasm for many of them dominated in the public even when it got paired with enduring rejection of some others, especially of utilising GM techniques for the agriculture, by different publics. This led to some dead end like situations in several public policy issues around different emerging technologies. As some learning, the wish repeatedly has emerged that some turn in regulation should be realised. This turn would be a more cooperative approach. That, as far as possible, would take, first, adequately, into account all aspects of uncertainty. This includes temporary ignorance elements with possible adversary effects, when the decisions should be made. The possible development of regulation of the dynamics of emerging technologies could lead this way to some sort of social robustness around these dynamics in co-evolution with the functions, applications of the emerging technologies. Second, this, non-reductionist behaviour would be realised in an anticipative mode. In this co-evolutionary process some social robustness is realised. This is the width of support by the different social groups for emerging technologies would essentially contribute that utilisation of the promises of new technologies can be realised while simultaneously regulating the (possible) dangers. Actually, the idea that emerged was about the co-evolutionary interactions of variation producers (in terms of technology) and the publics as comparative selectors. This process includes of course possibilities of enduring refusals notwithstanding any effort in cooperative learning.[12]

By now, we witness the emergence of a wide ranging policy innovation in this direction. This is exemplified in the turn to self-organizational governance through the discursive cooperation, dialogic relation of all the stakeholders (including concerned groups) around the emerging (nano)technologies. This emerging governance integrates de facto coordination dynamic and normative efforts. Kearnes and Rip emphasises the complexity of this issue and term it as a 'governance landscape'. De facto coordination and normative efforts together provide for some 'governance landscape' [9].As to its overall function some stability and continuity in action even in uncertain situations are needed and the emerging landscape provides for it by unifying the factual and the principal with some duration.

A de facto coordination dynamic may involve a huge set of ingredients, probably in different architectures, that accommodates to the individuality of the situations. A de facto coordination dynamic may include both institutions and cognitive and organisational tools and may be realised as some open method of coordination (OMC). Explicit forms of coordination may include strategic visions, roadmaps, technology platforms, lead market initiatives (LMI). But communication forms, like conferences, articles in journals also provide for some implicit, informal coordination. The normative efforts may include setting all those explicit forms already mentioned but also codes of con-

[10] The sometimes occuring instrumental utilisation of 'lay factual knowledge' or 'local knowledge' to spare time when making expertise is an exception of less importance in this respect.

[11] This is not to confuse with the much emphasised 'subjective' perceptions of quantitative risks.

[12] Enduring refusal may remain latent as it was with 'the rise of the dictature' when in the Korean Republic the dictatorial government ordered to sow those seeds around 40 years ago that were, benevolently, developed for the Korean folk by US agrar experts who reduced their problem to tasks fully defined in agricultural chemistry. Unfortunately it did not taste the Koreans and they forgot about it with the fall of the dictature. It was different with Valencia where the issue became irreversible when the dictature solved the problem of extraordinary flood by simply diverting the river, through digging an artificial channel, from the city. As enduring partial accomodation, by the population of Valencia, to the realised (practical) irreversibility includes that already the house of the Opera is in the old left river bad. Co-evolutionary inclusion as any instrument has its weaknesses too, but at least would not be able to delegate the responsibility for bad decisions with hard consequences. (The stories are from the PhD lectures of Imre Hronszky [8].)

duct by firms or states or set together by the agents in the arena. They may include labelling schemes, principles, guidelines, recommendations set by the EU or for example by the OECD for Multinational Enterprises (MNE), model codes, certifications, standards such as the recently under preparation Social responsibility ISO 26000. There is interaction between de facto coordination and normative efforts, based on some consensus among the stakeholders that explicitly intend to realise modulating actions in the evolutionary dynamic. The result of this cooperative effort would be getting, in some sense, 'better technologies'.

Among other governance instruments numerous frames and codes of conduct for nanotechnology appeared in the last some years, actually from 2000. These include the frame jointly accepted by DuPont and Environmental Defense Found (EDF) (Dupont Nano Partnership 2007) in the USA in 2007, the code of conduct developed by the BASF in 2004 and also the code of conduct developed by the European Commission by 2008. They all are partly different things but are elements of the experimentation with governance, by way of setting frames and codes of conduct. This amplifying experimentation with developing a new governance landscape, in relation to the possible adverse effects, is recently a most important emerging achievement for the governance of emerging nanotechnologies. But it can be expected that it will be serving as the model for any other governance of emerging technology issues too.

As mentioned the new governance instruments that together realise a bottom-up regulation mode may provide either for a complementary effort or a substitution for regulation based on formal laws, for the top-down regulation. Actually, with emerging issues they work in a complementary way with the old regulation but instead of the coming new, until, through progressing patternisation (standardisations are decisive part of it) it does not become possible to include more formal regulation. Whether and when in the more stabilised phase more formal legal regulation that became possible will also be realised depends on different issues. It depends for example on the comparison of mutual strengths and weaknesses of formal and informal regulation. These are also different for every agent in the arena that raises the complexity of the regulatory situation. This is a relation that is strongly dependent on economic, political social and ideological contexts. Assessing needs for and possibilities of formal regulation (just as it is with soft law based regulation) needs serious SWOT analysis for any special case. Just as a brief hint to some weaknesses of regulation based on formal law we find among the numerous situations that may be practically unable to be regulated in some special environment by formal law those environments in which some rapid breakthrough political, technological, economic or social changes occur. Drivers in this direction may come from inside too, so to say, as (unexpected) emergence of radical innovations in the field as well as together.

3 Advantages of, difficulties with governance approaches

Trials to realise formal regulation may fall short in the emergence phase when the numerous uncertainties surrounding radical innovation in this phase simply make impossible, or at least senseless, to set governing laws. Beside this we find as basic weakness with hard law based regulation that it constraints the actors in the arena instead of trying to provide for an enabling milieu where co-operative actions of the stakeholders may even lead to enormous synergic effects. That means that above the uncertainty problem considerations, some urge to shift to an enabling milieu may give impetus for raising and maintaining governance and soft law based regulation.

The question arises how to normalise this emerging phase, is it possible to somehow normalise it at all?[13] (Concerning looking for the range of application alternatives it may not be desirable at all but this is different with normalising the relation to possible adverse effects.) Instead of accepting that the choice is simply 'yes' or 'no', to preliminary indicate the direction I try to justify, a term will be introduced, the 'soft normalisation' to help follow the issue.[14] (Its meaning will be made clear through the whole article.) 'Soft normalisation' is by its nature something partial, unbalanced in some way, temporary in the regulatory dynamic but has already some, tentative direction with promising of the cooling of the dynamic. But it is already some progressing patternisation[15] and at least recently trials are made in it to modulate it toward some solidified structure of the dynamic to be able to exploit it. But it is a legitimate question if the acceleration of technological development and the raising turbulence of the socio-economic environment will systematically move 'soft normalisation' toward giving place to enduring normalisation.

We find in the wide regulatory practice already that turning to soft law regulation may provide for some sort of good solution for governance of emerging issues. While a soft law itself lacks the possibility for legal sanctions it still has effects in legal practice, for example its principles may serve as starting points

[13] A positive answer to this is explicit denial of the idea of Rosenberg that we are essentially condemned to blind experimentation for a while in the most important respects.

[14] I overtake the term from Imre Hronszky, from his PhD lectures. (Hronszky 2006 [8]). We can model emergence of new technologies as progressive emergence and solidification of trends. An aspect of this may be, usually it is, that different sorts of 'soft law' will be accepted by the agents to provide for normative regulation. These together with the de facto governance processes are the governance landscape. They provide for some sort of normalisation of these processes of emergence that progresses from quasi rule-less original state to emerging patterns. This means that dominating ways of handling the problems of emergence appear and get some solidification, both on the factual level as research methodologies and the normative level to regulate what would be acceptable. Soft normalisation is giving dominance to a governance landscape, the progressive self-organization in regulation of, to say it with Thomas S. Kuhn, some preparadigmatic phase. In his paradigm dynamic model, well described exemplars and formal prescriptions take over the dominance in the normal science (normal technology) phase [10].

[15] This may be realised in a dynamic of repeated circles.

for renewed legal regulation. But soft law itself is not enforced and realised by any state or other administrative apparatus, it is based on voluntary action. Instead formal enforcement capacity, it rests upon the voluntarily agreed discursive cooperation of multiple authorities and sharing and deciding on mutual commitments. Mutual commitments are the base for it. Soft law regulation can serve for benchmarking, influencing the issues at stake or providing for some sort of informal controlling.

A new governance landscape with the emerging nanotechnology is quickly emerging now. A lot of questions have been raising with this development in the last decades. I mentioned some of them. They included the questions of what actually are the purposes of turning to governance?, further the more instrumental question: What are the effective means of its enforcement? From the perspective of methodology of cognition we can wonder as follows. Because in this phase, any standardisation effort would certainly need strong caution even when it may be our explicit aim to reach standardisation with the progress in the dynamic we can only say that the individuality of the situation can only be diminished by utilising some analogies to provide for some sort of 'inductive' generalisation.

But we can try to characterise the turn to governance from a different perspective and may recognise that we turn to governance instead of more efforts of governing either because we are not able to prescribe some constraint or because, for some reason, we are not willing to do this. In this later case we may want to leave independence for utilising the continuing flushing state of the issues to be able to develop some further joint effort based on the preserved free initiative of some agents. But weakness in power may be the reason too, to turn only to soft regulation as well as basic uncertainty. This and many other reasons may have an effect together that we would not turn to standardisation as soon as possible. Instead we only agree on voluntary codes for a while even when we are not sure how long. Voluntary codes frequently rely to a considerable extent on such uncertain issues as the market (e.g. consumers, shareholders, insurance companies) or public administration issues, peer and community pressures to stimulate and sustain policy outcomes, and make extensive use of non-governmental intermediaries (e.g., industry associations, consumer and environmental groups, and standards organizations) in code development and implementation.

In contrast to a widespread but superficial opinion governance and soft law based regulation is not without possibility of any penalty. In lack of the possibility of formally constrained penalty still there are numerous other possibilities of penalty, or rewarding. I just mention some of them. They are based on the various non-judicial forms of power in society. If you belong to some association it can withdraw its logo from you, a negative publicity can be developed around your firm, you may be excluded from the important association, all the different sorts of penalties and rewards for non-compliance may be effective. You may further be simply excluded from information flow too or loose other essential networking capacities. The formal law is either fully helpless when watching informal regulation in a concerned way. Perceiving resistance to soft regulation may induce turning to, even trigger some regulation based on formal law. It can be judged if for example reasonable standard of care is applied with the soft regulation but some agents still resist to it, or whether you really joined the self-regulation in 'good faith', etc.

It is interesting, on the philosophical level first, if turning to governance efforts is due to the sheer complexity of the issue and it just realises an instrumental behaviour or it is part of the shift toward a more deliberative, participative democracy or is a trying to realise both.[16] For example Habermas and his followers envision a coming free, emancipated society in which governance and soft regulation will be dominant and formal law preserves some subordinated role. As Gunther Teubner describes: "The task of the law then is still to control power abuses, but the central problem becomes rather to design institutional mechanisms that mutually increase the power of members and leadership in private institutions" (taken from [21]).

Because our case is the dynamic of emerging issues, especially of technologies, it is unavoidable to emphasize that there is no central agent in this case that has that comprehensive knowledge in comparison to any other agent in the field that allows to realise an, in principle optimum allocative regulatory behaviour. With this we have just to recognise the invalidity, for emerging issues, of one of the very basic innovation policy assumptions of the neoclassical economics. Instead we find capacities that may be developed and put into action by the principally uncertain agents. This is realising free co-operation and self-regulatory, or co-regulatory behaviour. Innovation policy gets a different role in the changed situation. It is, first of all, setting preconditions for evolution and realise vigilance. This is then to unify with some early selective activity but preserving space for flexible changes with this during the dynamic.

All this may lead to quick adaptation to the turbulent issues as it is so often emphasised, but the quickness is only one side. It seems at least as important that the self-regulatory dynamic together with the mentioned role for policy/management actions is realisation of a reflexive activity that includes what Michael Foucault calls 'responsibilisation'. Only 'responsibilised' quick actions help really to reach sustainable pathways. It is also decisive that governance may lead to sharing uncertain risks or, as Imre Hronszky emphasizes in the PhD lectures, may lead to sharing knowledge and trust (!) and exploring and exploiting with all this a still not well known economic resource, the cooperation extended to global dimensions.[17] It is still rather ques-

[16] In this respect is possible to understand that extremely narrow types of interpretations of the recently raising governance regulations that they are either realised for sparing the perceived transaction costs or just the opposite they realise some philantropy and nothing else are quite misleading because they concentrate only on one, perhaps only alleged element.

[17] Technology determinists falsly attribute this unbeliavable growing cooperativity to the Internet as its effect on society.

tionable how and certainly strongly dependent both on agents and environments, the different requirements, sharing uncertain risks (looking for safety), and sharing innovative knowledge (looking for entrepreneurial possibilities) may be integrated in good solutions. The historical practical learning in this direction led to good practices from clustering and network building to the forms of recent ecosystems practice and analysis. In a great part this is the effort of developing appropriate evolutionary behaviour in turbulent dynamics to reach sustainability.

All these aspects I only indicated can be and are already deeply analysed. I go in some details. Concerning risk taking Kernaghan Webb reflects on more detailed issues and asks why those parties that engage in voluntary co-ordinations undertake the risk. "In resorting to using voluntary codes, it is apparent that all parties are taking risks. Businesses that initiate code initiatives may find their efforts criticized as failing to accurately and fully reflect the interests of those affected, as not being rigorous or transparent enough, and as being nothing more than thinly disguised public relations exercises designed to win new customers or discourage the introduction of new laws. Non-governmental organizations that initiate voluntary codes may be attacked for their bias and unrepresentativity (and hence the illegitimacy and non-credibility of their initiatives), as engaging in get-rich-quick schemes to fill depleted coffers, and as lacking the experience and business acumen to run the programs. Governments run the risk of criticism that they are abdicating their regulatory responsibilities, are engaging in favouritism when program formulation and implementation are not scrupulously open, accessible and fair, and (when initiatives fail) of backing the wrong horse."

By giving answers to these questions she continues as follows: "If the risks are self-evident, then why do all three sets of players continue to develop the codes? The most obvious explanation is that they all variously *feel compelled* to initiate the programs. Individual firms and industry associations may develop the programs to 'answer their critics' (be they governments, non-governmental organizations, the media, community members, or others) or to 'get ahead of the curve' (by anticipating and addressing problems before solutions are imposed on them) and thereby maintain or increase profitability. Non-governmental organizations may initiate voluntary programs to 'get things done directly' (out of frustration with perceived inaction or inadequate action from government or industry) or to exploit an opportunity to influence action through the market and thereby gain revenue and influence. Governments may resort to voluntary programs to reinforce regulatory programs, because regulatory approaches are ineffective, cumbersome, slow, expensive, inefficient or inappropriate, because resistance to new regulatory programs is too great, or to stimulate action that goes 'beyond compliance. She concludes: "In all cases, the proponents have apparently concluded that the command-and-control regulatory model is not enough, and that it is necessary to develop non-command-and-control initiatives"[21]. (Emphasis made by her.)

It is possible to state perhaps that self-regulation aims at sustainable dynamic through sustainable governance. With the dynamics of emerging issues, of emerging technologies, etc. the need for self-regulation and its very basis in soft law is the requirement upgraded because of the lack of stable structures. Self-regulatory efforts contribute to the process of developing stable patternisation. The dynamic of the issue at stake, technology or anything else in its emerging phase will be modulated and reflexivity gets essential role in this process.

Two things at least are still to mention. First, there is something to say about the recent move to proceduralisation that is everywhere emphasized and discusses in political science literature. That means in our respect that mostly procedural rules for dialogue building are to be set as candidates for consensus, much less the substantial (value) side. The story is then about trying to realise some successful boundary working that the agents commit themselves to harmonise their behaviour along the shared values, by keeping rules of proceduralisation, or try to move in a justifiable way to a different type of proceduralisation and value sharing.

In cases like the governance of the dynamics of emerging technologies proceduralisation seems both unavoidable and very useful too. We can identify both with the dynamics of emerging technologies empirically. The case of governance of emerging technologies is about impossibility of predictions and there are numerous parties in the arena with different substantial (value) attitudes. Self-regulation of the conflicts and turn them to co-operation essentially needs a procedural attitude. To say with Habermas this is "providing a framework within which an expanding diversity of conflicts can be regularized through procedures that open up the possibility of 'dialogue' between participants" (taken from Webb 2004, p. 385 [21]). Second, it is demonstrated that governance may work well in economic fields with strong consumer presence. What about emerging technologies, where markets are still missing or at least uncertain? Who are the players on the, let me say for shortness, consumer side? One problem with emerging issues is that you can expect surprises, actually on both sides that quite unexpected candidates of producers and consumers appear and wish to get engaged with the discourse. The emerging technology may take an unexpected turn and offer with this new exploitation possibilities or the sensitivity of the consumers may suddenly change, for example because the technology (its production process or product, or the services it offers) enters into some new contextualisation process. Declaring and practising corporate social responsibilities is a promising soft law regulation form that may have strong influence on the process when a technology stabilises in its economic, social, political milieu.[18]

[18]Corporate social responsibility (CSR) is „business decision-making linked to ethical values, compliance with legal instruments, and respect for people, communities and the environment." (www.bsr.org) I would be inclined to explicity include into this characterisation the determination to sustain and rein-

Finally, I want just to mention a highly technical explanation why self-regulation becomes so important for regulating nanotech. Robert Lee and P.D. Jose write: "Given the divergence and uncertainties in the assessment of risks and benefits associated with nanotechnology, regulatory oversight in the future is likely to be partial and fragmented. Even where interests converge, the large time-frame needed for standardization of regulation coupled with the varying propensities of countries of the world to understand, assimilate and respond to risk issues increase the difficulties associated with creating appropriate regulatory regimes. In the absence of such controls, it may be necessary to rely on corporations behaving in a socially responsible manner by self-regulating when dealing with the conceptualization, development, use and disposal of nanoparticles. Caught between the reality and rhetoric, corporate managers need to manage trade-offs between corporate advantage and social responsibility in ways that may have a significant bearing on the survival of their firms and the future development of nanotechnology itself" [11].

4 On the emerging governance landscape in nanotechnology

Kearnes and Rip (2009) [9] quite recently summarise what the emerging regulatory landscape is and what sort of success is with it already realised, what it does promise and what are its limits. Assessment of this topic may be made from very different angles. Their interest to assess the emerging regulatory landscape is whether and how public participation will be strengthened in the recent dynamic. Their starting point is that a starting turn from risk governance to an innovation of governance has been occurring. This means that not only the governance of risk but the whole innovation process including its purposes too is more and more topic of reflection by different publics, together with a growing requirement for participatory processes in the upstream phase already.[19]

Result of this is an 'emerging governance landscape' of nanotechnology. With this an overcoming is emerging of the two extremes in regulatory intentions. One of the extremes is simply requiring mandatory moratorium as it was done by the ETC group or the Green-Peace UK in 2003. The other extreme is the identification of the challenge, in terms of EHS issues, set by the emerging nanotechnologies, by downplaying it as if 'business as usual' could probably be adequate answer to it, perhaps with some smaller corrections.[20] Kearnes and Rip enumerate several state institutions that share this opinion, expectation. They also show that with the emerging recognition of the possible depth of the uncertainty problem and its regulation possibilities a turn to soft regulation is emerging. They summarise the reasons why this turn occurs. They also outline some possibilities that an appropriate governance landscape may open with enhanced public participation.

Kearnes and Rip characterise the nano issue with four uncertainties. They are as follows. The first is what they call the 'time dilemma'. This is that we may be too restrictive with limiting development possibilities of certain nanotech directions too early or just may be too late with interventions concerning adverse EHS effects.[21] The second dilemma what they identify is the typical dilemma economists and managers concentrate on. This is that you may be too late to take place on the bandwagon to harvest the returns or you invest into the enterprise too early.

The third dilemma is how the publics will behave, even in face of the above mentioned changes. It is their important merit that they put this dilemma into their enumeration and may be at least somewhat surprising for the readers. The reason for the surprise may be that the turn to developing responsibility frames and codes is certainly made in the hope by the agents who unified to do some undertaking, especially by the producers, but perhaps also by the state agents, that concerned publics, and their own conscience, will be enduring satisfied with this progress. This is an important point and I shall come back to it when the question of how to go further, the possible visions of the possible future after the setting and introduction of ethical codes and the whole recent governance landscape will be touched on. They add a fourth dilemma to the series of dilemmas they set. This is how the state authorities will react on the further development and what sort of hard regulations, cristallisation of legal regulations will be made in the future based on the moral that will be able to drawn from the starting dynamic of soft regulation trials.

Kearnes and Rip share the opinion of Roco when enumerate strengths of turning to soft regulation. They emphasise that this type of regulation is of enabling nature. But I think they assess three characteristics of the emerging new regulation mode as most important. The first is that it is the turn as a whole itself as quite deep change in 'philosophy' of solving controversial issues, the turn to a sustained dialogue and giving to it a minimum regulation, acceptable to every agent who commits to interact in the arena. The willingness to realise some cooperation of a group of 'adversary' agents have stabilised, at least

force dialogic relation to affected publics and aspiration to shifting to more and more to self-regulation.

[19] Different forms of the very quickly developing so called open innovation radically shift the relation among producers and consumers. Firms recognising the new resource for reaching comparative advantage already systematically count with comsumers as designers too. This side of the story may help a lot not only to accept but also willingly integrate concerned groups too. It may work as some sort of assisting mechanism. I shall come back in more detail to the suggestion that systematic integration of concerned groups in dynamics of technological development is envisioned as some further possible even decisive resource both as possible comparative advantage on the market and for democratisation of the development of new technologies when I deal with the so called TEKSS report that was made on request of the DG research of the EC in 2006.

[20] In case of nanotechnology the wondering still is alive if simply some extension of the regulation of the safety for chemical substances could be the solution.

[21] I think they are wrong with the naming because the second dilemma they mention is also 'time dilemma'.

as a temporary solution, to channel the dynamic of the interaction of firms and environmental groups to a dialogic form, by now. Second, Kearnes and Rip also emphasize that this type of governance is of anticipatory nature and willingness to pursue opportunities and risks on a gradual basis will make innovations based on new technologies possible and to meet early the possible adverse effects, simultaneously. The third characteristic is that the recently starting form of governance provides, at least in some measure, as I shall come back to it somewhat later, only a part of the solution of the old problem of the relation of the movemental form of governance versus administrative regulation. This is as follows. Provided the progress of cooperation will be able to be continued long enough, the situation may be cooled down enough so that an appropriate administrative regulation phase can follow the recent more 'movemental' phase.

I know Kearnes and Rip are determined in supporting the recent development, but this is only a part of their full opinion. With the alleged achieved progress in the role of public participation by environmental groups the claimed positioning that is expressed by the need to turn to innovation governance is still perhaps only half way realised. But they envision a growing requirement of a symmetric relation between the concerned groups and firms in a further changing dynamic toward realising a "general culture of responsibility" as the EU code of conduct requires (EU Recommendation 2008 p. 7 [6]). Taken everything together they conclude that a balancing effort is realised that as some sort of 'calculative approach' takes into account both the support for furthering nanotechnology and providing for its safe realisation.

5 What can be the next phase?

I indicated several times that Kearnes and Rip identify the recent turn as a most important progress in the regulation story of nanotech. DuPont and Environmental Defense (EDM) realise together, just as the EC some pioneering steps.[22] But they also give hints in their paper that they imagine and expect a further historical period thereof. (I referred to their hints at the end of the last paragraph.) To help understand what their evaluative position is that allows them to expect and obliges to require a further historical period of governance I have to make a longer overview to show what some relevant basic tenets of critical STS are concerning this issue.

This summary has to be started from a very short philosophical consideration.[23] To any sort of question of practice we can approach from two starting points. Somebody may look first for learning what sorts of facts are available to help understand what the situation is, he is or may be involved and interested to change. This means that she turns to science to learn about the facts, believing in the capacity of science as independent autonomous institution to provide the management/policymaking practice by the needed valid factual knowledge. As result she gets a picture that shows the factual limits to the freedom of the management/policymaking action. She gets the 'risk profile' of the issue at hand in our case. On this basis she can weigh what can be planned based on her values, the subjective side. This is the traditional way of planning and leads, in the simple (abstract) case, to well-known series of steps. These are first the description/prediction step, followed by planning by involving values to make the plan. In case of stability, of well prognostisable dynamic and validity of some other simplifying preconditions an iterative process of repeated cycles of predicting, planning and controlling can be realised. This type of preparing the management/policy making action is called 'facts first' or 'sound science based' approach. I soon demonstrate what the problems of critical STS with this approach are.

Environmentalist or health groups for example typically approach the question of practice from the other end. 'Values first' is their starting point, the commitment to values they intend to realise. In case of uncertainty the two approaches led to very different dynamics and results. Let me begin with something that may be a bit take aback. Here we may meet a special sort of dogmatism by concerned groups. Because there is arguably some sort of unknown danger to guess in the story of emerging technologies they face they may realise a concerned behaviour, perhaps as even requiring (at least temporary) banning, even when otherwise purposes of developing the new technologies would highly fit their values. (Concerned people that give dominant place to their feeling may simply base their dogmatic behaviour on their feelings, only.)

But there is some ethical rationality behind this behaviour. The ethical rationality behind this behaviour that is dogmatic as a whole and in terms of some epistemic criticism is that you want to avoid some adversary effect without a compromise. In case of some new products this may refer to not accepting some consequences of committing a second order statistical failure. This is that you may err on the one or the other side, a type of winner-looser situation in solving the uncertain situation is set. Erring on the 'consumer side' will provide damages on them. These damages are not ethically justifiable because the benefits fall on the other side. But all this together means that a correct ethical standpoint may lead to false, dogmatic behaviour in practice if it is not connected to a valid cognitive argumentation.

How to overcome dogmatism? It is to connect the 'values first' commitment with valid cognitive argumentation and realising participation in a dialogic communication and practice. I think the, a quarter of century long development of the argumentation around the precautionary approach and the precautionary principle provides for some solution. But to be able to understand this we first have to make a differentiation between two interpretations of precaution. Common in both of them is the basic structure of precaution. A precautionary approach has to

[22] How far all these efforts are only pioneering steps is to see if one looks at the very small number of firms that have engaged in the process of setting a soft law based governance dynamic of nanotech already.

[23] I follow with this the argumentation made in the PhD lectures of Imre Hronszky [8].

realise a high level of safety, of protection as some value commitment, in the presence of strong uncertainty, but presence of plausibility concerning the facts. According to the first type of interpretation the decision maker simply accepts what is provided for as factual knowledge (by experts) and makes decision about the application or non-application of the precautionary approach. You evaluate if the uncertainty of facts makes the situation to manage already too dangerous for your chosen protection level.

The precautionary approach, application of the precautionary principle belongs this way already to the institutionalised tools of management/policy making by for example the European Union and reflects on the factual knowledge experts provide for. It realises a 'science guided management' process (CEC 2000). This is the typical way to interpret the precautionary approach. We find it with the group of risk experts who interpreted the precautionary approach when UNESCO asked for an expert material (UNESCO 2005). For us now that message is first interesting that you are justified to use the precautionary approach because your values allow you this decision. (COMEST 2007) You may differentiate between weak and strong variants of the precautionary principle as it is done in practice according to the difference whether you prescribe 'it is possible' or 'must' in the prescription of application. From our recent point of view this is irrelevant, even when the practical consequences of using the 'weak' or the 'strong' version are enormously different. The precautionary approach is a management principle this way.

But a group of STS researchers, of the constructivist sort of Science and Technology Studies (STS) researchers,[24] declares the precautionary approach as first being not a management but a risk assessment approach. They identify what we can call a decisionist fallacy when traditional risk science defines its risk topic and methodology[25] they put their finger into the, at the end not fully avoidable, contingency of providing for facts and demonstrate that facts just as risk facts are unavoidably constructed.[26] They demonstrate that different sorts of objective description may be provided for the same situation, depending on different perspectives. This means that some sort of normative commitment is realised by any chosen perspective.[27]

STS researchers require that the looking for facts will be the most possible careful not only in terms of providing for techniques to realise the highest possible exactness, but first including most careful weighing of all the possible perspectives and dimensions to choose for the frame of looking for facts. This means that the highest possible precaution should be realised already in risk assessment, in looking for those risk facts that are representative from the practical point of view they have to serve for. One has to find the adequate risk (uncertainty) description.[28] The essence of what traditional risk science requires when it puts its requirement to be 'objective', that means to be the least biased, is most reached when not only the reproducibility is provided for but this precautionary approach on the assessment level is as fully as possible realised.[29] Nota bene (!), this is not any critique on risk science and expertise as a whole but requiring a more reflexive risk science and expertise.

Further, in contrast to the mainstream of risk assessors critical STS insists on the equal importance of all the different sorts of uncertainty and tries to put adequate emphasis on 'ignorance', too. In this respect, the precautionary approach is a management approach, a management approach that gives due attention not only to 'ignorance' but also to reflexivity. That last requirement gets its special importance when 'indeterminacy' occurs and you have to try to get orientation at all. To add to this is that this group of researchers identifies that in real issues there are always different classes of risks/uncertainties present and present not simply as different categories, but they interact, interpenetrate each other in real life cases. The table below helps to make understood the different sorts/qualities of uncertainties.

I have now to indicate at least what critical in the critical STS behaviour means. This is some sort of political commitment to uncover what the consequences in the practice, political and policy consequences can be if one and not the other sort of risk/uncertainty description will be realised and chosen as factual basis for decision making.[30] The conclusion is that

[24] Science and technology studies is a well instutionalised research approach that tries to search science (or technology) without disciplinary abstraction at the very beginning. It takes science (or technology) as object of study in interaction with its environmnet and resorts to the different disciplinary tools as the process of research requires. Its main advantage is its holistic starting point. 'Constructivist' means in this respect that the 'basic epistemic bias' is that any solidified form of scince (or technology) includes results of decisions at the 'boundary' work. That 'boundary work' means how the object is defined, what its essential characteristics are, etc.

[25] I assess some decision a decisionistic fallacy when contingent elements are included into some methodology without reflecting on it.

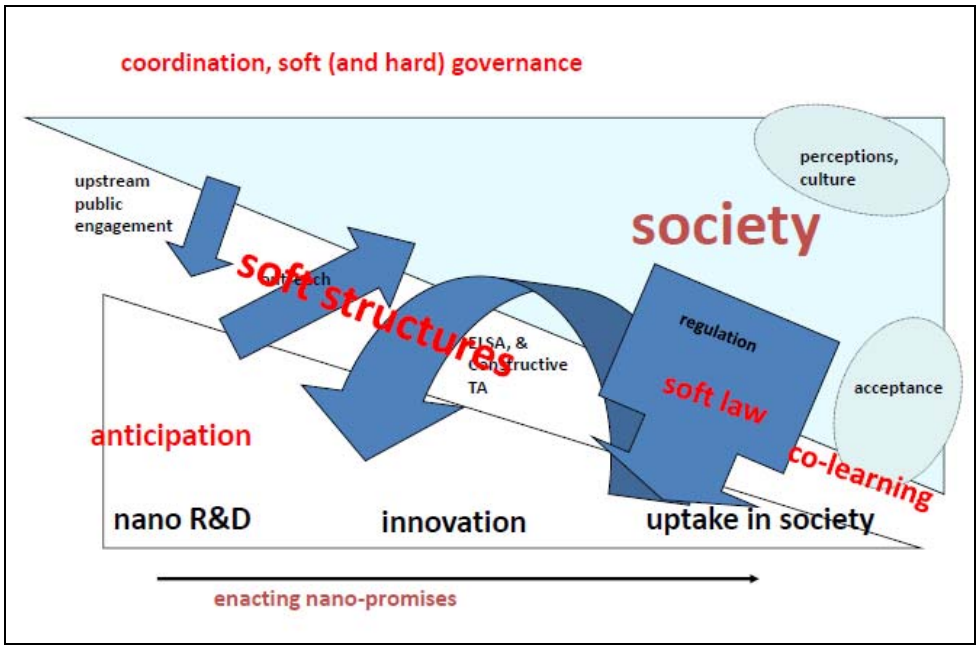
[26] TEKSS (Felt – Wynne 2007) [7] enumerates a long list of contingent choices, starting with characterising risks with mortality instead of other possibilities, etc.

[27] Paradoxically, to realise that objective description of the factual world that is relevant to the policy issue, the researcher has, unconsciously or consciously to take some value perspective to frame its methodology or she makes it just by chance as many risk researchers do, when for example just analogically utilise some standardised framing.

[28] As a study prepared by the Institute of Prospective Technology Studies (IPTS) prettily formulated: applying precaution is not using less science as the defenders of the precautionary approach are several times accused, and as some falsely really do, but using more science by trying to diminish decisionism by including all the possible research perspectives as far as possible [17] .

[29] Satisfaction with simple reproducibility of some, eventually identified risk relations does not try to overcome the contingency and decisionism just because it does not even try to make topic of research all the possibilities how much reproducible risk quantities are possible to be found around the same research object.

[30] The most simple technical decision can exemplify this. Take the problem of characterising the risk of an accident. There are a lot of different possibilities. It is possible to measure it, say, by the ratio of human death in an accident, or additionally taking into account injuries, material damages, etc. It would be even possible to take into account non-material damages, giving special way if the dmaged person is a child, etc. But in the case it is decided for one characterisation that also means that not any other alternative is chosen as being represen-



Source: Kearnes and Rip 2009 [32]

Fig. 1. Coordination, soft (and hard) governance

Tab. 1. Different qualities of uncertainty

• **Risk:** under which we know both the probabilities of possible harmful events, and their associated kinds and levels of damage. This is where the various techniques of risk assessment are most usefully applicable.
• **Uncertainty:** where we know the types and scales of possible harms, but not their probabilities. This is the best established 'strict' definition of the term 'uncertainty', under which 'risk assessment' is strictly not applicable.
• **Ambiguity:** where the problem at hand is not one of the likelihood of different forms of harm, but where the measurement, characterisation aggregation or meanings of the different issues are themselves unclear, disagreed among specialists or contested in wider society. For example: how exactly do we define 'harm' or 'risk'?
• **Ignorance:** where we don't have complete knowledge over all the possible forms of harm themselves. Where we 'don't know what we don't know' – facing the possibility of surprise. This renders problematic even the questions that we ask at the outset in risk assessment.
• **Indeterminacy:** where the possibilities for different social 'framings' depend 'reflexively' on complex interactions and path dependencies in the co-evolution of social, technological and natural systems. In other words, not only do our commitments and choices depend on what we know, but what we know is conditioned by our preferred or expected commitments and choices.

Source: Felt – Wynne 2007, [7] *p. 36*

the first political/policy step is made already when the type of risk/uncertainty description is chosen. Responsible discourse, a dialogue of equal partners as the very first step over the framing of the looking for risk/uncertainty facts, framing of the methodology in the wide sense is to realise to avoid the mentioned decisionism as far as possible. [31] This is the point where the need for being the most possible circumspective may meet the need for democratisation of expertise. If one accepts that public participation may provide for additional perspectives that realising the requirement for the most possible responsible approach to uncover risks/uncertainties of some situation makes coincide the instrumental and the political requirements: a full participation of stakeholders including the effected publics becomes the highest requirement. This is not about substituting the experts at all but engaging with them in the framing of their work in a dialogue, in a 'two ways communication'. This puts strong requirement on both sides. It requires experts to acquire an expert-citizen quality and the publics as much understanding of expertise that enables them to reflect on the framing of the expertise. I put a graphical overview of the dynamic of co-evolution of society and new technology, according critical STS.

Kearnes and Rip (2009) [9] certainly interpret this way the recently strengthening dynamic of dialogue, and the steps already made in some direction, represented by the NanoRisk Framework and the recommendations the Code of Conduct set by the EC formulates and this makes up an essential part of their critique. But this is only the upside down part of the innovation dynamic, the dealing with the safety of some innovation driven for whatever reason. But they go further and assess the steps already made in practice by these efforts from a more requiring point of view too.

This is actually the turn from risk governance to innovation governance that the publics and concerned groups should get a dialogic relation to the very goals of the innovation dynamic. This is realising a participative democracy that provides a fur-

tative for the risky/uncertain issue. It is easy to see that the chosen methodology for identifying 'the facts' has policy and political consequences.

[31] 'Nature', the world outside, its characteristics that are unknown when the responsible reflection on framing is made have their essential role. So, even the most responsible approaches are always limited and require from time to time renewing reframing efforts.

ther resource for innovation dynamics. There is a uniquely concentrated formulation of this perspective in an expert report, actually a manifesto, Taking European Knowledge Society Seriously (Felt – Wynne 2007 [7]) that was prepared for the DG Research of the EC in 2006. From this ambitious point of view there is a new global innovation challenge. This is to change the whole frame in which the global innovation efforts are made. While the recently dominating frame requires the as soon as possible exploration of for new resource for their exploitation as soon as possible in the global innovation race the alternative their suggest concentrates on the direction. It would give primacy to responsibility and will realise it by systematic inclusion of concerned groups into a dynamic of systematic experimentation to ward a more sustainable global society. From this point of view the frame set for research on uncertainty by DuPont and US Environmental Defense (EDF), the "Nanorisk Framework to Aid in Responsible Development of Nanotechnology" and the Code of conduct worked out by the EC are first steps in this direction.

We can ask how far may this be *projecting wishes* into something? How far setting the framework is more result of constraints than of estimated benefits for DuPont, or any other company? On what pressures were the Nano Risk Framework developed by DuPont and Environmental Defense Found (EDF) and the Code of Conduct worked out by the EC? More general we can ask the same about the recent proliferation of similar issues, especially of voluntary codes. How far are these efforts if not some sort of greenwashing but only promises first for communication and marketing reasons?

One possible answer may be that firms try to meet the perceived challenge that some governments or governmental departments for example in the UK are more and more willing to listen to the 'hidden anxiety'. Having had earlier clashes in bad memory regulatory institutions start to consider anticipative regulation measures. Nanoscience and nanotechnology are a special issue in this respect, for a number of reasons. First, because they do not exclude some very concerned interpretation around the implications in terms of adverse environmental and health issues.

[32] ELSA in the table is for Environmental, Legal, Social Impacts Analysis. Prescribing ELSA investigations was first introduced in the USA in the early 90s.

6 Some doubts

[33] Second, because nanotech, in comparison to the GMO issue has much smaller mobilising capacity among the citizens. So, a possible clash can be prevented. Third, and this is also a lesson from the earlier debates, any sudden catastrophe would cause incalculable public reaction effects. Fifth, governments and public administration institutions, self-governments may get inclined, even determined to meet the still 'hidden anxiety' anticipatively.[34] Taking into account the (partly by firms anticipated) pressure by the governmental side may be a strong driver for companies to engage in some sort of voluntary action.

Beside that can you count with some *comparative advantages* in the market when demonstrating anticipative responsibility that means not only responsibility for the recent production processes and products but also for the possible new ones. *But the main problem I think with the recent Nano Risk Framework is that it does not refer to any sort of 'soft punishment' in case firms would not behave according to the quite thorough guidance.*

The Nano Risk Framework requires to iteratively realise a process of six elements in developing a rational basis for future regulation. The code operates to both produce baseline data and to demonstrate best-practice within DuPont. As such the framework has six steps for both the development of information of the use of nanomaterials, and commissioning of forms of life-cycle analysis and risk management. The six steps, which operate sequentially through the lifecycle and risk assessment processes, include:

[33] Simply, the uncertainty is rather high, in many cases with nanoparticles, even when reports from different research institutions and from many firms often have a 'business as usual, only with a bit more care' style. It is typical that these sorts of reports mostly have a quite contradictory effect in the public than that they intend to reach. This is the case, say, when a report produces data on effects on 'the skin' simply, without any differentiation, or suggests that nanoparticles should be handled the same way as quartz particles, because both are possible causes of lung cancer and the management technique suggested is putting the waste in paper bags and signalise that hazardous nanoparticles are in the bag.

[34] As an example I refer to the EU Parliament critique over the perceived insufficient development of responsible nanotech in April 2009. "Parliament calls for the provision of information to consumers on the use of nanomaterials in consumer products: all ingredients present in the form of nanomaterials in substances, mixtures or articles should be clearly indicated in the labelling of the product (e.g. in the list of ingredients, the name of such ingredients should be followed by the word 'nano' in brackets). MEPs deplore the absence of a proper evaluation of the de facto application of the general provisions of Community law in the light of the actual nature of nanomaterials." The information is taken from an EU portal (Public health 2009).

Step 1: Describe material and application
Step 2: Profile Lifecycle(s)
Step 3: Evaluate Risks
Step 4: Assess Risk Management
Step 5: Decide, Document Act
Step 6 Review and Adapt (DuPont Nano Partnership 2007, 8).

Kearnes and Rip correctly observe that "the Nano Risk Framework is similar to the voluntary schemes developed by Defra in the UK and the US Environmental Protection Agency (EPA), inasmuch as it relies on developing baseline data upon which to commission life-cycle analyses and further risk assessment and risk management activities." (Manuscript to the DEPEN meeting in Budapest, 2009, p. 18) They correctly emphasise: "However the framework goes further"(...)"in that it requires action on the basis of the information developed. As quoted above, it is through this 'information-led' process that the authors of the framework suggest that 'the adoption of this Framework... support[s] the development of a practical model for reasonable government policy on nanotechnology safety.' (DuPont Nano Partnership 2007, 7) In this way the BASF and EDF/DuPont codes operate strategically and in an anticipatory way, in order to guarantee each firm a stake in future regulatory debates, and indeed to frame future debates on the regulation of nanotechnology through the compiling of relevant information and the demonstration of best practice." (Manuscript to the DEPEN meeting in Budapest, 2009, p. 18)

The evaluation of risks is conceptualised as an 'information led' approach in the Nano Risk Framework. Three critical remarks seem to be correct in this respect. First, and this critique is positive, that in contrast to this it tries to give place to precaution in the meaning of precautionary assessment too through application of worst case scenarios in case of 'information gaps'. The second critical remark is that the Nano Risk Framework too much emphasises the continuity with established risk assessment procedures. So, it states: "Although we began this partnership without any preconceived opinions on whether nanoscale materials might require entirely new methods for evaluating and managing risks, we were pleased to find that the basic principles of many existing risk frameworks could be applied to our work. For example, this Framework follows a traditional risk-assessment paradigm similar to the one used by the U.S. Environmental Protection Agency (EPA) for evaluating new chemicals" (DuPont Nano Partnership 2007, p. 16). Third, the whole planned process is narrowly expert based at least in its concrete texts. It speaks for example about the importance of dealing with potential triggers for obtaining additional data, but does not suggest to do this in interaction with possible users, workers (DuPont Nano Parnership 2007, p. 24). So the frame is result of cooperation with environmental NGOs too, and especially with EDM, but it does not suggest concrete participation of NGO-s in realisation of the concrete search processes.

I want to tell some remarks on the Code of Conduct recommended by the EC. Conceptualising the works the principles layed down in the Code the Commission declares them as integral part of institutional quality insurance mechanisms. Based on the aim to develop a general culture of responsibility needs and desires of all stakeholders should be taken into account to reach good governance of N&N research, with emphasis on the "challenges and opportunities that may be raised in the future and that we cannot at present foresee." (EU Recommendation 2008, P. 7) *The Code of Conduct realises a position of requiring anticipatory governance based on utilising the precautionary approach. Unfortunately the precautionary approach is identified by it as management principle, only.*

I finish this short overview with the observation that with the recently *already reached governance elements some firms and some concerned groups constructed already a jointly shared boundary object. As any boundary object this too allows that while preserving their basic differences the agents can work on topics of joint interest. It depends not only on the willingness of the participants but unforseeable interactions in the rather turbulent milieu of the recent world history how quick and wide the consolidation of the working around the common boundary object of coevolutionary governance will be reached.*

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