The Research Council of Norway

Work programme 2008 – 2014

Programme

Ethical, Legal and Social Aspects of Biotechnology, Nanotechnology and Neurotechnology – ELSA

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Ethical, Ethical, Legal and Social Aspects of Biotechnology, Nanotechnology and Neurotechnology – ELSA

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1 Background

1.1 History; reasons for establishing the programme

The term ELSI research (Ethical, Legal and Social Implications) was introduced in the context of the US Humane Genome Project (HGP) around 1990. Since the turn of the century, ELSA (Ethical, Legal and Social Aspects) programmes have been commonly established as separate programmes or sub-programmes of national genomics research programmes in many European countries and Canada, as well. In the European Framework Programmes ELSA-like activities, especially related to bioethics, have been a component since the Second Framework Programme (1987-1991). EU's Science and Society Action Plan from 2002 emphasizes the importance and the role of new technologies for developing responsible science.

The Research Council of Norway (RCN) initiated a separate programme on Ethics, Society and Biotechnology in 2002. The programme lasted until 2007. Also the large scale programme Functional Genomics in Norway (FUGE, 2002-2011) from its inception decided to spend 3-5% of its funds on research concerning ethical, social and legal aspects of functional genomics. In 2004-2005 RCN's large scale programme in nanotechnology and new materials, NANOMAT analyzed relevant aspects of health, environment, risks, ethics, law and society. A report on the topic was published in collaboration with the National Research Ethics Committee for Natural Science and Technology and the Norwegian Board of Technology. The NANOMAT programme has funded ELSA research projects since 2006, and the Work Programme for 2007-2016 expresses a clear commitment to ELSA activities.

In 2006 the RCN appointed a planning group tasked with reporting on challenges facing research on ethical, legal and social aspects of biotechnology, nanotechnology and cognitive sciences and making recommendations on how such research should be organised in the future. The planning group delivered its report June 2007. The RCN decided to follow the recommendations of the planning group to establish a new ELSA programme with a broadened scope, encompassing nanotechnology and cognitive sciences in addition to biotechnology. The Programme Board proposes to use the term neurotechnology instead of cognitive sciences. The programme intends to cooperate closely with FUGE and NANOMAT.

The reasons for establishing the new ELSA programme are threefold. First, recognition that RCN's technology programmes for research on biotechnology and nanotechnology (first and foremost FUGE and NANOMAT) in their science/technology and society activities can benefit from collaborating with a specialized ELSA programme. Second, ELSA issues relating to emerging technologies have much in common across the technologies/scientific disciplines involved (cf. also the concept "converging technologies"). Third, RCN is itself an important actor in the borderlands of science/technologies and society, and intend to use the ELSA programme as a learning platform experimenting with modes of integrating science, technology and society. An underlying assumption is that both science and governance institutions need to learn to make a shift in policy and practices towards more inclusive, reflective and open forms of learning.

1.2 Context of the programme

Since the end of the Second World War science and technology have become entangled in every aspect of our lives. The assumption that science will bring progress and social benefits has allowed scientist to work relatively autonomously. However, since the late 60s there has developed a recognition that science also may bring about impacts that are not necessarily deemed good for society. Hope and expectations associated with science have become contested.

New frameworks and metaphors challenge the traditional *linear model* of knowledge production and innovation. The linear model assumes that clear cut boundaries between science and society can be established. According to the linear model knowledge production starts with basic research, followed by applied research, development, production/commercialisation; subsequently leading to economic growth and societal benefits. The task of science is seen as dealing with facts, whereas society takes care of values.

From the 1980s and beyond, there has been a growing insistence on more co-evolutionary and interactive images in models relating to science and technology policy. Research about science, technology and innovation has increasingly stressed their dynamic and networking character, and thus promoted an opening up of discussions and experiments concerning how science, technology, society and policy relate to each other as well as how productive interactions can be fostered and enhanced.[1] Such ambitions are related to ideas about "new modes of governance".

ELSA research is often described as being situated in a tension between promotion and control of scientific development and innovation in the borderlands between science and society. Three central concepts for the ELSA programme are *recontextualization of science*, *reflexivity* and *interactive knowledge production*.

<u>Recontextualization of science</u>

The idea that science communicates with society is familiar. It is often assumed that non-scientists are not really up to date with the latest developments of science and need to be informed. But once the institutional boundaries between science and society become fuzzy, science is opened to a flow of reverse communication *from society*. Recontextualization of science implies that people take a place in the production of knowledge: as users/target groups in the market, as members of NGOs, and as addressees of policies. Patient associations influence research agendas and engage in research themselves, undermining the exclusive rights of scientists. Authority over science is also claimed by non-scientists, such as members of the parliament, well informed/highly educated lay people and indigenous people. Thus, recontextualization implies that not only does science speak to society, but society can also "speak back" to science.[2]

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[1] As summed up in Spaapen, J., Dijstelbloem, H., Wamelink, F. (2007) *Evaluating Research in Context*, Consultative Committee of Sector Councils for Research and Development, The Hague.

[2] Nowotny, H., Scott, P., Gibbons, M. (2001) *Re-Thinking Science*: *Knowledge and the Public in an Age of Uncertainty*, Blackwell, Cambridge, UK. Rip, A. (June 25/2007)"A Changing Social Contract between Science and Society", conference presentation at *Responsible Research in Europe: Science and its Publics*, Munich: http://www.prime-noe.org/Local/prime/dir/General%20Presentation/News/Munich%20Rip%20changing%20social%20contract.pdf

Reflexivity

By *reflexivity* we mean the capacity of actors (researchers, institutions) to question their own taken-for-granted assumptions and routines. Reflexivity implies awareness of the limitations of our knowledge. In terms of learning, reflexive learning means insight into the assumptions which tacitly shape our own understanding and interactions.[3] For ELSA research, reflexivity implies reflexivity-in-action rather than in standpoint or in interpretation[4]. A dynamic and systemic way of understanding science-society relations, poses new challenges concerning competence, capacity building and skills for policy organisations and national funding agencies as well as for researchers. It has even been suggested that our traditional repertoire /sets of practices characterised as "*technologies of hubris*" need to be replaced by "*technologies of humility*"[5]. Such a transition implies that we move away from models of prediction and control, towards a richer public deliberation about visions, ends and purposes of science and technology. Thus, the reflexivity of science and technology systems/institutions, policy institutions and researchers emerge as a key asset.

Interactive models

Interactive models of knowledge production and research policy are particularly relevant for new and emergent science and technologies, such as biotechnology, nanotechnology and neurotechnology. These sciences and technologies are often assumed to have a huge potential for innovation, and a capacity to transform sectors such as health care, industry, agriculture and marine harvesting. However, the claimed potential benefits are also associated with risks.

The widely recognized problem of European public unease with science and technologies is particularly related to new science-based technologies, as illustrated by the public distrust of science in the GM debate. The expectations of biotechnology, nanotechnology and neurotechnology seem to refer to a philosophical agenda, namely the total constructability of humanity and nature. These are examples of fundamental questions that require reflexivity-in-action and public deliberation.[6]

1.3 Scope

Nanotechnology, biotechnology and neurotechnology are *generic* as well as *basic* technologies since these technologies have potential applications in many areas and ways. They are also technologies that can give rise to a broad array of innovations, novel solutions and services, products and markets. All three technologies are also often termed *strategic technologies* as they are regarded as technologies that companies and economies need to master and be able to exploit effectively in order to assert themselves in an increasingly knowledge-based global economy. To an even greater degree than is the case for biotechnology currently, nanotechnology can also be characterised as an *emergent technology* that undergoes rapid changes.

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[3] See e.g. Brian Wynne's "Afterword" in Kearnes, M., Macnaghten, P., Wilsdon, J. (2006) *Governing at the Nanoscale: People, policies and emerging technologies,* published by Demos, UK.

[4] Rip, A. (June 29/2005), "There is mainstreaming, loss of critical distance: are STS scholars finally growing up?" Paper presented to the workshop "Does STS Mean Business Too?" Said Business School, Oxford.

[5] Jasanoff, S. (2003) "Technologies of humility: Citizen participation in governing science", *Minerva* 41: 223-244.

[6] Felt, U., rapporteur, (2007) *Taking European Knowledge Society Seriousl*y, Report of the Expert Group on Science and Governance, Directorate-General for Research, European Commission. Nordmann, A., rapporteur, (2004) *Converging Technologies – Shaping the Future of European Societies*, HLEG Foresighting the New Technology Wave, Directorate-General for Research, European Commission.

Neurotechnology is rapidly emerging as a technology with a broad spectrum of applications. Neurotechnology drives neuroscience research into brain biology, structure and function, illuminating longstanding questions about consciousness, cognition and learning. Neurotechnology is also at the forefront of pressing societal concerns, including research into memory, aggression, and motivation. Here neurotechnology has clear clinical applications, however, emerging neurotechnologies are being marketed as having business, forensic and security applications as well. Finally, neurotechnology has implications for everyday living, promising to enhance individual performance and happiness.[7]

These three fields of science and their related technologies are often referred to jointly – and together with "information and communications technology" (ICT) –as converging technologies. *Converging technologies* are defined as "technologies and knowledge systems that support one another in the evolution towards common objectives"[8]. This is a concept where ICT, biotechnology, nanotechnology and neurotechnology are increasingly merging and/or complementing one another. As an area of research that cuts across traditional discipline boundaries, nanotechnology itself is a converging technology.

The development of new technologies is full of tensions. On the one hand, modern technologies may open up a broad spectrum of new issues, services and products in various areas, as with biotechnology ranging from medicine and agriculture to environmental protection and law. At the same time, development may be marked by uncertainty and considerable scepticism and resistance by many members of the public. Although uncertainty and disagreement continue to be important features of the position and development of biotechnology, the scepticism and resistance of the Norwegian opinion now appear to be on the wane in favour of more positive attitudes.[9] The interplay between benefits, risk and ethics appears to play a major role for social acceptance. The fact that the new products are perceived as beneficial seems to explain the existence of overwhelmingly positive attitudes towards medical applications, whereas negative attitudes have tended to overshadow the positive with regard to genetically-modified food products and plant varieties. Laws and regulations designed on the basis of growing knowledge and experience regarding the particular challenges raised by biotechnology is now in place, while the results of new research and innovations require constant adjustments in rules and regulatory practice.

Lessons about new and emerging science and technology have been learnt from the experience with biotechnology. Nanotechnology and neurotechnology should consider those lessons. For the ELSA Programme, the challenge is to search for overarching dynamic frameworks, drawing on what is available already in the literature and in relevant experiences, and developing this further in the projects the ELSA Programme intends to support.

The programme addresses research on ethical, legal and social aspects (ELSA) relating to biotechnology, nanotechnology and neurotechnology. In addition to initiating and funding

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[7] Moreno, J. (2006) *Mind wars: Brain research and national defense*, New York. Farah, M., Illes, J. et al. (2004) "Neurocognitive enhancement: what can we do and what should we do?" *Nature Reviews Neuroscience* vol 5 no 5 , 412-425. *NeuroInsights* (2007) The Neurotechnology Industry 2007 Report: www.neuroinsights.com/reporthighlights/html

[8] Nordmann, A. rapporteur,(2004), *Converging Technologies – Shaping the Future of European Societies*, HLEG Foresighting the New Technology Wave, Directorate-General for Research, European Commission p. 14.

[9] Hviid Nielsen, T. (2007) "Flere ser mere positivt på bioteknologi" [More people have a more positive view of biotechnology], *Samfunnsspeilet* no. 1, 2007.

research, the programme will engage in/promote other activities aimed at strengthening the integration of new and emergent sciences and technologies and society. The programme will strive to develop good social engagement practices integrated in research.[10] Approaches and methods developed and used in the programme could in the future also be applied to other areas, such as energy and climate where new governance arrangements appear to be emerging.[11] The ELSA Programme Board could cooperate with RCN Programme Boards in these areas. Research on risks to the environment and health that does not have ethical, legal or social aspects should primarily take place in initiatives other than the ELSA programme. An example would be environmental risk assessment of genetically modified organisms (GMOs).

The primary stakeholders to the programme are research communities and educational institutions. Other stakeholders are hospitals/health providers, technological providers and innovators, public authorities like ministries and politicians; trade organizations and companies; voluntary organizations interest groups and the general public. The programme will seek collaboration with other institutions mediating the interface between science, technology and society, such as the Norwegian Board of Technology and the Norwegian Biotechnology Advisory Board.

The RCN is itself a stakeholder, not merely as a funder of research, but also as a learning organization operating on the border between science, technology and society.

[10] See The European Research Advisory Board (EURAB) Final Report 07.013 "Research and Social Engagement", June 2007: http://ec.europa.eu/research/eurab/pdf/eurab_07_013_june_%202007_en.pdf

[11] See discussions concerning new modes of governance developed e.g. by Rip, A. (2002) *Challenges for technology foresight/assessment and governance*, Final report of the Strata Consolidating Workshop, European Commission, and Voss, J-P., Bauknecht, D., Kemp R. (2006), *Reflexive Governance for Sustainable Development*, Edward Elgar, Cheltenham.

2. Objectives of the programme

The overall objective of the programme is to develop research-based knowledge and competence on ethical, legal and social aspects of biotechnology, nanotechnology and neurotechnology. The program shall create a platform for doing research that is reflexive and socially robust. The program should achieve transmission and learning by comparing technological and scientific areas.

The program should lay the groundwork for developing Norwegian ELSA research that maintains high international standards of quality, and is able to identify adequate solutions concerning the interdisciplinary *quality assurance* of its activity. This research should have high visibility in and make active contributions to international ELSA research, as well as creating international collaboration.

The programme should contribute to bridge the gap between ELSA research and innovation by stimulating interaction between ELSA research and technology programs and projects. The programme should contribute to increase reflexivity and promote learning among ELSA researchers as well as scientists. Thus, the programme shall encourage ELSA researchers to be aware of the context of implication, which includes becoming a responsible party to the public debate. ELSA researchers participating in the programme should present a plan for how their research will engage the wider society as well as researchers in relevant science/technology fields. Conversely, researchers in biotechnology, nanotechnology and neurotechnology should participate in ELSA studies, or at least be willing to consider the ongoing work and findings and take these up in their strategic decisions. The programme should encourage researchers to interact more with civil society.

The programme should also explore the relationship between ELSA research and democracy, and contribute to clarify and deliberate *normative questions* concerning the shaping of science and innovation.[12]

Specific operational goals will be developed in the annual action plans of the programme.

[12] Felt, U., rapporteur, (2007), *Taking European Knowledge Society Seriously*, Report of the Expert Group on Science and Governance, Directorate-General for Research, European Commission.

3. Major research themes

3.1 General themes and studies of concrete technological developments/innovation paths

The program goals are ambitious in their reference to dynamics of emerging science and technology and their embedding in society, and how to address such issues in an interdisciplinary and interactive way. The complexity can be productively reduced by identifying a number of general themes and questions that can be addressed through social science and humanities studies, but also have dedicated studies of technological development trajectories and their societal aspects and implications. This approach is adopted (and argued for) in the new Dutch funding programme on 'societally responsible innovating',[13].The programme will also address the need for a general theoretical and reflexive framework. Promising elements of such a framework will be identified below.

The research themes outlined and discussed in-depth in the report of the Planning Group (with a few topics added) can be presented under five headings.

Risk and uncertainty	**Values, conflict, Culture**	**Governance**	**Global justice**	**Deliberative processes**
Risk, uncertainty and susceptibility in science, the relationship to the requirement for informed consent and safe guarding of society's interests. *The precautionary principle*.	Technology changes and social processes, exploring empirically how social and cultural factors needs affect the selection, design and dissemination of technologies	The influence of market forces vs. other mechanisms for coordination on scientific and technological development. How to arrive at *legislations* and regulations that can be used to achieve desired outcomes.	Global ethics: Technology development priorities in relation to the need in industrialised vs. developing countries	Public engagement and democratic decision processes related to new science and technology
	Social and ethical issues raised by new forms of life; cybrids; etc., issues related to tissue/blood/embryo banking, biological waste, *informed consent*, autonomy, etc.	*Intellectual Property Rights (IPR):* The impact of IPR on technological choices, innovation and priorities in the scientific community, IPR and society: How IPR		

[13] This is the literal translation of the title of the Dutch Programme, *Maatschappelijk verantwoord innoveren*. See http://www.nwo.nl/nwohome.nsf/pages/NWOA_73FFTS

		regimes design influence on balance between openness and protection of private investment in research, and on innovation, growth and the issue of fair distribution		

Concrete technological developments/innovation paths studied could be:

- New ‘intelligent’ materials and nano-structured surfaces
- Surveillance through ambient intelligence, as a support to quality of living (e.g. domotics), and as a way of controlling and disciplining
- Implants (cochlear implants, Parkinson’s patients) and the grey zone between therapy and human enhancement
- Regenerative medicine
- Agriculture and food production
- Forensic uses of biotechnology (e.g. DNA databases, courtroom use of neuroimaging, etc.)
- Military/defence/security applications of biotechnology and nanotechnology
- Synthetic biology

Other topics for integrated projects could be specified in action plans and calls for proposals. Importantly, topics for integrated projects can also be introduced by researchers applying for funds through the programme.

3.2 Elements for a theoretical and reflexive framework

A number of components of the ELSA Programme (see 1.2 and 1.3) were inspired by recent work on reflexive co-evolution of science, technology and society. This can be used for background analysis and diagnosis, and thus become a building block for a theoretical and reflexive framework that will be articulated over time, as additional insights from concrete projects, and possibly in dedicated projects.

We offer a brief example of such analysis and diagnosis, starting with the recognition of a division of labour between the developers of new science and technology and other parts of society receiving the results and experiencing the effects.[14] Such a division of labour leads to a separation in the activities and perspectives between “*promoters*” and “*selectors*” (in a broad sense, parts of the selection environment) of new technology.

[14] See Rip, A., Misa, T., Schot, J. (1995) *Managing Technology in Society: The Approach of Constructive Technology Assessment*, London, for the full analysis.

Promoters of new technology are typically scientists, technology developers, business managers and governmental agencies in charge of technological development. *Selectors* are typically (i) regulatory agencies responsible for safety, environmental protection etc, (ii) new stakeholders such as consumer groups and environmental groups, and (iii) spokespersons for society. *Promoters* are "insiders" who know more, and have invested more at an early stage, whereas selectors are "outsiders" who have to wait and follow their lead. Second, technology developers (*promoters*) do not necessarily know much about the "outside", as the debate about GM crops and GM food illustrates. Third, there could be a difference in power between *promoters* and *selectors.* In sum, technology development takes place in a world full of such asymmetries and gaps.

It is clear that the stable institutional arrangements for scientific and technological development which dominated until the 1960s and 1970s are shifted and challenged by critical selectors and regulators. The emergence of ELSA studies and activities is a further indicator. The gap between promotion and control of new technology can be bridged in various ways, and this leads to new forms of governance (see below). Rather than exposing society to new technologies in a trial-and-error manner, there are attempts at anticipation and pro-active decision-making. One can position ELSA studies in this way: just as there now are test-labs and home-of-the-future experiments where new technology is tried out, doing ELSA studies about possible effects and their assessment is "trial" by studies"[15].

Another phenomenon is the recontextualisation of science,[16] and calls for deliberative processes and mutual learning between science and society (thus overcoming the earlier deficit model)[17]. Norway has for example designed and works an extensive system for deliberation and engaging the public *as well as experts and researchers*, through the Biotechnology Board (from 1991), the Board of Technology (from 1999) and the Research Ethics Committees (from 1990). Such arrangements are examples of response to challenges stemming from new generic scientific and technological developments, in particular the domains covered by the present ELSA Programme, biotechnology, nanotechnology, and neurotechnology/. One can position them as "trials": attempts at analysis, assessment and governance, which must themselves be reviewed and modified (already to avoid a false sense of assured accountability and consensus). A concrete example is whether and to what extent regulation can be based on existing legal and regulatory frameworks (with some adaptation), or whether new provisions and approaches are necessary.

The new sciences and technologies, with their extended possibilities of manipulating nature and man/society, create challenges that cannot be fully addressed in traditional ways. For example, risk assessment works only when there is clarity about the technology and its uses, and is definitely problematic if one wants to consider more ambitious applications (like active nano-materials and nano-particles, cognitive intervention). As has been forcefully argued, one should go for *deliberative approaches.*[18] Similarly, bioethics has to be developed further, while nanoethics and neuroethics are only beginning to be discussed.

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[15] Rip, A. (2002) Co-Evolution of Science, Technology and Society, An Expert Review, Enschede, NL, page 11.
[16] Nowotny, H., Scott, P., Gibbons, M. (2001) *Re-Thinking Science: Knowledge and the Public in an Age of Uncertainty*, Blackwell, Cambridge.
[17] Felt, U., rapporteur, (2007), *Taking European Knowledge Society Seriously*, Report of the Expert Group on Science and Governance, Directorate-General for Research, European Commission.
[18] Report for International Risk Governance Council (IRGC). See also the abbreviated version by Renn, O. and Roco M. C. (2006), "Nanotechnology and the need for risk governance", *Journal of Nanoparticle Research*, Spinger, NL, vol 8, no 2, pp 153-191.

4. Status of Norwegian ELSA research

Earlier Norwegian ELSA research has, as expected, been focussed on issues relating to biotechnology. ELSA research connected with nanotechnologies is in the initial stages. A large portion of ELSA research has been initiated and funded through programmes under the Research Council of Norway. They primarily include the programmes Ethics, Society and Biotechnology (the first ELSA programme), FUGE (Functional Genomics) as well as NANOMAT (Nanotechnology and New Materials)[19]. The RCN has not previously funded ELSA research related to neurotechnology.

The Ethics Programme (1991-2001) under the direction of the Research Council of Norway made a substantial contribution to the development of expertise in the area of ethics in Norway. After the programme concluded, the Research Council continued to fund the National Ethics Network, which has its secretariat at the University of Oslo. The network's primary instruments are coordinating national researcher training courses and a website for researcher training and research in ethics, www.etikk.no

ELSA research in Norway has not been systematically evaluated. However, the Programme Board of the first ELSA programme, Ethics, Society and Biotechnology, will during Autumn 2008 write a report summing up the research that has been initiated by the programme, including an internal assessment[20] of the activities/the programme. Some evaluations can already be made.

Significant competence has been built since 2000. Still, Norwegian ELSA environments are somewhat scattered and to a great extent dependent on the one or two persons in charge at each institution/research environment. However, national collaboration in several important ELSA fields has increased over the past 5 years. Also, most of the Norwegian ELSA researchers have established strong links with international research communities. For a small country, ELSA research in Norway is quite well developed.

Internationally, ELSA research environments are also relatively scattered. In Europe, the Netherlands and the UK have established centres for ELSA research. The Netherlands have developed a tradition for interaction between ELSA researchers and researchers in the technosciences through methods such as Constructive Technology Assessment (CTA). In the UK public engagement has been emphasized.

For a first overview of Norwegian research institutions involved in ELSA research, see Appendix 1.

[19] See http://www.forskningsradet.no/

[20] The evaluation will be made by the Programme Board.

5. Strategic considerations

5.1 Competence building

A principal concern of the programme is to foster research communities with strong and broad expertise in ELSA issues. ELSA research spans a wide range of topics, and is transdisciplinary in its nature[21]. It is important to be able to draw on different social sciences, the humanities as well as interdisciplinary research.

Thus, the Programme wants to strengthen well established research groups and communities and enhance interdisciplinary work. Individual projects and fellowships should be tied to such communities and be part of broader ELSA research projects/programmes. Projects that build ELSA research and competence in technological research environments will be encouraged.

Larger projects and groups receiving funding will be encouraged to develop national and international networks. They could collaborate on and share responsibility for national measures and tasks, such as researcher training courses. Following the example of the previous RCN programme for ethics research, annual gatherings for all researchers, research fellows and supervisors could be a key element in developing and maintaining national networks.

5.2 Modes of support

Three forms of support will be available:

- Pilots for innovative approaches
- Individual projects
- Strategic awards

The rationale behind pilot projects is to learn to deal with challenges in integrating ELSA research with technological projects. The duration of a pilot project will typically be 1-2 years, and the total funding will be around NOK 0.4 mill (€ 50 000). Learning and concurrent evaluation will be an integrated part of the pilot projects.

Individual projects should stimulate reflexive learning, and be funded with around NOK 0.8-1.6 mill (€100 000 -200 000) per year, lasting 1-3 years.

Training and competence building should be an integral part of strategic awards. The funding should be NOK 8-16 mill (€ 1-2 mill) per year for a period of 3 years.

Details will be given in Action Plans and Calls for proposals.

ELSA projects related to biotechnology, nanotechnology and neurotechnology have different points of departure and conditions, with ELSA-research related to biotechnology being the

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[21] See e.g. Helga Nowotny "The Potential of Transdisciplinarity": http://www.interdisciplines.org/interdisciplinarity/papers/5. Hirsch Hadorn, G., Hoffmann-Riem, H., Biber-Klemm, S., Grossenbacher-Mansuy, W., Joye, D., Pohl, C., Wiesmann, U., Zemp, E. (eds.) (2008) *Handbook of Transdisciplinary Research*, Springer, Heidelberg.

most well-developed area. An effort will be made to (further) develop ELSA research and studies on nanotechnology and neurotechnology.

5.3 Collaboration with other programmes in the RCN

RCN-initiated ELSA research related to biotechnology, nanotechnology and neurotechnology will rest on two pillars: The separate, core ELSA-programme (for which this work programme is designed), and ELSA-activities in the two large scale technology programmes FUGE (Functional genomics in Norway) and NANOMAT (Nanotechnology and new materials, nanoscience and integration). The Programme Board of the core ELSA programme will cooperate with the Programme Boards of FUGE and NANOMAT and give advice concerning their ELSA activities. The programme Board can make recommendations on ELSA applications submitted to FUGE and NANOMAT.

Grants through the separate ELSA programme will make it easier to address fundamental issues and projects that cut across biotechnology, nanotechnology and neurotechnology, and also to provide interdisciplinary quality assurance of ELSA research. Grants from the other programmes will ensure proximity, contact and coordination between scientific and technological developments and ELSA research.

The way ELSA is organised in the RCN is in itself suited for creating a more dynamic interaction since the same funding department/division in the RCN is also hosting a number of other relevant initiatives and programs. An ambition for Norwegian ELSA research, in addition to the dedicated Programme, can be to stimulate interactive/integrative research. Funding organisations (like RCN) could give priority scores to technological projects that have ELSA components integrated.

5.4 Interactive quality

ELSA researchers' task involves an obligation to communicate their research to the general public, as all researchers should do. However, "communication" is only part of the activity the ELSA researcher ought to engage in. S/he may become enmeshed in policy debates and perhaps take a stand. Being engaged with the greater society ought to be an essential and integral dimension of all ELSA research. ELSA research has risen as a consequence of public concern regarding modern science and technology, it is essential for ELSA research to be able to invite the public to "speak back". As part of a proposal, the ELSA researchers can present a plan for how their research will engage the wider society as well as researchers in relevant science/technology fields.

5.5 Evaluation

Evaluation will be an important component of the programme, since ELSA II will strive to define, help emerge and evolve additional standards for *quality assessment* and evaluation procedures pertaining to interdisciplinary, interactive and publicly embedded ELSA research. The programme will be evaluated based on the methods it contributes to develop, not on its impact on political processes/society.

5.6 International collaboration and co-ordination

The international dimension should play a key role in research funded under the programme. The first reason for this is the interest of *quality*: researchers should seek out active collaboration with international research communities considered to be particularly outstanding or leading in the field. Research stays will often be an effective way to link up with such research communities, in the form of stays abroad for experienced researchers and by research fellows applying for admission to institutions that offer particularly good researcher training in the ELSA disciplines.

There is also a *thematic* rationale: the issues that scientific and technological developments raise are themselves of an international and global nature. The evolution of the international agenda for the development of research and technology, the public debate and ELSA research are propelled by players that set the tone at a global and regional level - the US, the EU, China, India, Japan, Brazil, etc. The monitoring, "importation" and articulation of these agendas in a Norwegian context is a task of Norwegian ELSA research, to be taken up in the Programme.

Internationally comparative research is important, and has already shown to be fruitful in ELSA research. In addition, Norway has an obligation to, and self-interest in, collaborating with research communities in countries that at the outset are not as far advanced in this area and have a need to collaborate with a view to bolstering their own research in this area in terms of expertise, capacity and quality.

6 Time perspective and budget

The budget is NOK 4 mill for the up-start year 2008, and the proposed budget for 2009 is NOK 9 mill. The aim of the RCN is to increase the budget to NOK 10 mill a year 2010-2012. In addition, FUGE and NANOMAT will set aside funds for ELSA research in the same period. Projects in the programme will be encouraged to contribute with co-financing from their own institution or from other external institutions than the RCN.

The following ministries are proposed as funders of the programme: Ministry of Education and Research, Ministry of Trade and Industry, Ministry of Agriculture and Food, Ministry of Fisheries and Coastal Affairs, and Ministry of Health and Care Services.

2008	2009	2010	2011	2012	2013-2014	Total	
4	9	10	10	10	20	63	

Table 1 Proposed budgetary development (mill NOK)

Appendix 1 Tentative overview over Norwegian ELSA research

Research topic	R&D institutions conducting ELSA research
Science, technology and society: Governance and participation	• The Norwegian Institute of Gene Ecology (GenØk) at the University of Tromsø • University of Bergen, Stein Rokkan Centre for Interdisciplinary Studies (the Rokkan Centre) • University of Bergen, The Centre for the Study of the Sciences and the Humanities (SVT) • Norwegian University of Science and Technology (NTNU) • University of Oslo's Centre for Technology, Innovation and Culture (TIK • NIFU STEP Studies in Innovation, Research and Education • National Committees for Research Ethics in Norway • The Institute for Research in Economics and Business Administration (SNF)
Commercialisation, IPR	• University of Bergen, Faculty of Law • University of Oslo, Faculty of Law • Fridtjof Nansen Institute (FNI)
Medicine and health: Prevention, enhancement and design	• University of Oslo the Section for Medical Ethics, Faculty of Medicine • Norwegian University of Science and Technology (NTNU) • MF Norwegian School of Theology ("Menighetsfakultetet") • National Committees for Research Ethics in Norway
Food, environment and nature	• University of Tromsø's Norwegian Institute of Gene Ecology • The Norwegian University of Life Sciences (UMB) • Norwegian Centre for Rural Research • Fridtjof Nansen Institute (FNI) • National Institute for Consumer Research (SIFO) • National Committees for Research Ethics in Norway
Privacy, consent	• University of Oslo, Faculty of Law • University of Bergen, Faculty of Law
Risk, precautionary principle	• The Norwegian Institute of Gene Ecology (GenØk) at the University of Tromsø • The Norwegian University of Life Sciences (UMB • National Committees for Research Ethics in Norway • DNV (Det Norske Veritas)

Table 1. Past and on-going ELSA-research in Norwegian research and educational institutions

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