Responsible Innovation

description of thematic programme

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Responsible Innovation is a partnership between

- the NWO divisions Humanities and Social Sciences,
  WOTRO Science for Global Development, Technology Foundation STW and ZonMw
- the Ministry of the Interior and Kingdom Relations
- the Ministry of Foreign Affairs
- the Ministry of Defence
- the Ministry of Agriculture, Nature and Food Quality
- the Ministry of Education, Culture and Science
- the Ministry of Health, Welfare and Sport

This document is the translation of the Dutch 'beschrijving themaprogramma'. In case of different interpretation of the original (Dutch) text and this (English) translation the original Dutch text prevails.

Netherlands Organisation for Scientific Research

Thematic programme: Responsible Innovation

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Executive Summary

Responsible Innovation

Example: electronic patient dossier

The concept of electronic patient dossiers has been around for decades. Expectations are high in terms of patient security and savings on administrative charges. Nevertheless, this innovation is very slow to get off the ground. The ethical and societal discussion is constantly an important problem. What confidentiality model should form the basis for the architecture, how should security be organised, who should be able to view or edit the dossiers? The healthcare domain is highly fragmented. The government, hospitals, doctors' associations, patients' associations and insurance companies all have their own interests, approaches and views. How can these differences be reconciled in designs, and how can product innovations and system transitions be facilitated?

Backgrounds and considerations

The great societal potential of research and innovation is becoming more and more apparent. Tapping into that potential can improve the quality of society and of people's lives. When it comes to solving global problems in food supplies, health, safety, housing and transport, and to promoting sustainable economic development in general, people have great expectations from technology and science. As such, this issue is high on political and societal agendas around the world. In the Netherlands, the government hopes to give a fresh impulse to research, innovation and the application of their results. However, the government also faces an important challenge in ensuring that that impulse is firmly embedded in society. Questions about such issues as safety, health, privacy, responsibility and research direction in areas like genetics, nanotechnology, nuclear energy and the Internet demand serious attention. Considering the solutions that technological and scientific know-how is capable offering for societal issues and problems, it is important to examine their ethical and societal aspects. This will result in improved innovation projects and the best possible use of the opportunities that appear. Opportunities will certainly be missed, or not used properly, if people fail to understand or reflect upon those aspects. At the same time, failure to examine ethical and societal issues may cause serious harm to people's faith in science.

Expanding and renewing

Exploring ethical and societal aspects of technological development goes back several decades. For example, those aspects have been studied and debated as part of various forms of technology and impact assessments. Ethical aspects have also been mapped out and analysed. The thematic programme Responsible Innovation (abbreviated to 'MVI', from the Dutch *Maatschappelijk Verantwoord Innoveren*) expands on the knowledge gained during those lines of research. At the same time, however, it places a strong focus on the recent development that has become apparent in various places in this type of research: more proactive, with closer ties between the humanities, social and technological sciences, integrated into the technological development process, aimed at valorisation, and with an emphatically international quality.

Example: biofuels and food production

To help slow down the greenhouse effect, the EU intends for 10% of the energy supply for transport to come from biofuels by 2020. Achieving this target requires scientific and technological innovations, as the current generation of biofuels in fact only offer disadvantages. The most fundamental problem is that their production competes with food production. Only second-generation biofuels will meet sustainability standards, but these are not expected to be commercially available for 5 to 10 more years. Under what conditions is it justifiable and acceptable to produce biofuels? How can regulations and controls on that production be given shape? How can biofuels be developed that meet local requirements (such as in developing countries)?

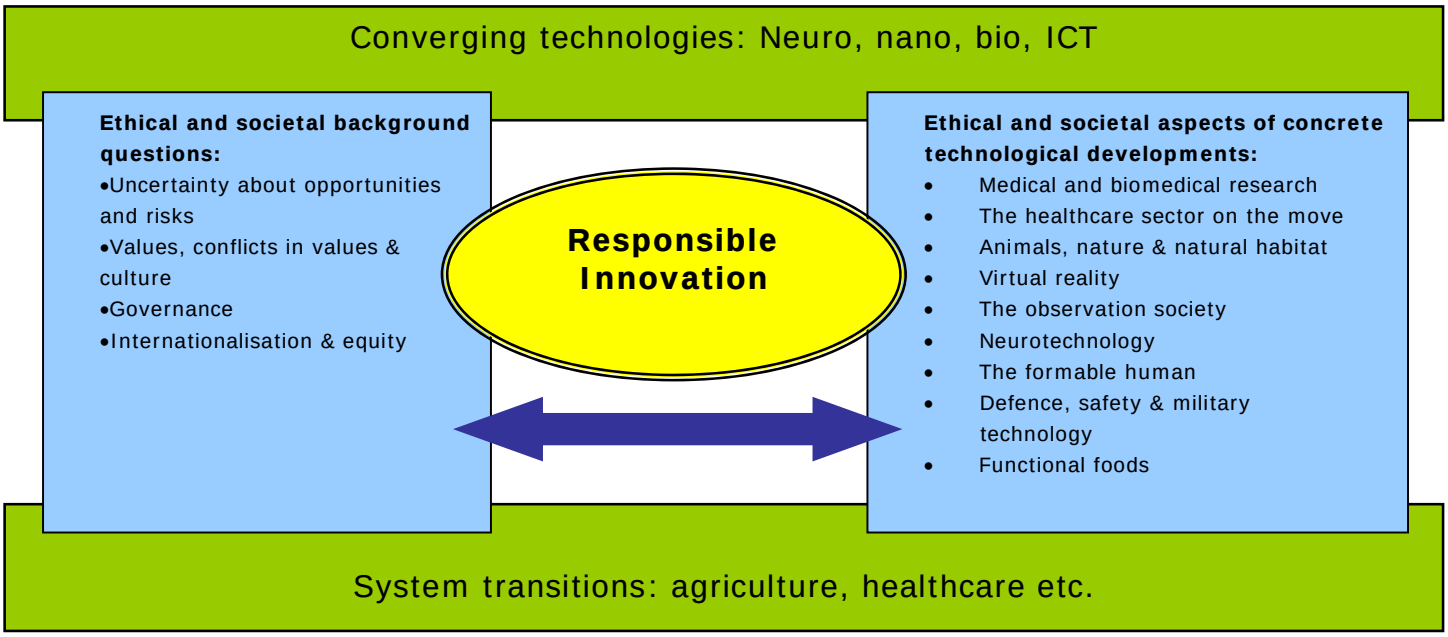
Objective and definition

The thematic programme MVI focuses on issues concerning technological developments for which it is reasonable to suspect that they will have a significant impact (whether positive or negative) on people and/or society. On the one hand, those developments concern new technologies (such as ICT, nanotechnology, biotechnology and neural sciences), and on the other, technological systems in transition (for example agriculture and healthcare). The programme contributes to responsible innovation by increasing the scope and depth of research into societal and ethical aspects of science and technology. It focuses on proactive research into the ethical and societal aspects of technological development projects, and explicitly draws attention to the international perspective. The programme emphatically involves not only Dutch

innovation projects, but also innovation projects in other countries or parts of the world, and in particular in developing countries. Intensive collaboration between researchers in the humanities, technological and social sciences is one of the principal cornerstones of the programme. A strong emphasis is also places on valorisation of the research.

Programme framework

Research into the ethical and societal aspects of concrete technological developments is incorporated into innovation projects and combined with research into more general issues. The research agenda has been defined in consultation with the ministries participating.



Partnership

The theme of 'Responsible Innovation' (abbreviated to MVI) is one of NWO's thirteen themes. These themes are multidisciplinary research programmes covering research questions in both scientifically and societally relevant current issues.

The MVI thematic programme is a partnership between NWO (divisions for Humanities and Societal and Behavioural Sciences, WOTRO Science for Global Development, Technology Foundation STW and ZonMw) and the Ministries of the Interior and Kingdom Relations; Foreign Affairs; Defence; Agriculture, Nature and Food Quality; Education, Culture and Science; Health, Welfare and Sport.

1. Responsible Innovation

1.1 Introduction

As the 21st century begins, technological innovation and innovative scientific research are high on political and societal agendas around the world. Groundbreaking research and new technologies are viewed as an important source for economic growth. The Dutch government hopes to give a new impulse to innovation in science and technology and to the application of the results.

The great societal potential of research and innovation is becoming more and more apparent. During the decades to come, the NBIC disciplines, as they are known (Nanotechnology, Biotechnology, ICT and Cogni-neurosciences), and the convergence between them will become central in that respect. Applying technological and scientific know-how will improve the quality of society, as well as the quality of people's lives. When it comes to solving global problems in food supplies, health, safety, housing and transport, people have great expectations from technology and science.

Example: virtual reality

Until recently, virtual reality seemed no more than a form of entertainment. However, cyber worlds have grown into a unique phenomenon, in which the effects of virtual and real behaviour and events overlap and influence one another. This gives rise to a whole series of questions. For example: Should actions that we censure offline – such as theft - be combated using legal (or other) measures in virtual form? How can people's privacy be protected in virtual worlds, both internally and in relation to the 'real' world, and what is the relationship in terms of enforcement? How should the virtual world be governed, and does it have democracy? Do fundamental cyber rights and values exist, such as non-discrimination, freedom of speech, the right to privacy and anonymity? See also §3.2.4.

However, ensuring that technological and scientific know-how is firmly embedded in society presents a formidable challenge. During the second half of the last century, biotechnology, the chemical industry, information and communication technology, food technology, medical technology, energy supplies and transport systems, construction and spatial planning led to scientific and technical breakthroughs and fruitful societal applications. However, they also often caused societal unease and public debates. Problems of safety, health, privacy, responsibility and control of research into genetics, nanotechnology, nuclear energy and the Internet are still very pressing. The unease and debates can be explained by the fact that the modern technology permeates deeply into all areas and sectors of society, and that technological developments will have a great impact on people's lives.

Considering the solutions that technological and scientific know-how is capable of offering for societal issues and problems, it is important to examine their ethical and societal aspects. The research will lead to improvements in innovation projects: they identify the choices underlying possible innovation projects, and the societal and ethical contexts that are needed to ensure the success of those innovation projects. Responsible innovation projects will certainly be missed if people fail to understand or reflect upon the ethical and societal aspects. At the same time, such failure may cause serious harm to people's faith in science and technology.

Example: human enhancement

Enhancement involves applying interventions - not in a therapeutic context, although a gray area exists - aimed at improving the workings of a person's body, brain and nervous system. This gives rise to questions of principles and norms about what the ideal human is. However, practical normative questions can also be asked, in relation to issues of fair competition in sports, at school and on the work floor. It is also unclear who is responsible for developments in the area of human enhancement. And how far may government departments go in enhancing 'their' militaries, fire services, police? Enhancement may allow such professionals to perform their duties better – but will those improvements not come at the expense of individuality and personal autonomy? See also §§3.2.7 and 3.2.8.

1.2 Brief history

Exploring the ethical and societal aspects of science and technology goes back several decades. Societal aspects have been researched and debated in assessments in various forms, such as technology assessment (TA, in variants such as constructive and participative technology assessment) and impact assessments (including societal and economic impact assessments, risk analyses). In addition, ethical aspects of science and technology have been mapped out and analysed, for example during research into Ethical, Legal and Social Aspects (known as ELSA research).

One familiar example of a technological development that resulted in exploratory activities is nuclear energy. The process of controlling the nuclear fission concept started during a war situation. Mainly because of its use by the US to end the Second World War, and the enormous impact that that use had, the world was highly critical about the application of the know-how in this area. The US government promoted peaceful use of nuclear energy through the Atoms for Peace programme. In part because of the critical attitude adopted by many people with regard to nuclear energy, right from the start of the development people were performing analyses of the risks, the way the risks were perceived, the costs and the benefits. In the 1980s, following a series of incidents, the discussion began again including, in the Netherlands, the broad societal discussion about energy supplies (1981-1983). An important part of that discussion revolved around energy scenarios. In recent decades, many countries have analysed the safest ways of storing nuclear waste and have organised debates about the conditions under which storing that nuclear waste would be acceptable to society.
With nuclear energy, research and the societal innovation process developed relatively independently from one another, and the contextual questions (e.g. energy scenarios) and normative questions were also generally unrelated. The current trend is to adopt a more integrated and systemised approach to contextual and normative questions. One example that can be put forward is research into change processes in the field of agriculture.

With biotechnology, the researchers who tried to combine DNA noted themselves that it gave rise to potential safety-related difficulties. As a result, regulations and standards for dealing with particular sensitive applications were introduced at an early stage. The development was accompanied by ethical analyses and the formation of ethical committees. Several applications in the field of medicine became embedded relatively effortlessly. This was particularly the case in situations where the benefits were high, the risks minor and the normative implications of a particular application were not considered to be far-reaching. One example is human-identical insulin, obtained using genetically modified bacteria. In situations in which certain groups judged the benefits to society to be slight, embedding proved much more problematic, for example genetically modified maize. In biotechnology, most attention has been devoted to potential risks of application and to normative considerations in development. Relatively less focus has been given to the context surrounding the developments, such as the reasons why the debates about biotechnology in medicine and in agriculture are entirely different.

A third example is ICT, where for a long time societal analyses dealt mostly with privacy, and much less with the contexts in which ICT was to be applied. For example, the system of electronic patient dossiers is still plagued by a lack of understanding of the context in which it is to be used.

1.3 Expanding and renewing

The thematic programme Responsible Innovation (MVI) ties in with know-how and experience already gained and with research currently being conducted in this field. At the same time, the approach adopted means that the programme will focus on the issues where more is needed, and indeed possible. The innovative and distinctive elements of the MVI thematic programme lie in the emphasis that is placed on:

- *Interaction between research in humanities, technological and social sciences*. Contributions from all these fields are needed in order to ensure responsible innovation in science and technology as envisioned in this programme;
- *Proactive planning*. The programme has an explicitly proactive dimension or ‘make’ perspective: right from the start, the envisioned research, development and preliminary and final designs must incorporate relevant ethical

and social aspects. MVI research should not only result in an analysis and understanding of a particular problem, but subsequently also lead to a 'design perspective' – in the broad sense, including institutional arrangements;

- *International orientation*. The programme has an international orientation and context: it emphatically involves not only Dutch innovation projects, but also innovation projects in other countries or parts of the world. The research explicitly devotes attention to the global context and aspects, and in particular those that are relevant to developing countries;
- *Valorisation*. The valorisation of the research will receive a great deal of attention, both at the level of the programme and at the level of the individual projects.

The theme of 'Responsible Innovation' (abbreviated to MVI) is one of NWO's thirteen themes. Those themes are multidisciplinary research programmes concentrating on matters that are current, with both scientific and societal relevance.

1.4 Ambition and primary objective

The thematic programme MVI is aimed at the systematic ethical and societal research of scientific and technological issues for which it is reasonable to suspect that they will have a dramatic impact (whether positive or negative) on people and/or society.
The concept of innovation pertains both to the introduction of new products, processes and services and to organisational and societal renewal. This programme description defines innovation primarily as the use of application of the results of science and technology. Responsible innovation concerns research, development and design, and takes societal values, interests, needs, rights and welfare into consideration. The programme's ambition is expressed in its title: Responsible Innovation. By performing ethical and societal examinations of science and technology, the programme will contribute to responsible innovation.
The programme's primary objective is to expand the scope of technological research, development and innovation[1]. The word ‘technological’, in conjunction with ‘projects’, ‘developments’, ‘systems’ (etc.) should be interpreted in the broad sense. It pertains to the entire field covered by the natural sciences and technology. These projects explicitly do not concern technological developments in the strictest sense, but socio-technical, multi-actor systems. More and more often, those systems structure the conduct of actors, including their moral conduct. That goes for professional contexts in particular. As such, socio-technical systems represent a collection of opportunities and hindrances for people's and society's actions, ways of thinking, experiences and approval.

The emphasis will be on the MVI thematic programme (see also §2.6):

(i) research related to new technological developments, such as biotechnology and medical technology, nanotechnology, ICT, genomics and neurosciences, etc.;
(ii) research into transition processes: change processes in existing technological systems such as agriculture, healthcare and production processes.

Research into the ethical and societal aspects of concrete technological developments is incorporated into innovation projects and combined with research into more general issues that frequently appear in research into ethical and societal aspects of science and technology (see also §2.5).

[1] This choice implies that the various actors involved in innovation, such as scientific researchers or enterprises, are not the central factors in the MVI programme.

1.5 Valorisation

Utilising the research results is one of the main priorities in the MVI thematic programme. The aim is to ensure that the research actually contributes to innovation. The valorisation will be realised in various ways:
- The projects in which research is conducted into the ethical and societal aspects of concrete technological developments (see also §2.6) must include a 'make' perspective. This means that those projects not only result in an analysis and understanding of a particular problem, but subsequently also lead to a 'design perspective' – in the broad sense, including institutional arrangements. This centres around the question of what should be done to ensure ethical and socially responsible innovation.
- Each project includes a valorisation plan and a valorisation panel. The members of the valorisation panels will be users or prospective users, people who are prepared to valorise and expand the scope of the research results among the market they represent, and a contact from one of the participating ministries. That panel will be involved with the details, from the preliminary application until the detailed submission, and will remain involved in the project for its entire duration. The valorisation plan is aimed at the contribution and use of relevant research results by societal partners or stakeholders within and outside the established scientific community.
- At the level of the programme as a whole, the steering committee will develop activities with the programme's valorisation in mind. Possibilities include publishing a magazine for a broad audience, setting up publicity activities such as lectures, conferences and workshops, creating productions for educational television, preparing materials for education (such as teaching letters) etc., etc.

The committee will devote specific attention to ensuring that the results of the research into Dutch innovation projects are made available outside the Netherlands as well, focusing especially on less developed countries. The reverse is also important: results of research into innovation projects in other countries or parts of the world should be available not only there, but in the Netherlands too.

1.6 Promoting innovation

Research of ethical aspects of science and technology should not be confused with a moralistic, generally external judgment of 'responsible' versus 'irresponsible'. Ethics is the scientific study of moral values and of considerations based on those values (such as autonomy, responsibility, privacy, safety and care for the environment). Ethical analysis articulates standards and values, clarifies implicit conceptual confusions and exposes conflicting standards and values. Ethical analysis and societal exploration complement one another. The legal, societal, psychological and economic aspects of science and technology cannot be ignored, nor can the reflection upon the position of science, technology and technological systems in society. This means that such an exploration always involves research into social and psychological context questions and into effects on the wellbeing, health and autonomy of users.

Many people, including science/technological scientists and policy advisers, mistakenly believe that thinking about societal and ethical aspects of new technology almost automatically leads to promising research being cancelled and opportunities being let slide. The MVI thematic programme explicitly presents a different view: the research of ethical and societal aspects are intended to provide a constructive contribution to responsible innovations.

Example: smart cameras
Nowadays, cameras are everywhere in the public space. Some people are concerned that our privacy is at risk. Yet at the same time we also want safe surroundings. So what do we choose? Safety or privacy? Get rid of the cameras or put up more? Or … do we try to develop 'smart' cameras? Cameras that are made possible by innovative technology and that can embody the values of safety and privacy simultaneously. For example because the technology has a smart way of selectively processing data, or because of the way in which access to privacy-sensitive information is already an element of the technology itself. See also §3.2.5, about the observation society.

1.7 Interaction between research into humanities, technological and social sciences

Considering the programme's ambition to make a contribution to responsible innovation, the partnership and exchange of research results between research in the areas of science/technology, humanities and social sciences is a vital factor. This involves:

(i) Science and technology researchers (in the broadest sense, including medical scientists);

(ii) Humanities researchers: these will be primarily ethicists and philosophers (practical philosophy and philosophy of science and technology), but contributions from other disciplines are also possible (such as general history and history of science);

(iii) Social science researchers, or social and behavioural scientists: On the one hand, these might be researchers from more traditional disciplines such as sociology, law, economics and psychology, and on the other researchers from the 'interdisciplines', who contribute to reflections on the position of science, technology and technological systems in society.

The interaction between humanities, science/technology and social science will also allow the MVI thematic programme to increase the understanding of the interactions between and co-evolution of science, technology and society.

The interaction in the MVI thematic programme will target these three fields together. Explicit and emphatic cooperation between humanities experts and social scientists will also be an area of attention. The three fields will have different positions and contributions. Science/technological research and innovation are the direct reason for social and behavioural scientists and humanities experts to study societal and ethical aspects. Humanities and social science research into the ethical and societal aspects of research and innovation will require input and involvement from science/technological researchers throughout the entire project. The input from science/technology can be given shape at several levels of abstraction, varying from – for example – participation by a laboratory or R&D department that is working on a very concrete technological product (such as the development of a new type of observation camera), to a contribution by a mathematician who is an expert in pattern recognition.

Various forms exist in which the interaction between science/technology, humanities and social science research can be realised in practice. For example, one method involves the researchers from the various fields working together at meetings or in workshops: whether progress meetings or gatherings to jointly write articles or to exchange preliminary versions of papers. Another method is for technical scientists to be offered time and space (e.g. a period of three months) to work with researchers in the humanities and social sciences to integrate knowledge of the societal aspects of their research and publish their findings. A third example is the method in which technical scientists invite humanities experts and social scientists to conduct an exploration of specific aspects of their research.

Which form is most appropriate depends largely on the research and its contents, and as such will differ from one project to the next. In many cases, a combination of methods will be used. However, this does not alter the fact that success hinges on a number of conditions:

- substantive independence, meaning that the researchers from the various fields do not depend on the input of the other researchers for their own particular work;
- value and added value of the deliverables. The results achieved in all areas must have value;
- sufficient time for all participating researchers to interact, including the technical scientists. The budget must offer sufficient financial scope in this regard;
- sufficient research experience on the part of the participants. If a project includes one or more trainee research assistants, their supervision will demand extra care and attention. In more general terms, the researchers must be suited to working on multidisciplinary projects;
- a coordinating role for the project leader. The project leader is responsible for coordinating the joint activities and integrating the various results. He or she must be available to discuss the interaction throughout the duration of the project;
- a detailed working plan that explicitly incorporates the interaction.

Applications should explain how the interaction between science/technology, humanities and social science research will be given shape. In order to facilitate the coordinating tasks relating to the interaction and internal communications, the research proposals may request a budget. Unlike many other initiatives, a budget may also be requested for the input of the science/technology and technological scientists in the project.

At the start of the programme, researchers in the fields of science/technology, the humanities and social sciences will be brought together at meetings. The purpose of those meetings is to allow them to submit joint applications. Annual meetings will be organised to exchange experiences with the interaction between science/technology, the humanities and social sciences. In addition, the researchers will be asked to present their findings in joint papers. Users, prospective users and stakeholders will be invited to those presentations.

2. Research

2.1 General

The *objective* of the research in the MVI thematic programme is to increase the scope of research, development and innovation projects by adding an ethical and societal research, and so to contribute to responsible innovation. The inclusion of an ethical and societal will be integrated into the technological development process. As such, research, development and innovation projects constitute *the motivation* or the starting point of the research. Those projects anticipate what is possible and what is desirable.

2.2 Gaps

The research within the programme may tie in with know-how previously developed and information obtained in these areas. For example, a great deal of know-how is available in the fields of innovation and product development, research & development and design[2]. Similarly, a lot is known about the debate and decisions concerning the way in which new science and technology (particularly nuclear energy, biotechnology and ICT) are embedded in society. Yet the know-how already acquired about embedding science and technology in society, on the one hand, and about research, development and innovation projects on the other is not being integrated. This stems from a series of complex issues, each of which in turn has multiple aspects, such as:

- *Multi-actor character of innovation*: a large number of different parties are involved, such as researchers (humanities, technological and social sciences), society, industry, policymakers, legal experts, etc. The roles are not always clear, and moreover are subject to change;
- *Public values* (safety, care for the environment, sustainability, privacy, security, autonomy, legal compliance, etc.) play a major part in the acceptance of innovation. With new sciences and technologies, the public values often have yet to be articulated. At the same time, public values are defined differently by different groups, and their interpretations may change over time;
- *Uncertainty*: anyone involved in innovation faces the difficulties of a limited amount of know-how and of acting in uncertainty. That uncertainty can take a wide variety of shapes. For example, uncertainty exists about the further development following a specific innovation (for example in the pharmaceutical sector) or about the impact that such an innovation may have on such matters as lifestyle, or about societal controllability, but also about the approach to be adopted;
- *Responsibility:* it is often unclear who is responsible for what tasks. In addition, innovation projects cause responsibilities to shift. For example, selling functional foods means that supermarkets also bear a degree of medical responsibility. Lack of clarity in the division of responsibilities is a problem because the pressure on people to justify themselves and the demand for transparency and accountability in these respects are increasing all the time.
- *Unforeseen consequences* to which technology contributes, such as the implications of the use of biotechnology in less developed countries for Europe and the rest of the world.

The MVI thematic programme targets gaps in the research carried out to date, namely:

i) integration of the various aspects and issues involved in ensuring that technological processes become embedded in society, and

ii) anticipation of further developments, and in particular societal and ethical issues that may become important.

Understanding these areas will make it possible to realise development projects with a broader scope.

[2] See for example Fagerberg, J. (2004/2006), Tidd, J. et al. (2003) and Tushman, M.L. & P.C. Anderson (2004).

2.3 Relevant aspects

Traditionally, in the ethical and societal research of technological developments, new research projects are checked for a wide range of aspects. The table below lists those questions and aspects. It also gives an indication of the scope covered by the MVI thematic programme. The projects within the programme will each cover part of that broad scope.

I. Opportunities for	• What is the starting situation? • What are the possibilities for scientific innovation? • What commercial applications are possible? • What will the impact be on the existing competition? • What impact will this research and its results have on people's wellbeing and quality of life? • What developments are taking place internationally?
II. Risks & uncertainty	• What are the risks in terms of health, the environment/nature, societal wellbeing/cohesion, public order and safety? • What will the financial implications of success or failure be? What commercial consequences will there be? • What is the economic impact? • What are the political risks in terms of (1) national security and (2) continuity of organisations and (3) international relations? • Can the technology be monitored properly and controlled in society? • Will the technology affect the fundamental assumptions and organisational principles of society?
III. Standards and values	• Does this technology meet the prevailing criteria of ethical and legal tests for research and product development? • Will standards and values change as a result of these developments? • To what degree can and should the standards and values of other cultures be taken into consideration? In what way? • Is the technology acceptable to the domestic and international society?
IV. Sustainable development	• In what way can sustainability requirements and standardisation be institutionalised? • In what way will sectors and regimes shift as a result of the new technology (and policies)? • Are the standards for such factors as toxicity still sufficient for the new technologies?
V. Justice	• How will the new technology affect the balance between private and general interests? • What consequences will the technology have in terms of fair apportionment and equality in society, both nationally and internationally? • Will the technology threaten the solidarity between people? • Will certain groups of society be asked to make sacrifices (reasonable or unreasonable)? • Will certain groups need to be compensated as a result of the introduction and the use of the technology?
VI. Governance	• What commercial interests have to be factored in? What are the political interests? • Is another line of research and innovation possible? • Do the existing regulations suffice, or should new regulations be introduced? • Who will be responsible for controlling, monitoring and guiding this technology? In what way will monitoring and evaluation be organised? Who will be responsible for supervision, quality, safety, etc.? • In what way will decisions be made and democratic controls be organised? Will it be possible to allow users and stakeholders to participate/have input?

2.4 International orientation

The MVI thematic programme has an explicit international orientation and context: the questions and problems addressed by the programme are international questions and problems. The programme explicitly devotes attention to the global context and aspects, and in particular those that are relevant to developing countries; The emphasis on the international dimension is expressed firstly in the way in which the research is structured. Most projects are organised based on an international orientation and context, allowing room for international comparisons. Alternatively, the possibility exists to research issues that are specific to a particular country or part of the world: either the Netherlands (although it should be noted that in many cases the laws and regulations will require that the research be placed in a European framework), another Western country/area or a country/area in another continent, particularly less developed countries or areas.
The emphasis on the international dimension is also expressed in background questions concerning internationalisation and equity (see §3.1.4).

2.5 Ethical and societal background questions, ethical and societal aspects of concrete technological developments

The integration of aspects and issues will depend in part on the nature and societal context of the research and innovation projects, and as such will also start with those projects. There are two main lines of research.

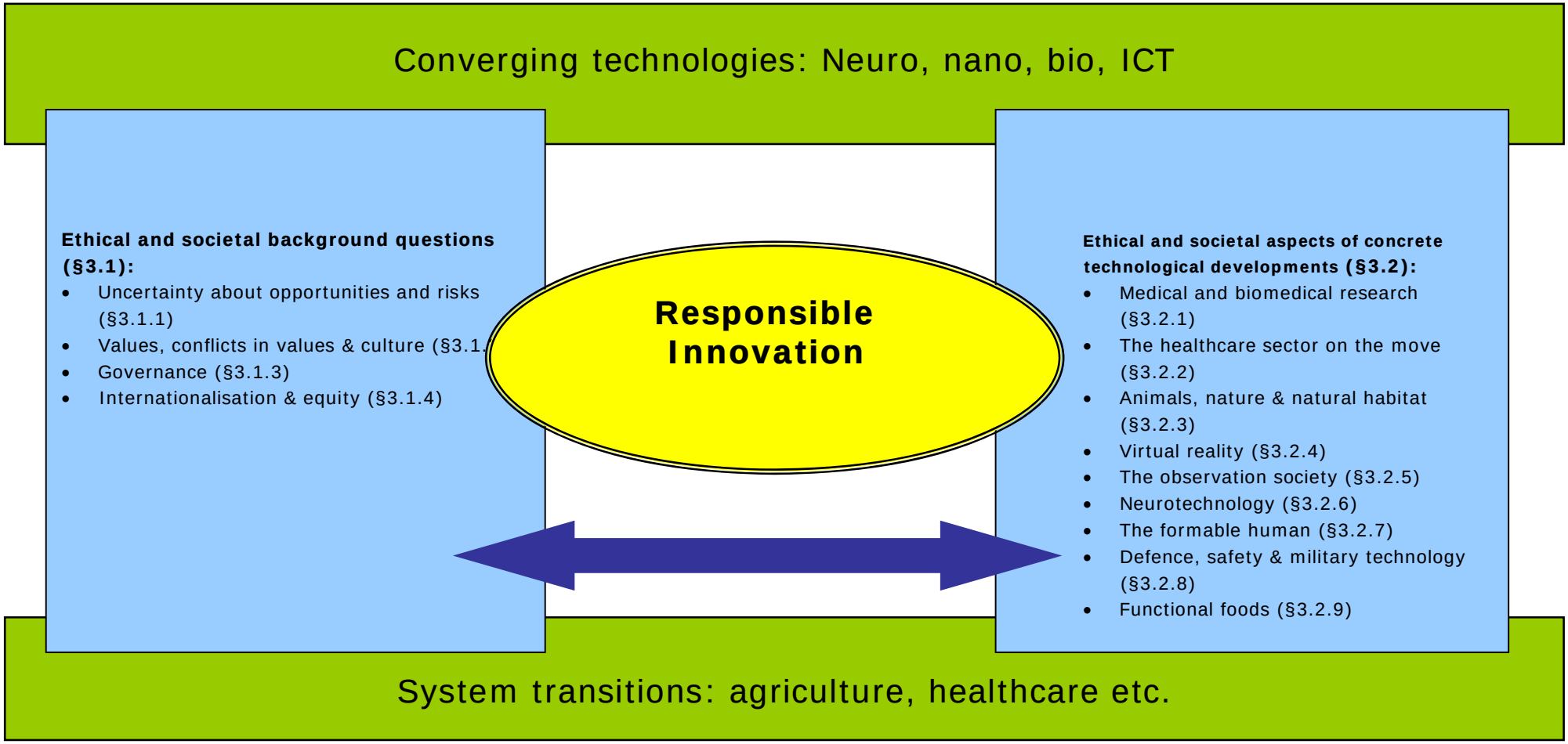
1. *Research into the ethical and societal aspects of concrete technological developments* in order to expand the scope of research and innovation projects (questions of expanded scope). This type of research is proactive: right from the start, the envisioned research, development and preliminary and final designs must incorporate relevant ethical and social aspects[3]. Research into the concrete technological developments can and must stem from general questions that are researched as such and are then linked back to the research and innovation projects.
2. *Research into ethical and societal background questions*. Those questions concern research into more general issues that often arise in research into ethical and societal aspects of science and technology.

Research into the ethical and societal aspects of concrete technological developments will involve researchers from the humanities, science/technology and social sciences. Their substantive input is essential for ensuring that it will be possible to apply the results to follow-up research and innovation. In research into ethical and societal background questions, input from science/technology researchers will consist primarily of input in terms of structure, supervision and dissemination of that research.
The formula adopted, with research into the ethical and societal aspects of concrete technological developments being incorporated into technological projects and combined with research into the ethical and societal background questions, is essential to the MVI thematic programme. The background research will form the basis from which the technological projects will profit. That is also the principal reason to include research into the ethical and societal aspects of multiple technological developments in a single programme.
These principal themes form the basis for the research agenda, prepared in consultation with the participating ministries. A diagram is included on the next page, representing the MVI agenda. That diagram is explained in brief in §2.6.

2.6 Notes to the research agenda

The MVI thematic programme concentrates on new and converging technologies, on the one hand, and on system transitions on the other. There are two main lines of research: on the one hand, research into ethical and societal background questions, and on the other research into the ethical and societal aspects of concrete technological developments. Those themes are briefly explained below. Chapter 3 sets out the research agenda.

[3] This proactive dimension may include the preliminary design phase, in which the hypothetical idea has not yet been translated into a concrete design for research. An example of such a preliminary design phase is research into intervention in the human germline (acts involving reproductive cells and embryos). See also Olsthoom-Heim E.T.M., G.M.W.R. de Wert & H.B. Winter (2006). *Evaluatie embryowet*, Reeks evaluatieregelgeving 20, The Hague: ZonMw.


Converging technologies: Neuro, nano, bio, ICT
Ethical and societal background questions (§3.1):
Uncertainty about opportunities and risks (§3.1.1)
Values, conflicts in values & culture (§3.1.
Governance (§3.1.3)
Internationalisation & equity (§3.1.4)
Responsible Innovation
Ethical and societal aspects of concrete technological developments (§3.2):
Medical and biomedical research (§3.2.1)
The healthcare sector on the move (§3.2.2)
Animals, nature & natural habitat (§3.2.3)
Virtual reality (§3.2.4)
The observation society (§3.2.5)
Neurotechnology (§3.2.6)
The formable human (§3.2.7)
Defence, safety & military technology (§3.2.8)
Functional foods (§3.2.9)
System transitions: agriculture, healthcare etc.

Converging technologies

During the coming years, important developments are expected to emerge rapidly in the area of what are referred to as the 'converging technologies' (neuro, nano, biotechnology and ICT). At the same time, it is in precisely in the application of these technologies that pressing ethical and societal questions are being asked. For example, new ICT is making datamining increasingly simple for businesses. But do the profiles generated by that technology not increase the possibility that certain groups will be discriminated?

System transitions

Besides the more 'traditional' innovation that concerns products, services and production processes, more and more innovation deals with transforming complete socioeconomic systems. Technology is not only hardware, but is always linked to socioeconomic systems and institutional arrangements. These system environments often possess structural features that ensure that problems can only be resolved if the entire system environment is redesigned. For example, in the healthcare sector, doctors are increasingly working as part of a complex system that imposes all manner of conditions and gives rise to questions about who is responsible, while the approaches adopted in developing countries still do not take sufficient account of the system conditions.

Ethical and societal background questions:

Some ethical and societal background questions arise again and again in relation to converging technologies and system transitions. They may pertain to the fact that innovations offer opportunities, but also present risks and uncertainties, or to a conflict between different values, such as privacy and safety. Questions also arise about 'governance': who is responsible, what influence do policymakers and other actors have? Because of the emphasis on the international dimension in the MVI thematic programme, background questions about internationalisation and equity are also addressed. The aim of research within the MVI programme is to expand the scope of technological research, development and innovation. As such, research into ethical and societal background questions must tie in with current and emerging innovation processes. This means that that connection is a precondition, and is given shape by ensuring that the research is linked to or embedded in one or more concrete technological cases.

Ethical and societal aspects of concrete technological developments

Large numbers of developments are taking place in the field of converging technologies and system transitions. The group defining the agenda had to choose among all these different established and emerging innovation projects. In a series of lengthy discussions and consultations, a number of themes were identified that are urgent and very important. For example, questions exist about 'human enhancement', stemming from a combination of developments surrounding the converging technologies.

Considering the programme's focus on expanding the scope of technological projects, research into the ethical and societal aspects of concrete technological developments should have a 'make' perspective. It not only results in an analysis and understanding of a particular problem, but subsequently also leads to a 'design perspective' – in the broad sense, including institutional arrangements. This centres around the question of what should be done to ensure responsible innovation.

Programme unity

The projects in the MVI thematic programme will, therefore, focus on themes that are linked to multiple innovation projects. The cohesion between those projects lies in i) the 'make' or designer perspective to which they should lead, while unity and cohesion in the programme is also created by ii) the research into the ethical and societal background questions that continually arise in connection with converging technologies and system transitions. This means that that research will be relevant to the projects targeting the ethical and societal aspects of concrete technological developments. When the MVI thematic programme comes to an end, a closing study will be conducted to provide a summary of the results and of the correlation between the individual projects. The programme's international dimension will also receive explicit attention. Workshops will be organised throughout the programme's duration to present and discuss the preliminary research results, to ensure that the other projects can also utilise those results (see also §4.5).

3. The research agenda

3.1 Ethical and societal background questions

The aim of research within the MVI programme is to expand the scope of technological research, development and innovation. As such, research into ethical and societal background questions must tie in with current and emerging innovation processes. This means that that connection is a precondition, and is given shape by ensuring that the research is linked to or embedded in one or more concrete technological cases.

3.1.1 Uncertainty about opportunities and risks

New technology and innovations offer unprecedented opportunities and possibilities. At the same time, technology is also an important factor in today's 'risk society', both as an instrument for creating solutions (to map out and limit risks) and as a cause of problems (for example GMOs and mobile telecommunications masts that lead to societal and political unrest). During the past two decades, the debate about risks and risk management has faced four important developments, whose mutual dynamics caused risk regulations to become increasingly complex:

- New technologies with potentially disastrous and irreversible external implications for which non-proliferation is difficult to realise;
- Other interests besides health are increasingly being considered (particularly ethics, aesthetics, global socioeconomic relations);
- Liberalisation of global trade;
- Growing need for certainty and risk exclusion.

New qualitative interests that are expressed in risk systems are culture-specific, and as such regulation systems should include sufficient options for expressing culturally specific elements. These last two developments in fact mean that risks are dealt with using simpler and more harmonious means. The two forces meet one another in various international forums (such as the EU and the WTO) and cause friction.

These conflicts logically give rise to societal and ethical questions. How should the way in which people deal with uncertainty about opportunities and risks be given shape institutionally and procedurally, for example? Institutional questions include the manner in which and the degree to which scientific advice should be incorporated into the democratic process and legitimised. In a global context, questions about risk control and regulation are obviously even more urgent. This applies not only to questions of legitimacy, but also to the problems of globalisation on the one hand versus culture-specific interpretation of opportunities, risks and risk perception on the other. Various social science issues naturally also exist. How 'risky' is the risk society in actual fact? Why are opportunities not seized? Are the risks at the forefront of the societal and political debate (such as the threat of terrorism, airplane safety, climate change and genetic manipulation) in fact also the greatest risks? Do regulation measures help to actually limit risks, or do they serve more to increase people's sense of security? What is the relationship between risks and risk perception? And which of the two is actually more important?

From the point of view of innovation, the need for too much certainty should also be questioned: uncertainty is not by definition a bad thing, but can in fact stimulate innovation and creativity. Against that background, research needs to be conducted into legal, psychological, economic and social mechanisms for dealing with uncertainty: in what way could society, at the micro level, but also at the macro level, utilise uncertainty and limit risk avoiding conduct in order to stimulate innovation, without creating societally irresponsible risks?

Examples of themes and possible research aspects

- Medical and biomedical research (§3.2.1)
- The formable human (§3.2.7)

However, other areas of application are also possible. Possible aspects in this research:

Opportunities:

- What is the starting situation?
- What are the possibilities for scientific innovation? What commercial applications are possible?
- What will the impact be on the existing competition and the international relations?
- What impact will this research and its results have on people's wellbeing and quality of life?

Risks and uncertainty:

- What are the risks in terms of health, the environment/nature, societal wellbeing/cohesion, public order and safety?
- What will the financial and/or commercial implications of success or failure be? What is the economic impact?
- What are the political risks in terms of (1) national security and (2) continuity of organisations?
- Can the technology be monitored properly and controlled in society?
- Will the technology affect the fundamental assumptions and organisational principles of society?

3.1.2 Values, conflicts in values & culture

On the one hand, technology influences our values and our culture, for example the way we think about the good life. On the other, all manner of values are incorporated explicitly or implicitly into technology. Modern societies are also characterised by value pluralism. Different values have the same cultural and historical origins, while some values have other origins. Those values may conflict, be wholly at odds with one another, or simply disagree with each other. Differences of opinion may arise about interpretation, application and priorities in practical, ethical and societal disputes. For example, sustainability may conflict with economic growth, or privacy with safety, or privacy with transparency, or efficiency with accountability. When values conflict, the challenge is for innovation projects to properly reflect both sides, for example privacy and safety in the case of observation technology. One way in which this can be achieved is by developing ‘smart camera’s’.

Examples of themes and possible research aspects

- The healthcare sector on the move (§3.2.2)
- The observation society (§3.2.5)

However, other areas of application are also possible. Possible aspects in this research:

Standards and values

- Is the technology acceptable to society? Does this technology meet the prevailing criteria of ethical and legal tests for research and product development? Will standards and values change as a result of these developments?
- Does MVI imply certain societal or moral values?
- To what degree can ‘value sensitive design’ offer solutions that properly reflect all conflicting values in design choices?

Sustainability (example of a value):

- In what way can sustainability requirements and standardisation be institutionalised?

Justice (example of a value):

- How will the new technology affect the balance between private and general interests? What consequences will the technology have in terms of fair apportionment and equality in society?
- Will certain groups of society be asked to make sacrifices (reasonable or unreasonable)? Will the technology threaten the solidarity between people?
- Will certain groups need to be compensated as a result of the introduction and the use of the technology?

Etcetera for other values, such as safety and privacy.

3.1.3 Governance

The theme of ‘governance’ is already being studied at length. Little attention is being paid, however, to applied science and technology: their impact on governance and – reversely - the governance of that technology.

Two movements reinforce one another. On the one hand, governments are delegating more. They propagate market forces, and often see governance in terms of self-regulation. The government's task is to monitor the situation and intervene if necessary. On the other hand, actors involved in innovation are prepared to consider broader issues – issues that fall beyond the scope of their direct business or other interests. The MVI thematic programme wishes to promote innovative research into these mutually strengthening trends. How can they be evaluated (in normative terms) and adjusted if necessary?

Within the theme of governance, legal and conceptual issues also factor largely. For example, it is unclear what new technologies mean in terms of the constitution – can a right to privacy of correspondence be phrased in a technology-independent manner? Intellectual property (see insert) is another example of a current issue within this theme.

Examples of themes and possible research aspects

- Virtual reality (see §3.2.4)
- Intellectual property and biomedical innovations (see insert)

However, other areas of application are also possible. Possible aspects in research into *governance*:

- What commercial interests have to be factored in? What are the political interests?
- Is another line of research and innovation possible?
- Do the existing regulations suffice, or should new regulations be introduced?
- What are currently the principal obstacles to responsible innovation?
- Who will be responsible for controlling, monitoring and guiding this technology? In what way will monitoring and evaluation be organised? Who will be responsible for quality, safety, etc.?
- What does responsible innovation mean in terms of involving stakeholders? Which stakeholders? In what way can participation by and input from users and stakeholders in the technology be incorporated? In what way will decisions be made and democratic controls be organised?
- What part can legislation and the legal system play here? What changes will have to be made?
- In what way will sectors and regimes shift as a result of the new technology (and policies)?

Intellectual property and biomedical innovations

Nowadays, the value of innovation and the returns it generates do not lie in tangible objects (as during the industrial era) so much as in intangible concepts - knowledge of the human brain, know-how that furthers genetics, Internet applications, etc. In this age of information, however, we are still using assumptions, terms, control instruments and concepts from the physical era. For example, the legal and economic concept of 'property' is a crucial factor for companies to conduct business. Legally, however, property only pertains to physical and financial goods. Property in terms of personal data, of knowledge of the human body, etc. does not exist.

Another example is tissue engineering, which makes it possible to produce body-specific material and organs. As a result, we are faced with the question of what precisely the final outcome (newly produced body material) is: a medicine, a medical instrument, an organ. For the standards/requirements that apply to the reliability of that material, for example, or its acceptance by society, or the question of whether we can trade that material, or sell it, etc. (all matters relating to the responsible manner of dealing with these new technological possibilities), it is important to determine or define a clear concept of precisely what this new 'product' is.

3.1.4 Internationalisation & equity

The MVI thematic programme places a strong emphasis on the international dimension: both the European and the global context and aspects, and in particular those that are relevant to developing countries. The emphasis on the international dimension is expressed in the way in which the research is structured (see §2.6) and in background questions that have been placed on the research agenda. Those background questions concern internationalisation and equity. More specifically, they pertain to the technological developments and innovation on the one hand and to apportionment and equality in the world on the other.

Researchers in the field of 'global justice' regard the gap between poor (9/10 of the world owns 1/10 of the resources) and rich (the other way around) as ethically unacceptable. Technological development and innovation should serve to eliminate or reduce that gap, but definitely not increase it. This assumption gives rise to a whole range of issues that have to be researched and are far from being clear. How can that gap be eliminated (what development models?), how can the development of learning capacity (and as such the utilisation of knowledge and innovation) be improved, and who should make the decisions in this respect (global governance)? Who can be held responsible for the outcome? How do the developing countries handle questions of apportionment, and what do they themselves do in this connection?

Pluralism of cultures, interdependencies and ideological, ethical and legal history differences have to be taken into account in this connection. It is also definitely important to be aware that technology is not only hardware, but is always culture-related and linked with social systems. International exchanges of technology also mean bringing about system transitions with stakeholders. But how, and what system?

Examples of themes and possible research aspects

- Animals, nature & natural habitat (see §3.2.3)
- Functional foods (see §3.2.9)

However, other areas of application are also possible. Possible aspects in this research:

- What are the practice, meaning and potential of responsible innovation in Europe and in a wider international context?
- What is the potential importance of specific innovation projects for international poverty reduction? Which are promising? In what way can poor countries (poorest groups) profit from knowledge development (both upstream and downstream)?
- How do relevant actors in other countries and cultures judge the ethical and societal aspects of those projects within their specific context? How can their standards and values be taken into account, and how can their priorities be carried through? In what way can innovation processes be embedded in local and supralocal systems, to allow the parties involved to benefit from them?
- What facilities, measures and arrangements in terms of policy and otherwise should be introduced to allow responsible innovation in developing countries? What are the implications of the technological developments for Dutch policy, both for development aid and in other areas?

3.2 Ethical and societal aspects of concrete technological developments

The aim of research within the MVI programme is to expand the scope of technological research, development and innovation. Research into the ethical and societal aspects of concrete technological developments often has to have a 'make' perspective. It not only results in an analysis and understanding of a particular problem, but subsequently also leads to a 'design perspective' – in the broad sense, including institutional arrangements. This centres around the question of what should be done to ensure ethical and socially responsible innovation.

3.2.1 Medical and biomedical research

Stem cell research

A great deal of interest is being devoted all around the world to research involving stem cells, and in particular research with human embryonic stem cells (hESC). Although developing cell therapy is the most visible objective, fundamental scientific research with hESC is also important, focusing at such matters as developing sickness models. However, using embryos as a source of hESC is controversial. In part because of that controversy, 'embryo-friendly' alternatives are being researched – many of which lead to ethical questions in their turn. Possible areas of further research are:

- In the development of 'embryo-friendly' alternatives, the primary focus is on what are known as 'embryo-like artefacts', such as 'parthenotes' and other embryo-like entities that are constructed in such a fashion as not to be viable. What do experts expect in terms of the applicability of such alternatives? What is the ontological and moral status of such entities? Are they in fact still embryos? Should they be protected from an ethical point of view, and if so, to what degree and why? What should this mean in terms of regulating embryo research?
- How should the creation of human-animal combinations be regarded, such as hybrids/cybrids and chimaeras, and in particular the 'human-to-animal embryonic chimaeras'? What research do research have in mind? Is that responsible in ethical and societal terms, and if so under what conditions?

Translational medicine

Medical research is increasing dramatically. Expectations are high in terms of ensuring that the rapid developments in molecular life sciences, imaging techniques and bioinformatics generate clinical applications, such as neurodegenerative disorders, cancer, cardio-vascular diseases, muscle diseases, and many other illnesses. More and more frequently, the question is being discussed of how to reduce the long through-time from laboratory to clinic. That discussion is conducted in a broader context referred to as 'translational medicine', which concerns the knowledge chain from 'bedside-to-bench' research, translating laboratory results to the medical practice. People everywhere are seeking ways to improve and speed up the connection from the rapid developments in molecular biology, biotechnology and imaging technologies to clinical research and the medical practice. This branch of medicine could make it possible to market new medicines faster, more efficiently and more cheaply (no more need

for the generally time-consuming trials). However, as matters stand, it mostly gives rise to questions: economic and legal questions about new medications and new applications for existing medications. Do the European regulations and the Dutch Medicines Act in fact allow for medicines to be marketed faster, for example? What is volume of cost savings can be realised? And, in more general terms, will the pharmaceutical companies actually be pleased with this development?

Shortening the development process calls for new methods for defining risks. That process of defining risks has both a scientific aspect – what methods exist for identifying risks? – and an important normative side. How do various stakeholders such as industry, researchers, clinical specialists and other medical experts, including patients and authorities, perceive the risks? What principles and standards are applied? How should we translate the various measures of results that are relevant to people's quality of life and social functioning? One example is the discussion about Alzheimer's, in which not only the parameters for measuring cognitive functions (and progress in those functions) are important, but also measures for social findings, namely social functioning in relationships with family members and care workers. Or rheumatology, where besides function restriction, aspects of quality of life that are important to patients, such as tiredness, play an important role.

More and more patients and their organisations are demanding a greater degree of involvement in scientific research, both in defining the agenda and priorities for research and in conducting the research (defining measures for results, recruiting patients, etc.). A large number of patients' organisations in the Netherlands and abroad are already participating in the research networks of industry, researchers and clinical centres. That involvement will become even more important when it comes to defining the different means to accelerate the development process. The question that has to be addressed is how the development of new medicines is progressing, with a view to normative choices by the respective parties, and what possibilities exist for coordinating the development and application of those new medicines with what is desirable and acceptable from the point of view of treatment providers and patients and their families.

The evaluation of research protocols and of clinical trials will change fundamentally, as a result of the new developments in medicinal research. This will have important consequences for the current system of assessment by ethical committees. A wide range of ethical questions can be raised in this connection. How should the financial burden, pressure and risks for the patients be estimated in early clinical studies? What uncertainties should and should not be permitted? To what degree should laws and regulations be adapted? How should communications with patients and informed consent be arranged?

Much of the research aimed at accelerating the development process of medicines will consist of research and tests in the area of cell and tissue materials, which are increasingly also being stored in large quantities in biobanks. Numerous questions can be put forward in this context. How should informed consent be arranged: generic, specific, opt-in or opt-out? Who should have access to biobanks, and under what conditions? How should public-private partnerships be arranged? For what commercial objectives or changes in those objectives should assessment be requested? What cost-benefit considerations are made, and what standards are applied in that connection? What role should patients and consumer organisations play in this development, and what is the role of other stakeholders?

3.2.2 The healthcare sector on the move

In the healthcare sector, technologic developments and innovations offer unprecedented possibilities for improvements. Yet those improvements often prove difficult to realise and guide. Innovations in healthcare give rise to many ethical and societal questions. Moreover, the healthcare sector is a complex multi-actor system. For example, doctors appear to play an important part in encouraging or promoting particular innovations, such as home use of medical technology. Conversely, changes in this sector touch very closely upon people's quality of life, and as a consequence the patients' perspective is very important. In addition, international accessibility and access to healthcare are also points demanding attention.

Electronic patient dossier

The concept of electronic patient dossiers has been discussed for decades. Expectations are high in terms of patient security and savings on administrative charges. Nevertheless, this innovation is very slow to get off the ground. The ethical and societal discussion is constantly an important problem. What confidentiality model should form the basis for the architecture, how should security be organised, who should be able to view the dossier, who should be able

to edit it? The healthcare domain is highly fragmented: the government, hospitals, doctors' associations, patients' associations, healthcare insurers: each group has its own interests, approaches and views. How can these differences be reconciled in designs, and how can product innovations and system transitions be facilitated? Denying the ethical, legal and organisational sensitivity of these issues is no longer an option.

Home use of medical technology

More and more often, patients are being offered the possibility of using advanced medical technology in their homes, either themselves or with the help of others. Examples include home monitoring of high-risk pregnancies, parenteral treatment (home dialysis, home treatment of children with cystic fibrosis) and home artificial respiration for neuromuscular diseases A new generation of self-diagnosis equipment is on the point of being developed. Besides the technological developments, other factors have contributed to the increase of home use of medical technology: demographic and epidemiological developments leading to changes in the demand for healthcare (greater emphasis on chronic illnesses), patients' desire to remain at home for as long and as much as possible, the move to rationalise the healthcare sector (through such methods as reducing hospitalisation times) and the increasing use of volunteer aid.

This development involves more than simply relocating healthcare in a technical sense. It also involves a number of important societal and normative aspects, which deserve further investigation. The overall question is under what conditions, and for whom, transferring advanced medical technology from hospitals to homes may actually lead to improvements in healthcare and in people's quality of living. Relevant aspects include:

- *Quality* - How can/should the quality of home use of medical technology be guaranteed? Are the requirements the same as those that apply in a hospital setting?
- *Responsibility* - What can and may be demanded of the patient's support system? Who is liable for any errors?
- *Relational aspects* - What will change in the relationships between patient and those who share the responsibility of providing care to him or her? Will home use increase the patient's autonomy and privacy?
- *Economic aspects* – What impact will home use have on the business models in the healthcare sector? Will home use increase the number of quality adjusted life years (QALYs)?
- *Importance and benefit* - What normative concepts are part of the ‘script’ of specific forms of home technology? What does medical technology 'do' to the patient and his or her environment? Will ‘home’ still be ‘home’?
- *Choice and accessibility* - How free will the patient and his or her environment be to choose whether or not to have home treatment? Conversely: if use of home care technology offers significant benefits for patients, the ideal of realising the assumption of such accessibility may prove difficult.

Addiction care

The area of addiction research has undergone a shift in paradigms from the psychosocial model to the biopsychosocial ('BPS') model. Inspired in part by neurobiology, the dominant view is currently that an addition such as alcoholism is a brain disease with a hereditary component: brains change (neuroadaptation) under the influence of the addition. The result is an addicted brain. Most people have responded favourably to that shift in paradigms; a large group consider that the current views properly reflect the complex reality of addictions and addicts. The new paradigm has a destigmatising effect, inasmuch as addicts are no longer portrayed as weaklings, but as sick individuals who need proper treatment and care.

The flip side of that ‘apology’ is, so it would seem, that the autonomy of the addict is undermined: if the addict is a puppet controlled by an addicted brain, what remains of his or her free will and moral responsibility? Is this not an illusion that prevents the problem from being tackled properly? And, with a view to providing proper care, should addicts who refuse treatment not be approached at an earlier stage with more coercion and even duress? This question will become more relevant as more effective treatments become available in the future, possibly inspired by the field of pharmacogenetics.

Questions for further research include:

- What is the current status of science with regard to the neuroadaptation of the 'addicted brain'? To what extent do neuroscientists support the idea that the addict's brain has been 'hijacked' by the addictive substance?
- Should a distinction be made here between various forms (nicotine, alcohol, drugs addiction, etc.) and the degree (more/less permanent /serious) of addiction?
- What views do stakeholders have about autonomy and competence or incompetence of addicts in the context of possible treatment, taking into account the type and degree of addiction?
- Do the modern understanding of addiction-as-a-brain-disease and the issue of competence or incompetence of addicts offer more possibilities for justifiable coercion and duress in the context of prevention, treatment and care – and if so, to what degree and under what conditions?

Screening

Screening is an increasingly important part of modern-day healthcare. The general definition of screening is 'research among people aimed at systematically detecting or preventing an illness or a predisposition for an illness at an early stage.' There are various forms of screening (such as the distinction between genetic and non-genetic screening, for example), it can take place at various times (for example in connection with in vitro fertilisation, with children or with adults), and it serves various purposes (preventing illness, facilitating considered choices). Numerous normative questions and aspects exist. To begin with, some questions concern desirability or acceptability: is screening, in general or in a specific case, actually advisable? How should the pros and cons of early detection be weighed against one another? How should the objection be regarded that screening serves to increase medicalisation? And if screening is advisable, what ethical and other conditions should be laid down?

Screening is and has been the focus of a great deal of research already. As a consequence, in order to qualify for subsidies under the MVI thematic programme, research proposals in this field are subject to a number of additional conditions on top of the standard MVI project conditions. Research proposals must concern one or more forms of screening that give rise to existing or new questions that are difficult to answer within the existing normative framework. Moreover, the proposals must be coordinated with other programmes and centres conducting or subsidising research into screening, such as the Centre for Society and Genomics. In this manner, the MVI thematic programme hopes to promote research into forms and/or aspects of screening that have not yet, or only barely, been researched previously.

3.2.3 Animals, nature & natural habitat

Biodiversity and nature

Industrialisation, climate changes and globalisation mean that everything that is connected to nature is becoming more and more scarce and controversial. Changes are causing breaches between ecosystems and within ecosystems. They are creating new groups of poor people (fishers and farmers are losing their livelihoods) and new groups of rich people. The question is, which changes are ethically acceptable and which are not. To what degree can scientific examination of these changes and technologies make a positive contribution to the way in which we deal with changes, and to reducing the difference between rich and poor?

Many of the 'services' that natural and semi-natural ecosystems provide to society are not attributed any value on the markets. International and northern institutions (governments, commercial and societal midfield) are promoting a major trend to convert and value ecosystems for private, market-oriented use. However, that use may be at the expense of the general interest and of poor people, for example in the case of scarce water sources. Calculating the 'total economic value' of ecosystems is an important necessity, regardless of whether a regulatory of economic course ('payment for environmental services') is chosen for protecting that value. For example, are we capable of rising above the current randomness of concepts and techniques that emphasise Western concepts of value and price and research whether they can be reconciled with local and indigenous ways of valuing ecosystems? Can we clarify the legal construction of rights of ownership and non-profitable obligations toward society in different circumstances? Or can we take the methods of valuing ecosystems from their economic isolation and value relevant ecosystems in conjunction with the affected population, stakeholders, policymakers and development professionals? The issue of intellectual property, at the level both of local population groups and of research institutes of international companies, and the appropriation of genetic sources are of similar value in this context.
Other questions that are relevant to this theme include:

- What biodiversity occurs where on earth? Where is biodiversity suffering most from climate changes? How can ecosystems with a high degree of biodiversity be supported? Does designating 'hot spots' help? Will they protect nature and people, etc.?
- Property issues come into play: nature as public property ('commons') or private property? Ethical questions also exist in connection with the value of preserving certain species in relation to creating opportunities for other developments.
- A more concrete issue is the creation of new nature. What ecosystem issues are at the heart of matters, how should regulations and governance be given shape? How should we deal with 'temporary nature'? What part do NGOs and international organisations play in this context? Multi-level governance often results in top-down policies: how can local developments be taken into consideration?
- How do we promote sustainable ecotourism? What regulations and certification systems are required for that purpose?
- Do the Biodiversity Treaty and the European Directives work properly?

Animal production

The increasing and dynamic demand for food production is an impulse for the search for the ethically most responsible scientific and technological approaches. Besides scientific research into the most effective conversion of feed into meat, research has slowly started into alternatives to meat (insects, in vitro meat). The coexistence of intensive and extensive animal husbandry systems requires coordination and regulation. Increasing interdependencies mean that questions of harmful effects of migrating species (zoonoses, introduced species) are important. Some important questions include:

- How can alternative sources of protein (such as insects) be produced and utilised in an ethically and societally acceptable manner?
- Animal production is surrounded by a complex of questions: How can we resolve the forthcoming shortages of animal fodder? What bio-industry is acceptable to which cultures? How can and should we deal, at the international level, with different systems (intensive, genetically modified, extensive, etc.) for animal husbandry? Questions also exist about the application of biotechnology to animals.
- Preventing animal diseases gives rise to a whole series of questions about such issues as risk management, fear politics and the consequences of risk management for local, small-scale animal husbandry firms.
- What part do European and national regulations play, and what is their effect?

Biofuels and food production

Very many countries wish to slow down the greenhouse effect and so reduce CO2 emissions. For example, the EU has decided that CO2 emissions should be down by 20 percent by 2020, and that by then biofuels will make up 10 percent of the energy used for transport. As matters stand, the necessary measures cannot be implemented: they require scientific and technological innovations. Basically, the current generation of biofuels - ethanol from alcohol from sugar cane, beets, maize, rapeseed, soya and sunflower - only offers drawbacks. The production is not truly CO2-neutral, since large volumes of fossil fuels are used for fertilisers, pesticides and transport (estimates vary from 0.2 to 0.9 litres of fossil oil per litre of biofuel). The demands in terms of space are enormous: the average car would consume a football field of maize every year. Water consumption is also high. The demand for soya and other crops means that more rainforest is being cut down (or burned down, like in Borneo) and that marginal land is being put to use. Similarly, the monocultures also threaten biodiversity. The most fundamental problem, however, is that the production of ethanol is competing with food production, and that by forcing prices up this threatens food production and encourages farmers to earmark their current crops for fuel rather than for human food or cattle feed. Europeans will then face the competition between their cars and their meat: however, in less developed countries, the primary concern is how to obtain food.

Only second-generation biofuels, produced by extracting energy and chemical materials from cellulose from any plants at all, meaning that waste such as wood pulp and straw can be used, will meet sustainability standards; however, these are not expected to be commercially available for 5 to 10 more years. That generation will, theoretically, not compete with food production. Another interesting field of research is research into the technological possibilities of plants and organisms that are not part of the human food chain and that could be used by developing countries and to which no other drawbacks are attached. Energy from algae is one such possibility.

Relevant questions in this area include:

- Production: under what conditions is production of biofuels acceptable (responsible) – sustainable (CO2-neutral) biofuels that do not hinder food crops?
- The development of biofuel crops involves choices about using land, possibly already being used for food crops, about high water consumption or less, about unused or infertile land, etc. How can those choices be made in an ethically responsible manner?
- There are many issues in connection with the design of regulations (certification systems), standardisation and monitoring. Are CO2-neutral, sustainable biofuels being produced?
- How can ethically acceptable innovation of biofuels be organised that is suitable for local requirements (for example in developing countries)? For example, energy from algae: what technological systems are needed, what societal changes have to be made and can be justified?
- Developing energy- extensive food production systems and energy-producing food production: How should access to research priorities, applications and increased participation be arranged?

3.2.4 Virtual reality

Numerous applications have been developed for virtual reality, of which online games are currently the most prominent. Where until recently this seemed to be no more than a virtual reality that has little to do with the 'true' reality except in terms of providing entertainment, it has now become more than a new variation of our 'real' world: cyber worlds have grown into a unique phenomenon, in which the effects of virtual and real behaviour and events overlap and influence one another.

The increasing interrelation of virtual and 'true' reality obviously leads to a number of societal questions. Financially, the dividing line between the two worlds, physical and virtual, has diminished: Linden dollars of Second Life (SL) have an exchange rate with hard US dollars, and objects and identities in the virtual world are worth real money, and sometimes a lot of it. This makes virtual money and attributes an interesting target for theft, laundering and other forms of crime. At the same time, political questions have been put forward about virtual child pornography in Second Life. Should actions that we censure offline be combated using legal (or other) measures in virtual form? Problem areas include virtual child pornography, virtual rape and abuse and virtual theft. Does this call for other concepts and mechanisms than have been used to date for their offline counterparts? Can people who feel themselves to be victims of a particular event in Second Life (through their avatars) also be qualified as victims for legal purposes? How can psychology (virtual victimisation) and economics (virtual economics) provide guidance in answering these questions?

Second Life possesses a sort of split personality. On the one hand, its members want to show, and preferably magnify, everything about themselves. Moreover, it is possible to learn a great deal about an avatar by examining its inventory. At the same time, players do not wish to show everything, and when selecting an avatar opt for identity features that differ from their own identity. There is a need for privacy in Second Life. Similarly, the avatar's mask is also important: people can experiment in Second Life, without wanting to be associated with those experiments in their 'real' lives. Yet a link also has to be made between people and avatars in the 'real' world, if the boundaries of ethics or the law are exceeded. How can people's privacy be protected in virtual worlds, both internally and in relation to the 'real' world, and what is the relationship in terms of enforcement?

At the conceptual level, the question arises of whether this is a new world, a new social reality, or ultimately just a game. That qualification is important for applying law to such virtual worlds, both in public-law (gambling, data protection) and private-law terms (for example property, contracts, liability). This is also a relevant issue from the point of view of regulation. The virtual world is not subject to its own internal dynamics of community formation and the 'regulation' of the conduct of its 'inhabitants'. How should the virtual world be governed, and does it have democracy? Do fundamental cyber rights and values exist, such as non-discrimination, freedom of speech, the right to privacy and anonymity? Who passes judgment in cyber world: should institutions from the real world be set up in the virtual world for that purpose, or is it wiser for that world to choose its own specific dispute mechanisms? What part should governments, the game developers and the players fulfil in this connection?

Linked to the conceptual qualification of the cyber world is the question of the best degree of regulation. As a new but interlinked element of the 'reality', it should possibly be regulated at a similar level to the 'real' world, with 'real' law, institutions, standards and values and technical control mechanisms. Conversely, it can also be argued that cyber worlds are places for experimenting and as such form an important engine for innovation, which would be

hampered by too many forms of regulation and government involvement. The parallel with discussions about regulating the Internet in the 1990s looms.

A proper analysis and discussion about the new implications of virtual worlds and the mutual influence between 'real' and virtual worlds requires a cross-discipline approach. The legal, ethical, social, economic, psychological and technical aspects of all these questions are closely linked.

3.2.5 The observation society

The combination of various developments such as miniaturisation of criminal investigation equipment, new technology for cameras and sensors, datamining and values and conflicts in values call for a fundamental reflection upon the surveillance society. What is the psychological effect on people of the fact that potentially they can be observed anywhere and any time (as in the Panopticon, where people do not know for certain at which moments they are being watched)? What are the societal implications of the ubiquitousness of invisible cameras in mobile telephones? What are the legal and ethical boundaries, and are they shifting? Are these developments creating a society in which suspicion is the baseline? Who will observe the observers?

In all these issues, the role of empiricism should not be underestimated. Very little scientific research has been carried out that demonstrates that the societal problems that such forms of surveillance serve to combat will indeed be solved. Consequently, some people claim that camera surveillance is not effect, is sensitive to improper use and will only cause the problems to shift. Others argue that camera surveillance helps against petty crime such as bicycle theft, but not against 'emotion-related crimes' such as nightlife violence. Empirical research into the effectiveness of different forms of surveillance is urgently needed.

Sensors and cameras

Camera surveillance is the clearest example of the increasing possibilities and applications for observation in modern-day society. It has grown exponentially during the past five years, and the end of that growth is not yet in sight. Ethical and societal implications depend in part on the context in which camera surveillance is used. In public spaces, cameras are currently used primarily by municipal authorities and police forces, particularly in nightlife districts and on roads and in public squares. The objective is often to preserve the public order, ensure road safety or investigate and prosecute offences. Private spaces with camera surveillance include places of employment, shops, casinos, or red light districts (for the protection of employees). In all these uses, not only traditional camera images are considered, but also combinations with pattern recognition (such as facial recognition and aggression detection) and sound. Infrared cameras and heat sensors can also be used, for example for tracking down cannabis farms or for scanning people for weapons during customs inspections (without needing to search them). However, other forms of sensors are also being introduced, from chemical sensors that 'smell' blood or explosives to 'sniffer wasps' trained to detect drugs.

The development and increasing use of smart and traditional cameras and sensors naturally gives rise to ethical and societal questions. Those questions primarily concern privacy, though other fundamental rights and values are also at risk. Cameras and other forms of surveillance affect various factors, including:

- *Privacy, ethics and human rights* - Although legislation is in place that protects personal data in relation to camera surveillance, those laws offer a great deal of discretionary freedom for assessing the need for surveillance; the question is whether, as a result of those laws, privacy is still viable in the current political and societal climate and can be protected by the current legal framework; this also leads to a demand for other instruments to protect people's privacy, such as Privacy Enhancing Technologies (PETs) or 'privacy by design';
- *Societal exclusion and discrimination* - Surveillance is not in place everywhere, but rather depends on geographic circumstances and on social background, ethnicity, etc.; cameras and sensors are used selectively, and their results are utilised selectively, which involves a considerable risk of being done in an unfair and possibly discriminating manner;
- *Choice and power* - When on public streets, people have no choice as to whether or not they are followed by cameras or other instruments (dozens of times every day), nor do they have any choice regarding the use of the personal data gathered about them as a result. In terms of monitoring the monitors, citizens are clearly at a disadvantage. New forms of power compensation, both institutional and incorporated into technology, should be considered, for example by offering people the possibility of 'looking back' at those monitoring them;
- *Transparency and resistance* - It is not easy for people to keep track of the information that is gathered about them, by whom, when and for what purposes. More and more, that information determines the lives of those

people (opportunities and choices). As such, it is logical that people should have a say in the matter. One condition in this regard is transparency. It should be apparent who is being observed at what times and for what purposes, and how long images and data may be kept and for what purposes. Particularly in a society in which surveillance is increasingly a product of public-private partnerships, transparency must have a consciously chosen organisation. This even more important considering that people should also have the possibility to challenge overly intrusive observation or improper use of observed information.

Miniaturisation of criminal investigation equipment

A series of developments in technology make it increasingly easy to observe people and objects remotely without detection. Previously, an observation team had to be on site, and at most could use binoculars and an unwieldy directional microphone to observe someone from 50 metres away, while running the risk of being noticed. Nowadays, around-the-clock camera surveillance (with zoom function) and other sensors mean that observation is possible from any distance. The observation possibilities increase substantially with equipment miniaturisation. The directional microphones that previously needed to be carried around in plain site now fit on a small antenna built into the arm of a pair of glasses; cameras are not only built into mobile telephones, but also fit into buttonholes, allowing observation without detection. The scenario of 'smart dust' – dust particles with sensors and transmitters that are scattered in groups to monitor areas or persons – is approaching rapidly. In the short term, it will be applied in such areas as logistics, smart spaces and perhaps the military, though in the longer term it may also yield possibilities for criminal investigation and maintaining the public order.

For some people, it is a dream scenario to be able to keep track of suspects or groups of suspects, while for others it represents a doom scenario of the 'Panopticon' society gone mad with Kafka-esque touches. The police will have a whole new range of technical options for gathering more and more data without the persons involved being aware. However, the reverse is also true: people – including criminals – will also be able to keep better track of the police. Moreover, use of observation equipment is not restricted to government authorities: private investigation is still on the rise, while private citizens (jealous husbands, for example) may also wish to spy on one another.

Although miniaturisation can be seen as no more than a difference in scale, it nevertheless gives rise to normative questions: the invisibility of being observed represents a qualitative difference from the previous situation. Since the risk of detection on the part of the observers is much smaller, the use of observation equipment will become much more accessible. A natural drawback to its use is removed, and as a consequence the question arises of whether other drawbacks should be introduced in its place, such as legislation (for example the relatively recent introduction of laws against secret camera surveillance), technical standards or codes of conduct.

Responsible datamining

Datamining is using computerised tools to search for relationships in databases. It is usually used in databases that are so large that their users lose sight of the available information. In the past, supposed relationships were tested using hypotheses. Datamining, conversely, generates its own hypotheses, by comparing available parameters and verifying the existence of any correlations.

Often (but not always) the patterns and relationships that datamining reveals concern information about people and groups of people. In that case, the term used is automated profiling. Several benefits and drawbacks are associated with it. Benefits include the ability to identify target groups and adopt a specific approach. Numerous other uses by government services and police forces, the business sector and the medical sector are imaginable.

As most of the profiles are generated primarily for making decisions, this system may also have negative aspects. For example, the profiles offer selection possibilities, which may result in discrimination, if the selection is based on criteria that are deemed undesirable in terms of society. It may lead to stigmatisation if the profiles of certain groups of the population are made generally available. Similarly, people with a particular profile may be confronted with information about themselves (such as their life expectancy) that they might not want to know. Datamining makes significant increases in scale possible, and moreover makes it possible to identify unexpected relationships, which gives rise to a wide range of ethical and societal questions.

Many people appear not to be properly aware of what organisations (both in the business sector and government authorities) gather information about them, what information that is, what they use it for and what rights they have in terms of access and editing. As a result, it is difficult for many people to form an opinion about the developments

in this area. The legal framework for protecting citizens – primarily data protection, as laid down in the Dutch Personal Data Protection Act (*Wet bescherming persoonsgegevens)* – appears to be inadequate in a number of respects, for example because of insufficient transparency and the non-applicability of the data protection laws to individual and group profiles. In fact, the legal framework may fail owing to what some feel is an outdated paradigm that is aimed at preventing unnecessary data processing, whereas in modern-day society data processing is so ubiquitous that the emphasis should instead be shifted to regulating the use of personal data in making decisions .

From a technical perspective, the reliability of the information in databases and the profiles generated from that information using datamining play a crucial role. That may also benefit the people whose data is concerned, since they are subject to more accurate decisions and receive far-reaching personalised treatment. An important question here is also whether consumers have choices concerned the amount of personal information that they provide and the degree to which the treatment they receive is generic or personalised. For providers of products and services, it is interesting to know to what extent they may refuse customers and clients on such grounds as a poor repayment record or health risks.

Datamining also gives rise to related, more fundamental, ethical and psychological questions: what does it mean for citizens, consumers and employees to be increasingly treated on the basis of a profile instead of individual qualities? Does datamining affect people's identity and identity perception? How does untransparent profiling, for example in the context of the Internet, affect consumers' choice and their related possibilities for growth?

3.2.6 Neurotechnology

Human brain research is increasing dramatically[4]. Not only fundamental scientific research is being performed, but more and more often clinical applications for human brain research too. That latter area is expected to keep growing during the coming years. It is not strange, therefore, that a subspecialisation has arisen within the field of biomedical ethics that articulates and studies the normative questions: neuroethics. Several sub-themes can be distinguished in that field, each of which gives rise to its own questions. In regular healthcare, neuromodulation and neuroimaging are the issues. Outside regular healthcare, too, developments in the field of neurotechnology may have a substantial impact.

Neuromodulation

Neuromodulation concerns techniques such as deep brain stimulation, transcranial magnetic stimulation and nervus vagus stimulation. Those techniques are currently applied primarily – and mostly in the context of medical scientific research - for psychiatric and neuropsychiatric disorders such as Parkinson's disease, Gilles de la Tourette syndrome, obsessive-compulsive disorders and depression. The expectations for these techniques are high, yet in practice the therapeutic results are often mixed blessings. For example, patients may display serious behavioural problems and personality changes. Questions for further research include:

- What is the risk-benefit ratio of such interventions, and how is it measured? (This also concerns risks relating to changes in the patient's personal identity.)
- What are the problems and difficulties associated with the process of informed consent? This question concerns both competent persons (for example the general problem of the validity of approval given by patients with their back to the wall, and what is known as the therapeutic illusion), and (even more so) patients whose competence is debatable;
- How should cyborgs and their identities be considered? How much brain technique and other such procedures can a human bear without losing his or her human identity?
- What part does the industry play in the development and proliferation of neuromodulation technologies, and what does that mean for the responsibility of researchers? Examples include ‘disease mongering’.

Neuroimaging

Neuroimaging covers the whole of medical imaging techniques that make the brain and the nervous system visible, such as fMRI (functional Magnetic Resonance Imaging). Development of existing and new imaging technologies creates possibilities for evaluating and possibly even predicting complex human behaviour, diseases and disorders. Uses of such techniques include studies into the relationship between the brain and emotions and moral judgment, predictive and non-predictive diagnostics for psychological disorders such as depression and post-traumatic stress

[4] In the Netherlands, a large ‘National Brain and Cognition Initiative’ has been set up.

disorder, and the evaluation of sub-clinical images such as mild cognitive impairment (MCI) in connection with Alzheimer's. Possible ethical and societal questions include:

- How should we deal with additional anomalous findings in the context of scientific research and the clinical practice? Examples include privacy issues and people's right to know (or not to know);
- What are the expected implications of imaging for patients' self-perception, and what implications does it have for 'proper use'/guidance?
- In the context of criminal law and criminology, what are the possible implications of brain images for the moral and legal accountability and responsibility of suspects/perpetrators? (A similar, but broader issue of autonomy/free will also presents itself through other lines of science – for example neurobiology.)
- What possible applications exist beyond the medical sector (for example for staff recruitment, selection for military missions, insurance, access to public services or spaces) and what are the ethical and societal implications of those applications?

Neurotechnology beyond regular healthcare

We know more and more about the brain and the techniques for examining the brain are becoming better, less and less harmful and less and less costly. The consequences of this development are becoming more and more apparent in society. Neurotests and techniques offered outside the regular healthcare sector include applications for possible or diagnosed diseases. However, numerous other uses are possible. In the United States, more and more suspects are having brain scans performed to find disculpatory material (tumours, etc.) to explain their behaviour; law enforcement authorities talk about making 'brain fingerprints' to identify terrorists and about 'brain lie detectors' to unmask liars; human resource officers believe that brain examinations could provide more information than traditional psychological tests; in neuromarketing, people are trying to find out what happens in the human brain when someone chooses brand A instead of brand B, and how that behaviour might be influenced; economists and ethicists want to know what happens in a person's human brain when he or she makes a decision; brain researchers are urging legislators to take their findings into account; in education, a 'brain-based learning' movement has started - short, virtually no other type of medical research has a greater impact on non-medical fields in everyday life than brain examinations. Besides the questions already identified, another question here is whether it is desirable/acceptable for such applications to be offered and provided in a commercial setting, and if so, under what conditions.

3.2.7 The formable human

The problems set out below are independent from the specific technological options that make further enhancement or life extension possible. However, new technology can make it possible for difficulties to be overcome: an enhancement about which one could only speculate now appear within the realms of possibility. It then becomes urgent to properly evaluate the interaction between new technology and enhancement options.

Enhancement is the use of interventions for the purpose of improving functions - not in a therapeutical context - that are linked to the workings of the body, brain and nervous system. The basic questions about 'enhancement' have existed for some time, for example in the world of professional sports, and do not necessarily concern new technological possibilities. Tutoring and private tuition may also be considered forms of 'enhancement'. Normative questions about principles can be raised, recently addressed explicitly by the transhumanists: what is the ideal human? How can a response to their philosophy for phrased? Other, more concrete, practical normative questions also exist, concerning matters of fair competition (in sports, at school, and possibly even in connection with access to jobs). And there is the grey area between therapy and enhancement, and the societal responsibilities for it.

Relevant general ethical and societal questions include:

- What is the societal context of the development of techniques for enhancement? What part do individualisation, aging and commerce play?
- What is the situation with the possible health risks and the effectiveness of different forms of enhancement?
- What are the implications for fundamental rights, personal and moral identity, individual autonomy and moral responsibility?
- What is the identity perception of the formable human, and what is the psychological connection between the body and external technology connected seamlessly to the body?
- What are the limits of parents' powers of decision and control in situations involving the possibility of use for their children?

- What are the expected societal implications, and what do they mean in terms of the desirability of enhancement? Examples include the consequences for societal solidarity and justice (on a global or a smaller scale). Will enhancement increase the unfair division of privileges between the 'haves' and the 'have-nots'?
- How should the possibility of a 'rat race' be viewed? What should be done if individual freedom to decide on enhancement turns into an urge to use it to rule out the possibility of overlooking any competitive edge?
- What responsibilities do individuals, aid workers and the government have? In connection with the government's responsibility, the question arises of what the implications are of the government's duty to protect public assets.
- Several ministries face the problem of how far they may go in enhancing 'their' military, fire services, police forces to allow them to perform their duties better – but will those improvements not come at the expense of their individuality and personal autonomy?

A number of specific applications require particular attention:

Global justice

The topic of human enhancement also gives rise to questions about global justice. How can fair, global access to enhancement technologies be organised? What part can the WTO play in this connection? How are ethically acceptable decision-making systems concerning this issue structured? What enhancement preferences do developing countries have? How can enhancement technologies be developed that reduce the risk of improper use? What does improper use mean in this connection?

Neurotechnology

The possibilities for affecting the brain and change their performance are becoming ever greater: for example medicines such as Prozac and Ritalin, and the rise of entire institutes dedicated to neuroengineering ('tinkering with the brain') in the US. These processes are also interventions aimed at improving functions in a non-therapeutical context, for example to increase a person's cognitive abilities and alertness, refresh their memories, or change people's moods and feelings. Besides pharmacological interventions, examples also include neurostimulation and neuromodulation using brain implants.

First of all, there is the question about how matters stand with science and public opinion. What possibilities can be expected in the short and medium term? What are the risks? For example, it is not unthinkable that memory enhancement will disrupt the natural balance between remembering and forgetting and as such will undermine the memory's working instead of improving it. Assuming that cognitive enhancement becomes available and is safe to apply, will people actually wish to make use of such technology? If so, to what extent and under what conditions? In situations involving a great deal of social competition, or under the pressure of employers' expectations, how free will they be to refrain from using products that improve a person's cognition or alertness?

Life extension

A great of research is being conducted into factors involved in the process of aging, and into possibilities for influencing that process, for example through nutrition, manipulating hormones or using regenerative medicine/stem cell therapy. 'Forever young' appeals greatly to people's imagination, but does not appear to be very realistic. It seems more realistic to considerably increase people's life expectancy. 'Anti-aging' research and its possible application with a view to life extension gives rise to numerous research questions.

First of all, here too there is the question about how matters stand with science and public opinion. What possibilities can be expected in the short and medium term? Assuming such technology becomes available, will people actually wish to make use of it? And if so, to what extent and under what conditions?

Possible ethical and societal questions include:

- What is the purpose of medicine, and how does life extension relate to that purpose? Should doctors allow themselves to be involved?
- How do our views of aging affect research into life extension and its possible application, and vice versa?
- What are the possible or definite societal implications, and what do they mean in terms of the desirability of life extension and of setting conditions?

Possible implications include:

- The gap between those who can and cannot afford life extension (which includes the issue of international equality and accessibility), and the gap between those who do and do not use, or wish to use, the possibility of life extension. What if the difference in the life expectancies of the 'haves' and the 'have-nots' increases even further: can that be justified, against the background of the requirements of fairness?

- Implications for the way in which people live their lives, for they way in which they deal with existential questions, such as perceptions of meaning/meaninglessness, boredom/fulfilment, perceptions of finiteness, etc. Implications for people's perception of personal identity: will it be possible to experience life as a whole if we reach much higher ages?
- The implications of an exponentially older society for access to work (what about a 'productive gerontocracy', which limits the opportunities of younger people?), societal facilities such as healthcare (a longer life will probably lead to a considerable morbidity), insurance and pensions (will they remain affordable?), and the threat of overpopulation (are tight family policies and/or – in the more distant future - interplanetary relocations not another aspect of life extension?)

3.2.8 Defence, safety & military technology

Enhancement of military personnel

Military applications of human enhancement are used, on the one hand, for improving the performances – both physical and mental - during military and peacekeeping missions, and on the other for reducing health risks. For both aspects, this requires altering humans to push back their limits. Examples of enhancement of military personnel include, on the one hand, direct alteration of the human body, and on the other embedding the soldier in future (technological) advanced system environments (wideware).

This gives rise to a number of questions. What impact will use of this technology have on military personnel as human beings, in both the positive and the negative sense? And how far can you go, with whom and when? To what extent is it possible to apply this technology to an individual, and to what extent to an entire army?

It is also unclear what technological and other developments that are relevant to this application domain are taking place, or are expected in the medium and long term. Research is needed to provide more information about this issue too. Neuromodulation, neuroimaging and other neurotechnologies will also have a part to play in this connection (see §3.2.6). For example, questions can be raised about the brain activity of military personnel in combat situations, and about influencing that brain activity, in order to prevent 'cognitive impairment' and 'stress-related disorders' (see 'the moral soldier').

For military purposes, it is also important to know what the countries with which the Netherlands is to cooperate during operational missions are planning to do with the new possibilities for enhancing military personnel, and how they view this issue. The differences may be so great that proper cooperation is no longer possible. How far would the Netherlands have to go to ensure operational cooperation with those countries?

The moral soldier

Much of the complexity of present-day military operations is caused by moral questions and dilemmas that are the order of the day in regions where the military is deployed. Many of those problems have serious consequences because they concern the use of force, where in many cases the moral dilemma implies a choice between life and death. National and international publications draw attention to the moral responsibility that the soldiers in question bear in this connection, and as such also to the need to provide military personnel with better moral/ethical preparation for their task. Moral competence and moral professionalism are, therefore, important elements in the professional profile and training of soldiers. This includes the ability to recognise and properly judge the moral dimension of situations, the ability and willingness to act responsibly based on that information, and the ability to properly identify and process personal confrontations with tragic or less dramatic moral dilemmas. This gives rise to various questions. To what extent is it possible to influence the development of moral competency and professionalism? In what fashion can this aspect of human functioning be controlled? What role can neurotechnology play in this regard? Does this not interfere (possibly to an unacceptable degree) with the soldier's personality and 'agency' or their development? How far can we go in this respect in order to achieve the best possible level of performance, and up to what point is that ethically responsible?

Battlefields of the future

Another issue concerns new weapon technologies and information technologies and their introduction onto the field of battle. Those new technologies hide a technological control paradigm, which assumes that technology, or at least a technological edge, can be decisive for winning battles. In concrete terms, that means the following. It can be argued that new weapons and technologies lead to what is known as a *revolution in military affairs*. All aspects of warfare in the industrialised countries will be greatly affected by the introduction of these technologies. In countless command centres, for example, the command structure has become entirely dependent upon a network of information systems (wideweb). An important objective in that connection is to reduce the amount of time between

identifying an enemy target and hitting it (known as the *sensor to shooter* chain). However, it is possible to question the extent to which the technological control paradigm referred to above is valid. In fights against an enemy that behaves normally, the benefits of technological superiority are self-evident, as is apparent from the Kosovo crisis (1999) and the two Gulf Wars (1991 and 2003). However, in fights against an enemy that does not behave in a regular manner, the technological edge has considerably less weight, as is demonstrated by the US defeat in Vietnam or the difficulties experienced by the US to win the *hearts and minds* of the local population and maintain the public order. Besides researching the validity of the technological control paradigm, attention may also be devoted to the new technologies as such: Network Centric Warfare, non-lethal weapons, biological weapons, direct energy weapons, nanotechnology, etc. Important questions concern the evaluation of the moral and legal permissibility of such technologies.

3.2.9 Functional foods

Functional foods basically include all foodstuffs to which something has been added to improve a particular bodily function (such as sight, hearing, strength or memory). One important subcategory is health food: foodstuffs to which a health-stimulating ingredient has been added in comparison with traditional foodstuffs. Functional foods are based on the assumption that validated relationships exist between people's genetic predisposition for particular diseases, the intake of certain foodstuffs and the prevention and risks of diseases. Based on those relationships, people could be able to have their genetic profiles determined, to show their potential risks. That profile can then be used for selecting particular foodstuffs. Such profiles can either be group profiles or aimed at one specific individual. A choice for particular foodstuffs is determined by such an individual profile is referred to as ‘personalised nutrition’. Validating that relationship between predisposition, food intake and risk prevention requires gathering and analysing large volumes of data, and as such means that biodatabases will play an important role. Examples of functional foods *avant la lettre* include lemons (against scurvy) and unhusked rice (against beriberi). Some insurance companies already grant discounts on premiums if policyholders can prove that they buy proven functional foods, in particular Becel Proactiv products. Medicalisation of foodstuffs is a frightening concept for many people.

Development and production

The issue of functional foods gives rise to various production-related questions. For example, what functions are stimulated? Are those functions appropriate for other societies and cultures, or do those societies and cultures in fact have no need for them? In Western countries, for example, there is a demand for food containing less energy. Such foods might be good for the obese groups, but not for poor countries or famine-struck regions. Generally, those poor groups need food containing particular vitamins, or extra minerals to compensate for certain nutritional deficits (such as zinc).

To what extent is the production of functional foods contingent upon the supplies of raw materials elsewhere (including water)? Is it ethically responsible to use those raw materials? Functional foods are often developed using local know-how. For example, in African countries, food for AIDS patients is developed based on trial and error. Major problems also exist with the present system of intellectual property (e.g. CBD). What systems are ethically more responsible? Using animal testing, for example to determine safety, also gives rise to questions. Finally, what does ‘corporate responsibility’ mean precisely in the context of functional foods.

Sale and consumption

Functional foods can also be considered from the perspective of sale and consumption. Do such foodstuffs call for tests and screening methods for potential users? What should happen with the resulting biobanks (access, management, privacy)? How do these social systems fit into local systems elsewhere? How are functional foods marketed: is it possible to regulate claims - both globally and adapted for national, local systems - to prevent marketing mechanisms such as fraud, fear and coercion? To what degree do functional foods contribute to the shift from collective healthcare organisations to larger, private responsibility? Under what conditions can they help to maintain collective solidarities? In terms of risk management: how should an ethically responsible system, whether worldwide or local, for risk management be organised that registers and analyses harmful side effects of functional foods?

Bibliography

This bibliography sets out key publications in the field covered by the scope of the MVI programme.

Responsible innovation: general

- Abma, T.A. & J. Broerse (2007). *Zeggenschap in wetenschap. Patiëntenparticipatie in theorie en praktijk*. Den Haag: Lemma.
- Abma, T.A. & G.A.M. Widdershoven (2006). *Responsieve methodologie. Interactief onderzoek in de praktijk*. Den Haag: Lemma.
- Batya, F. (ed.) (1998). *Human Values and the Design of Computer Technology***.** Standford: University of Chicago Press, distributed for the Center for the Study of Language and Information. Series: (CSLI-LN) Center for the Study of Language and Information, Lecture Notes.
- Bowker, G. & S.L. Starr (1999). *Sorting Things Out: Classification and its Consequences.* Cambridge MA: MIT Press.
- Bijker, W., T.P. Hughes & T. Pinch (1987). *The Social Construction of Technological Systems. New Directions in the Sociology and History of Technology.* Cambridge MA: MIT Press.
- Dirven, J., J. Rotmans & A.P. Verkaik (2002). *Samenleving in Transitie, een vernieuwend gezichtspunt.* Den Haag.
- Fagerberg, J. (2004/2006). *The Oxford Handbook of Innovation.* Oxford: Oxford University Press.
- Flyvbjerg, B., H. Priemus & B. van Wee (eds.) (2008). *Decision-Making On Mega-Projects: Cost-benefit Analysis, Planning, and Innovation*. Cheltenham, UK and Northampton, MA, USA: Edward Elgar.
- Gibbons, M. (1994). *The New Production of Knowledge: the Dynamics of Science and Research in Contemporary Societies.* London: Sage.
- Jasanoff, S. et al. (eds.) (1995). *Handbook of Science and Technology Studies.* Thousand Oaks / California; Sage.
- Jasanoff, S. (2004). *States of Knowledge: The Co-production of Science and the Social Order.* London: Routledge.
- Joss, S. & S. Bellucci (2002). *Participatory Technology Assessment. European Perspectives.* Centre for the Study of Democracy.
- Keulartz, J., M. Schermer, M. Korthals & T. Swierstra (2004). Ethics in a Technological Culture. A Programmatic Proposal for a Pragmatist Approach. In: Science, Technology and Human Values, 29/1, 3-30.
- Mackenzie, D. (1990). *Inventing Accuracy: A Historical Sociology of Nuclear Missile Guidance.* Cambridge MA: MIT Press (1990).
- Meijers, A.W.M. (ed.) *Philosophy of Technological Sciences (Vol. 14 of the Handbook for Philosophy of Science)* (gen. eds. D. Gabbay, P. Thagard and J. Woods). Elsevier.
- Mitcham, C. & D. Johnson (eds.) (1992). *Macmillan Encyclopaedia of Science, Technology and Ethics.* MacMillan Press.
- Newby, H. (1992). One Society, One Wissenschaft: A 21st Century Vision. In: *Science and Public Policy* 1992; 19/1:7-14.
- Oudshoorn, N. & T. Pinch (eds.) (2003). *How Users Matter: The Co-construction of Users and Technology.* Cambridge MA: MIT press.
- Rip, A., Th. Misa &, J.W. Schot (eds.) (1995). *Managing Technology in Society. The Approach of Constructive Technology Assessment.* London: Pinter Publishers.
- Schön, D.A. (1983). *The Reflective Practitioner. How Professionals Think in Action.* New York: Basic Books.
- Schneiderman, B. (2003). *Leonardo's Laptop: Human Needs and the New Computing Technologies.* Cambridge MA: MIT press.
- Suchman, L.A. (1987). *Plans and Situated Actions. The Problem of Human Machine Communication.* Cambridge University Press.
- Sunstein, C. (2004). Moral Heuristics*. Behavioral and Brain Sciences* 28/531.
- Verbeek, P.-P. (2005). *What Things Do; Philosophical Reflections on Technology, Agency, and Design.* Penn State University Press.
- Kim Vincente, K. (2003). *The Human Factor: Revolutionizing the Way People Live with Technology.* New York: Routledge.
- Wilsdon, J., B. Wynne & J. Stilgoe (2005). *The Pubic Value of Science. Or how to Ensure that Science really Matters.* Demos: London.

- Winner, L. (1986). *The Whale and the Reactor: A Search for Limits in an Age of High Technology.* Chicago: University of Chicago Press.

Ethical and societal background questions

Uncertainty about opportunities and risks

- Beck, U. (2000). *Risk Society revisited: theory, politics and research programmes.* London: Sage Publications.
- Kahnemann, D., P. Slovic & A. Tversky (1982). *Judgement under Uncertainty: Heuristics and Biases.* Cambridge: Cambridge University Press.
- Nowotny, H., P. Scott & M. Gibbons (2001). *Re-Thinking Science. Knowledge and the Public in an Age of Uncertainty.* Cambridge: Polity Press.
- Perrow, Ch. (1986). *Normal Accidents: Living with High-risk Technology.* New York: Basic Books.
- Slovic, P. (ed.) (2000). *The Perception of Risk.* London: EarthScan Publications.

Values, conflicts in values and culture

- Boll, A.M. *The Asian values debate and its relevance to international humanitarian law*. Available at: www.icrc.org.
- Friedman, B. (1997). Human Values and the Design of Computer Technology. Stanford University Press.
- Hong-jong, L. (2003). Development, Crisis, and Asian Values. In: *East Asian Review* 2003; 15.2:27-42.
- Marshall, P. & B. Koenig (2004). Accounting for Culture in a Globalized Bioethics. In: *Journal of Law, Medicine & Ethics* 2004; 32:252-266.

Governance

- Arts, B. (1998). *The Political Influence of Global NGOs: Case Studies on the Climate and Biodiversity Conventions*. Utrecht: International Books.
- Felt, U. & B. Wynne (2007). *Science and Governance. Taking the European Knowledge Society Seriously*. Rapport van de EU.
- Haum, R., U. Petschow & M. Steinfeldt (2004). *Nanotechnology and Regulation within the framework of the Precautionary Principle*, Final Report. Berlijn: Institut für ökologische Wirtschaftsforschung gGmbH.
- Jasanoff, S. (2005). *Designs on Nature: Science and Democracy in Europe and the United States.* Princeton: Princeton University Press.
- Schön, D.A. & M. Rein (1994). *Frame reflection: Toward the Resolution of Intractable Policy Controversies.* New York: Basic Books.
- Thompson, D. (2005). *Restoring Responsibility: Ethics in Government, Business, and Healthcare.* Cambridge: Cambridge University Press.
- Tidd, J. et al. (2003). *Managing Innovation: Integrating Technological, Market and Organizational Change.* Chichester: John Wiley.
- Tushman, M.L. & P.C. Anderson (2004). *Managing Strategic Innovation and Change.* New York: Oxford University Press Inc.

Internationalisation & equity

- Fresco, L. (2003). A new social contract on biotechnology. In: *Agriculture* 21, 2003. Available at: http://www.fao.org/ag/magazine/0305sp1.htm.
- Kaul, I. et al., eds. (1999). *Global Public Goods: International Cooperation in the 21st Century*. New York: Oxford University Press.
- Leach, M. & Scoones, I. (2006). *The Slow Race. Making technology work for the poor*. Demos. Available at: http://www.demos.co.uk/files/The%20Slow%20Race.pdf.
- Moran, M., A. Ropars, J. Guzman, J. Diaz & C. Garrison (2005). *The New Landscape Of Neglected Disease Drug Development.* Pharmacetical R&D Policy Project, The Wellcome Trust. Available at: http://www.wellcome.ac.uk/assets/wtx026592.pdf.
- Pogge, Th. (2000). *World Poverty and Human Rights: Cosmopolitan Responsibilities and Reforms*. Cambridge: Polity Press.
- United Nations (2000). *Millennium Development Goals*. Available at: http://www.un.org/millenniumgoals/.

Ethical and societal aspects of concrete technological developments

Medical and biomedical research

- Dondorp, W.J. & G. de Wert (2005). Embryonale stamcellen zonder morele pijn? In: *Gezondheidsraad. Signalering ethiek en gezondheid*. Den Haag: Gezondheidsraad, 2005, 13-36.
- Holland S. et al. (eds.) (2001). *The human embryonic stem cell debate*. Cambridge, Mass./London: Bradford.
- House of Commons, Science and Technology Committee (2006). *Government proposals for the regulation of hybrid and chimera embryos*. Fifth Report of session 2006-07.
- Human Genetics Commission (2006), *Making Babies: reproductive decisions and genetic technologies*, available at http://www.hgc.gov.uk.
- Human Genetics Commission (2007), *More Genes Direct. A report on developments in the availability, marketing and regulation of genetic tests supplied directly to the public*, available at http://www.hgc.gov.uk.
- Olsthoorn-Heim E., G. de Wert & H. Winter (2006). *Evaluatie Embryowet*. Den Haag: ZonMw.
- The President's Council on Bioethics (2004), *Reproduction and Responsibility: The Regulation of New Biotechnologies*, Washington D.C.
- The President's Council on Bioethics (2005). *Alternative sources of human pluripotent stem cells. A white paper*. Washington D.C.
- The President's Council on Bioethics (2008), *Human Dignity and Bioethics: Essays Commissioned by the President's Council on Bioethics*, Washington, D.C.

The healthcare sector on the move

- Abma, T.A., G.A.M.Widdershoven & B. Lendemeijer, red. (2005). *Dwang en drang in de psychiatrie. Kwaliteit van vrijheidsbeperkende interventies*. Utrecht: Lemma.
- Berg, M. (1998). *De nacht schreef rood: informatisering van zorgpraktijken.* Den Haag: Rathenau Instituut.
- Kammen, J.R. van (2004). Geavanceerde thuiszorgtechnologie: morele vragen bij een nieuwe zorgpraktijk. In: *Signalering Ethiek en Gezondheid*. Zoetermeer: Raad voor de Volksgezondheid & Zorg, 101-125.
- Verweij, M. (2005). Opsporing verzocht? Screening in de huisartspraktijk. In: *Gezondheidsraad. Signalering ethiek en gezondheid*. Den Haag: Gezondheidsraad, 2005, 71-90.
- Wert, G. de (2005). Cascade screening: whose information is it anyway? In: *Europan Journal Human Genetics* 2005; 13:397-8.
- Willems, D. (2004). Geavanceerde thuiszorgtechnologie: morele vragen bij een ethisch ideaal. In: *Signalering Ethiek en Gezondheid*. Den Haag: Gezondheidsraad, 69-92.
- Widdershoven, G.A.M. (2002). Technology and care from opposition to integration. In: Gastmans, Ch. (ed.) *Between technology and humanity. The impact of Technology on Health Care Ethics*. Leuven: Leuven University Press, p. 35-48.

Animals, nature & natural habitat

- Brush, S.B. (2005). Protecting Traditional Agricultural Knowledge. In: *Journal of Law & Policy* 17: 59-109.
- Intergovernmental Panel on Climate Change (IPCC) (2001). *Climate Change 2001: Impacts, Adaptation, and Vulnerability*. A Report of Working Group II.
- Keulartz, J. (2005). Kyoto and the Ethics of Flexibility. In: Vermeersch, E. Ed. *Reading the Kyoto Protocol. Ethical Aspects of the Convention on Climate Change?* Eburon Academic Press, 117-155.
- Martens, P., A.J. McMichael & J.A. Patz (2000). Globalisation, environmental change and health. In: *Global Change & Human Health* 1/1:4-8.
- McLaren, J.S. (2000). Future renewable resource needs: will genomics help? In: *Journal of Chemical Technology and Biotechnology* 75:927-932.
- Mehta, M.D. (2003). Climate change and biotechnology: moving toward a carbohydrate-based economy. In: *Bulletin of Science, Technology & Society* 23.
- Smit, B. & J Wandel (2006). Adaptation, adaptive capacity and vulnerability. In: *Global Environmental Change* 16:282-292.
- Watson, R., J. Dixon, S. Hamburg, A. Janetos, & R. Moss, R. (1998). *Protecting our planet, securing our future*. UNEP, U.S. NASA, The World Bank.
- United Nations (1982). *United Nations Convention on the Law of the Sea*. Montego Bay, Jamaica: UN. Available at: http://www.un.org/Depts/los/convention_agreements/texts/unclos/unclos_e.pdf.

Virtual reality

- Castranova, E. (2005). *Synthetic Worlds: The Business and Culture of Online Games*. Chicago, IL: University of Chicago Press.
- Jankowich, A. (2006). EULAW: The Complex Web of Corporate Rule-Making in Virtual Worlds. In: 8 *Tulane Journal of Technology and Intellectual Property* 1.
- Lodder, A. (ed.) (2006). *Recht in een virtuele wereld. Juridische aspecten van Massive Multiplayer Online Role-Playing Games*. Elsevier.
- Mayer-Schönberger & J. Crowley (2005). *Napster's Second Life? The Regulatory Challenge of Virtual Worlds*. 100 Nw. U. L. Rev. 1775.
- McKenna, K.Y.A. & J.A. Bargh (1998). Coming out in the age of the Internet: Identity 'Demarginalization' through virtual group participation. In: *Journal of Personality and Social Psychology* 75/3, 681-694.
- Woolgar, S. (ed.) (2002). *Virtual Society? Technology, Cyberbole, Reality.* Oxford: Oxford University Press.

The observation society

- Boutellier, H. (2002). *De veiligheidsutopie: hedendaags onbehagen en verlangen rond misdaad en straf*. Den Haag: Boom Juridische Uitgevers, 198 p.
- Crime Prevention Panel (2000). *Just Around the Corner. A consultation document DTI*. March 2000, 30 p.
- Custers, B. (2004). *The Power of Knowledge. Ethical, Legal, and Technological Aspects of Data Mining and Group Profiling in Epidemiology*. Nijmegen: Wolf Legal Publishers.
- Garland, D. (2001). *The culture of control: crime and social order in contemporary society*. Chicago: University of Chicago Press, 307 p.
- Koops, B.-J. (2006). *Tendensen in opsporing en technologie. Over twee honden en een kalf* (oratie Tilburg). Nijmegen: Wolf Legal Publishers, 55 p.
- Lyon, D. (2001). *Surveillance Society: Monitoring Everyday Life.* Open University Press.
- Lyon, D. (ed.) (2006). *Theorizing Surveillance: The Panopticon and Beyond*. Willan Publishing.
- Lyon, D. (2007). *Surveillance Studies. An overview*. Polity Press.
- Petersen, J.K. (2001). *Understanding surveillance technologies: spy devices, their origins & applications*. Boca Raton, FL: CRC Press.
- Pister, K., *Smart Dust. Autonomous sensing and communication in a cubic millimeter*. Available at: http://robotics.eecs.berkeley.edu/~pister/SmartDust/.
- Schermer, B.W. (2007). *Software agents, surveillance, and right to privacy: a legislative framerwork for agent-enabled surveillance*. Leiden University Press.
- Swaaningen, R. van (2004). Veiligheid in Nederland en Europa: een sociologische beschouwing aan de hand van David Garland. In: *Justitiële verkenningen* 30/7:9-23.
- Zittrain, J. (2003). Internet Points of Control*. Boston College Law Review* 44:653ff.

Neurotechnology

- Fuchs, T. (2006). Ethical issues in neuroscience. In: *Current Opinion in Psychiatry* 2006; 19: 600-607.
- Gazzaniga, M. (2005). *The Ethical Brain.* Dana Press.
- Glannon, W., *Bioethics and the Brain.* Oxford: Oxford University Press.
- Glimcher, P.W. (2003). *Decisions, Uncertainty, and the Brain: The Science of Neuroeconomics.* Bradford Books.
- Illes, J. (ed.) (2006). *Neuroethics: Defining the Issues in Theory, Practice, and Policy.* Oxford: Oxford University Press.
- Renvoisé, P. & C. Morin (2005). *Neuromarketing: Is There a 'Buy Button' in the Brain?* SalesBrain Publishing.
- Tancredi, L. (2005). *Hardwired Behavior: What Neuroscience Reveals about Morality.* Cambridge: Cambridge University Press.
- Uttal, W.R. (2001). *The New Phrenology: The Limits of Localizing Cognitive Processes in the Brain.* MIT Press.
- Wolpe, P.R., K.R. Foster & D.D. Langleben (2005). Emerging Neurotechnologies for Lie-Detection: Promises and Perils. In: *American Journal of Bioethics* 2005; 5/2:39-49.
- Zeki, S., & O. Goodenough (eds.) (2006). *Law and the Brain.* Oxford: Oxford University Press.

The formable human

- Boia, L. (2004). *Forever young. A cultural history of longevity*. London: Reaktion Books.
- Bostrom, N. (2003). Human Genetic Enhancements: A Transhumanist Perspective. In: *The Journal of Value Inquiry* 2003; 37:493–506.
- Buchanan, A. et al. (2000). *From chance to choice*. Cambridge: Cambridge University Press.

- Dickenson, D. & G.A.M. Widdershoven (2006). Ethical issues in limb transplantations. In: Benatar, D. (ed.). *Cutting the core. Exploring the ethics of contested surgeries*. Lanham/Boulder/New York/Toronto/Oxford: Rowman & Littlefield Publishers Inc., p. 141-155.
- European Group on Ethics in Science and New Technologies (2005). *Ethical Aspects of ICT Implants in the Human Body European Group on Ethics in Science and New Technologies.* Published 16 March 2005, 34 p.
- Gezondheidsraad (2003). De maakbare mens. In: *Gezondheidsraad. Signalering ethiek en gezondheid*. Den Haag: Gezondheidsraad, 83-99.
- Harris, J., Clones (1998). *Genes and immortality. Ethics and the genetic revolution*. Oxford: Oxford University Press.
- Harris, J. (2007). *Enhancing Evolution: The Ethical Case for Making Better People*. Princeton University Press.
- Juengst, E.T., R.H. Binstock, M.J. Mehlman & S.G. Post (2003). *Antiaging research and the need for public dialogue*. Science 2003;299:1323.
- Kapoor, R. (2003). When humans outsmart themselves. In: *Futures* 2003; 35:787–791.
- Kurzweil, R. (2005). *The Singularity is Near: When humans transcend biology*. New York: Viking.
- Miller, P. & J.Wilsdon (eds.) (2006). *The politics of human enhancement and life extension*.
- Parens, E. (ed.) (1997). *Enhancing human traits: ethical and social implications*. Washington, DC: Georgetown University Press.
- Sandel, M. (2007). *The case against perfectionism: Ethics in an age of genetic engineering*. Cambridge, Mass.: Cambridge University Press.
- Warwick, K. (2002). *I Cyborg*. Century.
- World Transhumanism Association. *The Transhumanist Declaration.* Available at: http://www.transhumanism.org/index.php/WTA/declaration/.

Defence, safety & military technology

- Creveld, M. van (1989). Technology and War: From 2000 B.C. to the Present. New York: Free Press.
- Homan, K. (2005). Van pepperspray tot lasergun. Militaire technologie en de menselijke maat. Den Haag: Rathenau Instituut, Werkdocument 95.
- Moreno, J.D. (2006). Mind Wars: Brain Research and National Defense. Dana Press.
- May, L., E. Rovie & S. Viner (eds.) (2006). The Morality of War. Englewood Cliffs, New York: Prentice-Hall Publishers.

Functional foods

- Korthals, M. (2004). *Before Dinner*. Springer, chapter 8.
- Matthews, D. (2006). *NGOs*, *Intellectual Property Rights and Multilateral Institutions*. Report of the IP-NGOs research project, published December 2006. University of London: Queen Mary Intellectual Property Research Institute (IP-NGOs website: www.ipngos.org).
- Schroeder, D. (2007). Public Health, Functional Foods. In: *Journal of Agricultural and Environmental Ethics* 2007;, 20/3.
- http://www.scidev.net/announcements/index.cfm?fuseaction=printarticle&itemid=580&language=1.
- http://www.fao.org/sd/sdrr/portal/about_en.htm.

4. Programme management

4.1 General

The MVI thematic programme is a partnership between NWO (divisions for Humanities and Social Sciences, WOTRO Science for Global Development, Technology Foundation STW and ZonMw) and the Ministries of the Interior and Kingdom Relations; Foreign Affairs; Defence; Agriculture, Nature and Food Quality; Education, Culture and Science; Health, Welfare and Sport.

The programme will run for 6 years (2008-2014). Financially, it will start with approximately M€ 9. The funds currently available are only sufficient to allow part of the research agenda to be completed. As such, the aim is to obtain support for the programme elsewhere and attract additional finances.

The MVI thematic programme has a strong international orientation. The programme management will emphasise that orientation further by organising international conferences and workshops. The researchers will be encouraged to take part in European programmes, in particular the Seventh European Framework Programme.

4.2 Organisation

The MVI thematic programme will fall under the responsibility of a steering committee and a programme committee. For certain issues, meetings of the steering committee and the programme committee may coincide. The steering committee and the programme committee may decide in joint consultation to adjust the programme's priorities following an initial assessment, though the final decision lies with the steering committee. Assessment of applications is the responsibility of the Advisory Board.

The steering committee
The programme's steering committee is composed from representatives of the programme's joint financiers. The overall coordination lies with the steering committee, which has a definite input in the development of the programme, particularly in terms of knowledge sharing. Every year, the steering committee will determine the budget for the programme, within the limits of the available funding. The steering committee will also decide on possible adjustments to the programme, based on the programme committee's advice. However, the steering committee will interfere as little as possible in the management of the programme as such.
The steering committee appoints the members of the Advisory Board and of the Societal Panel, and selects the research projects to be awarded, based on priority advice presented by that committee, within the financial possibilities defined. The steering committee is also responsible for monitoring the research programme in practice in terms of progress and cohesion.

The programme committee
The programme committee is made up of experts – representing the NWO division Humanities and Social Sciences, and representing WOTRO, STW and ZonMw - who possess significant expertise in the area covered by the programme. The programme committee is responsible for providing assistance with regard to the programme as such. The programme committee is also responsible for assisting the steering committee in its decisions on the following matters:
- defining the further details of the planned activities (internationalisation, valorisation);
- organising the 'Platform for Responsible Innovation' (MVI Platform) and in particular bringing together researchers to allow them to submit joint applications;
- formulating a plan to set up a knowledge centre based on the MVI platform;
- increasing the scope of support for the programme and attracting additional finances.

When the programme is launched, one of the members of the programme committee will be appointed coordinator. The coordinator will also be asked to help initiate, structure and organise activities for the entire programme, and in particular to help attract additional finances.

Advisory Board, Societal Panel
In order to assess applications, the steering committee will set up an Advisory Board. This Advisory Board will advise the steering committee on matters concerning the selection of the preliminary applications and the

assessment of the full applications. The Societal Panel will be formed to assess the societal relevance of the applications. That panel will be set up by the steering committee, and will advise the Advisory Board.

MVI Bureau
The secretarial work for the steering committee, the programme committee, the scientific advisory committee and the societal panel will be carried out by NOW. The secretary will have a background in the theme sponsor's field. The NWO divisions Societal and Behavioural Sciences, WOTRO, STW and ZonMw have designated 'contacts'. The secretary will perform his or her work in close cooperation with those contacts.
The general rules of NWO apply to the programme's organisation, assessment and records and to the awarded research proposals.

4.3 Projects and subsidies

Projects
The interactive nature of the research is reflected in the manner in which the projects are structured and the research teams composed. The programme distinguishes two types of projects. Project grants can be requested for both types of projects.

1. Projects for research into the ethical and societal aspects of concrete technological developments
These projects have to have a 'make' perspective, i.e. they should not only result in an analysis and understanding of a particular problem, but subsequently also lead to a 'design perspective' – in the broad sense, including institutional arrangements.
All such projects are multidisciplinary, consisting of research in the humanities as well as in social sciences. They also require a clear input from science/technological research. Two modalities can be distinguished here:

A. Projects in which the input from science/technological research is clearly visible and is involved in the research in the humanities and social sciences.

B. Projects in which the research consists of an integration of both a science/technological component and humanities and social science components.

2. Projects for research into ethical and societal background questions
These projects should, preferably, be multidisciplinary. The research into background questions must tie in with current and emerging innovation processes. That connection is a precondition, and is given shape by ensuring that the research is linked to or embedded in one or more concrete technological cases.
Science/technological scientists must be involved at the least in preparing the research proposal, and must be represented in the project's supervision group.

Project grants
Project grants may be requested both for long-term and for short-term research.

Project grants for long-term research are intended to encourage researchers who wish to conduct promising research into i) ethical and societal aspects of concrete technological developments, or ii) into more general issues, and apply it in one or more concrete technological cases. Research proposals may be submitted in the form of projects with a budget of up to €550,000 and a duration of 4 years, with possible spread over at most 5 years, with applications for 2 or more researchers (who will be subsidised by NWO). Projects that exceed the limits specified should demonstrate other sources of funding.
Long-term research projects must have a project leader, who is available to discuss the interaction between humanities, science/technology and social sciences throughout the duration of the project. He or she is responsible for coordinating the joint activities and integrating the various results.

Project grants for short-term research may be requested for research in which quick results are needed: policy-supporting research and analysis of current issues that concern one or more of the themes of the MVI programme. As a rule, such research will concern the ethical and societal aspects of concrete technological developments. Projects for short-term research have a maximum budget of €125,000 and a maximum duration of one year. Projects that exceed the limits specified have to demonstrate other sources of funding.

The Calls for proposals (see below) set out further details about the rounds in the grant process, including the costs for which subsidies may be requested.

4.4 Grant process: rounds

As matters stand, the grant process will consist of two rounds. The first will be an open round, in which researchers may submit applications for any theme in the research agenda (Call for Proposals), and will commence in May 2008. During the second round, applications will only be possible for the areas specified by the steering committee (Call for Tenders). This will be the areas that did not receive sufficient attention during the first round.
Shortly after the first Call is sent out, the MVI Platform will organise the first meeting, to bring researchers together and so allow them to submit joint applications. In view of the time that the researchers will need to form partnerships, they will have three months' time after the publication of the Call to submit their proposals (preliminary applications).

4.5 Platform

The MVI thematic programme also includes a platform. That MVI Platform, in which the Rathenau Institute will also be represented, is closely affiliated with the research programme, and has an international dimension. Initially, it will serve as a place for researchers in this field and stakeholders in innovation (financiers, businesses, etc.) to meet and talk. Meetings will be organised for researchers and national and international stakeholders throughout the programme's duration. During the first phase of the programme, those meetings will primarily serve to bring researchers together to allow them to submit joint applications. Subsequently, the meetings will mostly concern provisional and final research results, on the one hand, and more general issues on the other. The interaction between humanities, technological and social sciences research will be an important aspect at those later meetings.

In light of the significant scientific and societal importance of the research into the societal and ethical aspects of science and technology, it might be advisable to set up a knowledge centre for the MVI programme: a place for researchers to meet to disclose and store the knowledge generated by the programme and the underlying material. Such a centre could also be responsible for communicating about the programme and the research results: initiating and maintaining and intensive exchange between all stakeholders. In this context, stakeholders are users, potential users, societal organisations, policymakers, journalists and all other interested parties. Another important responsibility would be to provide education and knowledge management. Logically, the platform function should organisationally be assigned to that knowledge centre.
More specifically, examples of functionalities include the following:

1. contributing to education for technology and other researchers (students/researchers);
2. developing training materials and competency development for researchers (in the area of technology, in the broadest sense), policymakers and others;
3. ensuring an intensive exchange between all stakeholders: besides proper communication (information, television programmes etc.) this also means ensuring an intensive level of involvement on the part of individuals and societal organisations in the development of new technologies and the accompanying decision-making process;
4. organising gatherings for researchers conducting research into societal aspects of technological research, either as part of the MVI thematic programme or as part of another programme;
5. providing knowledge management and disclosing information.

Developing such a knowledge centre will be an ambitious, labour-intensive and expensive project. The plans for the knowledge centre will be detailed further during the programme's first year. Important factors in its development will be its organisational structure and management and the parties involved (national and international), on the one hand, and its funding on the other (budget and financing plan).

Annex 1: Composition of the preparation committee and agenda committee

Theme preparation committee
The programme framework as described in the initial memorandum was developed by the theme preparation committee. That committee was made up of the following people:

- Prof.Dr. J.C.M. van Eijndhoven, Erasmus University Rotterdam (chair)

- Dr. N.C.M. Alma-Zeestraten, director of the Dutch Chemical Industry Association
- Prof.Dr. M.J. van den Hoven, Delft University of Technology
- Prof.Dr. A.W. Koers, General Counsel InterAcademy Council
- Dr. J.C.A. van der Lubbe, Delft University of Technology
- Prof.Dr. C.L. Mummery, Hubrecht Laboratory
- Prof.Dr. A. Rip, University of Twente
- Dr. M.E. Sleeboom, International Institute for Asian Studies, Leiden University
- Mr.Drs. J.Staman, director of the Rathenau Institute
- Prof.Dr. C.A.J. Vlek, University of Groningen
- Prof.Dr. G.M.W.R. de Wert, Maastricht University
- Prof.Dr. H.A.E. Zwart, director of the Centre for Society and Genomics

Agenda committee
The agenda committee turned the initial memorandum into the programme proposal. That committee consisted of representatives from the NWO divisions in question and from the ministries working with NWO in connection with the MVI programme:

Interior and Kingdom Relations
Drs. P.H.W.C. Niessen
Dr. H.L. Janssen

Defence
Drs. P. Bartels
Drs. G.J. de Wilde

Foreign Affairs
Drs. J.P.L.W.M. Rijniers

Education, Culture & Science
Mr. G.R. Valenti

Agriculture, Nature and Food Quality
Dr. J.T.C.M. Sprangers
Ir. P.J.M. Keet

Health, Welfare and Sport
Ir. V. van Nederveen
Drs. S.D. Kuijper

Humanities
- Prof.Dr. J.M. van den Hoven (chair)

Social Sciences
- Prof.Dr. B.J. Koops

Technology Foundation STW
- Prof.Dr. A. Rip

WOTRO Science for Global Development
- Prof.Dr. M.J.A.A. Korthals

ZonMw
- Prof.Dr. G. de Wert

Copy editor for programme proposal
- Ir. I. Oosterlaken

Annex 2: Composition of the steering committee and the programme committee

Steering committee
The steering committee is made up of representatives from the programme's joint financiers. The composition of the steering committee is as follows:

Ministries
- Drs. P. Bartels, Ministry of Defence
- Dr. P. van Hof, Ministry of Education, Culture and Science
- Dr. A. van Ravenzwaaij, Ministry of the Interior and Kingdom Relations
- Drs. J.P.L.W.M. Rijniers, Ministry of Foreign Affairs
- Dr. J.T.C.M. Sprangers, Ministry of Agriculture, Nature and Food Quality
- Drs. J.F. van den Berg, Ministry of Health, Welfare and Sport

NWO divisions, WOTRO, ZonMw and STW
- Drs. D. Guijt, ZonMw
- Dr. W.A. Dolfsma, University of Groningen, Societal and Behavioural Sciences
- Dr.ir. O.M.B. de Ponti, Nunhems Netherlands BV, WOTRO Science for Global Development
- Prof.Dr. M. Stokhof, University of Amsterdam, Humanities (chair)
- Prof.Dr. M.P.C. Weijnen, Delft University of Technology, Technology Foundation STW

Programme committee
The programme committee is made up of experts who possess significant expertise in the area covered by the programme:

- Prof.Dr. M.J. van den Hoven, Delft University of Technology (chair)
- Prof.Dr. B.J. Koops, Tilburg University, Societal and Behavioural Sciences
- Prof.Dr. M.J.A.A. Korthals, Wageningen University & Research Centre, WOTRO Science for Global Development
- Dr. C.A. Linse, Shell, Technology Foundation STW
- Prof.Dr.Ir. G.A.M. Widdershoven, Maastricht University, ZonMw

Advisory Board, Societal Panel
The composition of the Advisory Board and the Societal Panel will be announced on the website (address: www.nwo.nl/mvi).

MVI Bureau
- Drs. E.M. van de Meent-Nutma, Humanities, programme manager
- Dr. J. Roodenburg, Humanities, programme manager
- Drs. M.G. van Leeuwen, contact for Social Sciences
- Dr.Ir. G. Tuitert, contact for WOTRO Science for Global Development
- Mr. S.P. Oudejans, contact for Technology Foundation STW
- Drs. M. Slager, contact for ZonMw