INSTITUTE FOR THE STUDY OF SCIENCE OF RUSSIAN ACADEMY OF SCIENCES

THE SOCIAL SCIENCES AND HUMANITIES

RESEARCH TRENDS AND COLLABORATIVE PERSPECTIVES

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This book combines research contributions of Russian and European scholars in identifying new trends and perspectives of the international collaboration in the social sciences and humanities (SSH). The first section deals with different aspects of international cooperation in research: new challenges in the SSH, the problem of ideology intervention in international scientific communications, cross-cultural, organisational, and other barriers in establishing research contacts between Russian and foreign scholars. The book also includes papers on disciplinarity and interdisciplinarity in social, human and natural sciences, new trends in the philosophy of science, risks bringing by the spreading invasion of new technologies into everyday life, and issues on the governance of a knowledge society. A number of papers discuss different trends in the modern economy and society: new science and technology trajectories, global trends and mechanisms in nanotechnology, key aspects of a knowledge economy, limitations of the consumer societies, and crowdsourcing as an open innovation strategy to reduce the brain drain in CIS countries.

The publication is addressed to the SSH research community, university and PhD students.

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## Contents

FOREWORD .............................................................................................................................. 7

I. INTERNATIONAL COLLABORATION: CHALLENGES, PERSPECTIVES AND PRACTICES

GABRIELE GRIFFIN .................................................................................................................. 11

DISCIPLINARY AND INTERDISCIPLINARY TRENDS IN THE SOCIAL SCIENCES AND HUMANITIES

CHALLENGES IN INTERNATIONAL COOPERATION

The 7th Framework RTD Programme is the EU major instrument to support research in 2007–2013. The author sheds light on the contemporary context of conducting SSH research and current trends in disciplinary and interdisciplinary SSH research within the Programme. The paper includes a discussion on the cross-cultural barriers that effect collaboration in international research teams.

LEVAN MINDELI, VLADIMIR VASIN ....................................................................................... 28

SOCIAL SCIENCES AND HUMANITIES IN RUSSIA

PROSPECTS FOR INTEGRATION INTO THE EUROPEAN RESEARCH AREA

Translated from Russian

The idea of a Pan-European research area in the social sciences and humanities, connecting Russian and Western scholars, seems to be very attractive. A number of national and global topical problems that could be addressed as an agenda for international collaboration are discussed in the paper. Considerable attention is paid to cooperation in the field of science of science.

VLADISLAV KELLE .................................................................................................................. 49

IDEOLOGICAL COMPONENT IN THE SYSTEM OF INTERNATIONAL SCIENTIFIC COMMUNICATIONS

Translated from Russian

Ideological component explicitly or implicitly affects on research in the social sciences and humanities, while scientific communications are not subject to ideologisation since they are established to solve research problems. The author observes methodological issues of interaction between the social sciences and ideology and in this context discusses peculiarities of scientific communications during the “cold war” and nowadays.

RUBEN APRESSYAN ................................................................................................................. 64

TRENDS AND OBSTACLES IN INTERNATIONAL SCIENTIFIC LINKS

SPECIFIC ANALYSIS BASED ON PERSONAL IMPRESSIONS

Translated from Russian

More general problems of science and higher education in the country are in any case revealed in the international scientific collaboration. The author shares his international collaboration experience with the reader, discussing obstacles that impede establishing research links between Russian scholars and their colleagues from abroad.
II. PHILOSOPHY OF SCIENCE: METHODOLOGICAL ASPECTS

HANS LENK ............................................................... 85

HIGHER LEVEL INTERDISCIPLINARITY
BY METHODOLOGICAL SCHEME INTERPRETATIONISM
AGAINST METHODOLOGICAL SEPARATISM BETWEEN NATURAL,
SOCIAL AND HUMAN SCIENCES

Methodological scheme interpretationism is the approach developed by the author in his
philosophical publications. This paper discusses theoretical aspects of cross-disciplinary
or ‘interareal’ connections of diverse topical problem fields within our complex and highly
interconnected quasi artificial world. The author convincingly proves his methodological
conclusions regarding an abstract interpretationist ‘reunification’ between the different sci-
extentive disciplines, the humanities, and everyday understanding.

ALEXANDER OGURTSOV .................................................. 119

TRENDS IN THE MODERN PHILOSOPHY
OF SCIENCE
FROM CONSTRUCTIVISM IN THE UNDERSTANDING OF THE LANGUAGE OF SCIENCE TO
THE COMPREHENSION OF RESISTANCE OFFERED BY THE OBJECT UNDER ANALYSIS

Translated from Russian

In the course of progress, science changes the foundations of scientific knowledge,
research methods, and notion base. The philosophy of science plays an important role in
such a change in scientific knowledge. The paper observes trends in the analysis of scien-
tific knowledge in the 20th century. The author comes to the conclusion that we are wit-
nessing a turn from the constructivism towards a new understanding of the object and the
objectivity of scientific knowledge.

III. RISKS AND GOVERNANCE IN THE KNOWLEDGE SOCIETY

HANS LENK ............................................................... 135

ON RISKING AND RESPONSIBILITY
IN THE 21st CENTURY

AN APPROACH TO RISKING BEHAVIOUR, RESPONSIBILITY TYPES AND CONFLICTS,
AS WELL AS PRIORITY RULES WITHIN SYSTEMS TECHNOLOGICAL SOCIETIES

After the terrorist attacks as of September 11, 2001, questions of safety and risk manage-
ment and responsibility became topical to a high degree. The author argues that risk
assessment is usually seen too much merely as a question of statistics and as based on
technical malfunctioning. Consequently, in risk management and reactive treatment the
social and human dimension seems to be frequently underrated. A systematised typology
of different types and levels of responsibility is presented by the author as an analytical
instrument for differentiating such variants that could be used for a refined risk assessment
in management and priority decisions.
GOTTHARD BECHMANN ................................................................. 168

THE EMERGING OF A NEW GOVERNANCE OF KNOWLEDGE

KNOWLEDGE POLITICS

The relationship between society and science has changed in the past decades. The production of scientific knowledge should be directly integrated into economic and political decision-making processes. The author describes and delineates the notion of knowledge politics as a new field of political activity. The analysis clarifies efforts to anticipate the effects of new knowledge on social relations, and attempts to control its impact, as well as the main reasons why knowledge politics gains prominence as a field of political activity in modern societies. The paper also includes some pertinent episodes that illustrate knowledge politics in action.

VITALY GOROKHOV ................................................................. 188

NANOETHICS AS A COMBINATION OF SCIENTIFIC, TECHNOLOGICAL AND ECONOMIC ETHICS

Translated from Russian

Nowadays nanotechnology is viewed in all developed countries as the technology of the future that can save the world. These expectations are however clouded by insights about unforeseen negative consequences and risks associated with the introduction of new technologies. The author outlines ethical issues introduced by nanotechnologies into the contemporary life.

IV. TRENDS IN THE KNOWLEDGE-BASED SOCIETY

JARI KAIVO-OJA ................................................................. 207

KEY TRAJECTORIES OF SCIENCE AND TECHNOLOGY IN EUROPE AND THE WORLD

ANALYSING RESEARCH PERSPECTIVES AND INNOVATION DYNAMICS

Science and technology trajectories are becoming more and more crucial for understanding the future dynamics in all life spheres, and what is more innovation, creativity, and design are among the most frequently used words in business and society today. The paper includes brief discussions on science and technology trajectories, foresight and innovation system dynamics, open innovation theory, innovation category model, Schumpeterian innovation theory, and the triple helix model. Substantial attention is paid to non-economic and non-technological innovations.

NADEZHDA GAPONENKO ................................................................. 237

TOWARDS A BALANCED AND ADAPTIVE SECTORAL INNOVATION SYSTEM IN NANOTECHNOLOGY

METHODOLOGICAL PROBLEMS, GLOBAL TRENDS AND REGIONAL STRATEGIES

Translated from Russian

Sectoral innovation system in nanotechnology (SISn) is at the embryonic stage. The way we understand the formation and specific features of SISn has a great impact on state regulation policies and measures. The author traces trends, driving forces, and trajectories in SISn at the initial stage. Global trends and mechanisms, conducive to well-balanced SISn, are also under consideration in this paper.
Today the Russian economy is going through several simultaneous transformational processes, some of which are local, for instance market transformations, while others are worldwide tendencies, the most prominent of which is the transition to a knowledge economy. The author analyses economic foundations of a knowledge economy and concludes that educational systems and their subjects will be of the utmost importance in the future knowledge economy.

The EU-27 has been set on the path to becoming a leading global economic force. The human and natural resources of Europe offer enormous possibilities for economic and social developments. Critical to these developments are trends in consumption and consumer behaviours, together with the potential for consumers to act as innovators in markets. The paper discusses trends in consumption and consumer markets in the contemporary context of economic downturn. An agenda for collaborative research across EU and Russian networks and interests is offered.

Open innovation strategies, being more and more in use by innovation companies, set up opportunities to involve new groups of actors into innovation process. By discussing business practices from two Swiss open innovation service providers against the background of the brain drain from CIS countries, the paper demonstrates how open innovation strategies in general and crowdsourcing in particular can support more sustainable and, above all, local returns on investments in the CIS’s well-developed educational infrastructure.
This book is an unusual publication undertaken by the Institute for the Study of Science of RAS. First, it is issued in the Russian and English identical versions; second, the book is of multidisciplinary and interdisciplinary character; third, it is international by the composition of contributors; fourth, it is transnational by the content of the discussed issues.

This publication resulted from research efforts of Russian and European scholars who took part in the International Seminar Cooperation between Russian and EU Country Scientists in the Social Sciences and Humanities: Problems and Perspectives held in the Russian Academy of Sciences on the 23rd and 24th of October, 2008.

Papers, presented in the book, are grouped in four sections. The first one comprise four works that discuss different aspects of international collaboration: challenges and perspectives of international cooperation in the social sciences and humanities under the 7th EU RTD Framework Programme (Gabriele Griffin), reflections on collaboration perspectives between Russian and European scholars (Levan Mindeli, Vladimir Vasin), the problem of ideology intervention in international scientific communications (Vladislav Kelle), as well as the analysis of different hindrances in establishing international scientific links and contacts, such as cross-cultural barriers (Gabriele Griffin), lack of managerial competence in international cooperation in the universities, visa restrictions, a small share of researchers skilled in foreign languages in the Russian SSH community (Ruben Apressyan).

Papers of the second section belong to the philosophy of science. The first one applies the scheme interpretationism approach to overcome the methodological separatism between natural, social and human sciences and argues that, in spite of the disciplinary division of science, research is interdisciplinary in essence, at metalevel (Hans Lenk). The other paper analyses new trends in subject and object interrelations in the philosophy of science and demonstrates a turn from constructivism in the understanding of the language of science to the comprehension of resistance offered by the object under analysis (Alexander Ogurtsov).

The third section deals with ethical problems, arisen from new science-based technologies invaded in all life spheres, and the relevant need for a new governance of knowledge. The first paper of the section is focused on risks in the systems technological world and the relative general, corporate, and indi-
individual responsibility (Hans Lenk). The second paper touches upon the problem of increasing risks from the viewpoint of knowledge politics considered as a new field of political activity in modern societies (Gotthard Bechmann). The last paper of the section discusses concrete ethical aspects of nanotechnology becoming in use not only for specific purposes such as defence or production technologies, but also in everyday life (Vitaly Gorokhov).

Papers in the fourth section reflect on some trends of the modern knowledge-based society. In this section, key science and technology trajectories based on the foresights developed in the USA, Japan and Germany, as well as innovation concepts updated in the part of non-market elements enlarging the space for new innovation actors and agents are discussed (Jari Kaivo-oja). Another paper examines the problem of a balanced sectoral innovation system in nanotechnology (Nadezhda Gaponenko). Two small in volume papers deal with key features of a knowledge economy (Liudmila Kleeva) and limitations of consumer societies that become evident in the contemporary context of economic downturn (Linda McKie). The section ends with the paper discussing crowdsourcing as an open innovation strategy to reduce and prevent the brain drain from CIS countries to the developed Western world (Steffen Roth).

Before I invite the reader to sail the sea of pages of this book, I would like to thank the authors who found a time in their busy schedules to submit the papers for publication, the team of translators worked on the original texts, not easy to understand and a fortiori to translate, and Olga Ivanova, the editor of ISS RAS publishing group, who shared with me the work on preparing the publication and to a large degree contributed to the highest possible clarity in the texts of papers included in this book.

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INTERNATIONAL COLLABORATION: CHALLENGES, PERSPECTIVES AND PRACTICES
As an academic, I work in gender studies, a research field that has been interdisciplinary from its inception and, most typically, spans the humanities and social sciences, as well as, increasingly, the natural and hard sciences [1]. I have also directed a number of EU-funded interdisciplinary research projects, including on the integration of social sciences and humanities research methods¹, and, at present, I am a member of an EU expert group producing a report to the European Commission, intended to inform the next research framework programme, on current trends in the social sciences and humanities². This is the background which informs this paper, and it is particularly the last activity which is relevant here since I shall address three main points:

- Trends in the contemporary context of conducting SSH research;
- Current trends in inter/disciplinary SSH research;
- Issues in conducting cross-cultural research.

It is important to note that the second point in particular is informed by the work I am currently doing in the expert group and here it has to be borne in mind that research funding by the DG Research of the European Commission under its framework programmes is predominantly concerned with policy-relevant research — which is what I shall focus on.

¹ See, for example, the projects’ websites at: http://www.hull.ac.uk/ewsi and http://www.york.ac.uk/res/researchintegration

² The report of the METRIS group to the European Commission was prepared in December 2008 and published in March 2009. (METRIS — Monitoring European Trends in Social Sciences and Humanities — is a network of experts set up to monitor European trends in the social sciences and humanities in the EU member and candidate countries. — Ed.)
1. TRENDS IN THE CONTEMPORARY CONTEXT OF CONDUCTING SSH RESEARCH

Across many western countries, especially but not only in the Anglophone world, research cultures have changed significantly in the past thirty years, driven by changes in socio-political and economic circumstances which have led to an interrogation of the status of the university, of the nature and production of knowledge, and indeed of research in contemporary society [2–4]. I shall not discuss the historical details of this phenomenon here. Instead, I want to point out what the effects of this process of change have been:

1. Shrinking public funding for research in general — relative to research’s fiscal demands, not in absolute terms [5].

2. The establishment in research — but not just there — of an accountability culture where researchers in universities have to account, in increasingly bureaucratic terms, for how they spend public research funds and what the outcomes of their research are. This includes the issue of metrics and the quantification of research performance.

3. Directly related to this, an output-driven research culture.

4. Also directly related to that culture of accountability, a much more directive attitude towards research, resulting in priority setting for research funding purposes, and these priorities, expressed as so-called thematic priorities by research funders, are converging globally. Under Framework 7 in the European Commission these priorities are:

   – Health;
   – Food, Agriculture and Biotechnology;
   – Information and Communication Technologies;
   – Nanosciences, Nanotechnologies, Materials and New Production Technologies;

\[\text{3}\] The journal Accountability in Research Policies and Quality Assurance (published by Taylor and Francis, London) exemplifies in its content that culture. See also the website http://www.wmin.ac.uk/sshl/page-1216, of a project funded under FP5 entitled Analysing Public Accountability Procedures in Contemporary European Contexts, 2001–2004.

\[\text{4}\] Output here refers to the requirement in most funded research to identify the outcomes of one’s research in terms of publications, conference papers, patents, etc., and to the assessment of that research in terms of those outcomes.

\[\text{5}\] For further details, see: http://cordis.europa.eu/fp7
5. Variations of these, with the exception, possibly, of Socio-economic Sciences and Humanities, appear as the core thematic research agendas of research funders across the world, from Australia to the United States. These set the parameters for much funded research, to some extent more so in the social sciences than in the humanities.

6. As a consequence of the combination of shrinking public research funding, and a rising audit culture, researchers, especially in the Anglophone world, are increasingly being asked to account in detail for how they spend their research time. In Britain, for instance, we have the so-called Research Assessment Exercise which occurs every 4 to 5 years, requires every individual researcher to detail all aspects of their research activity including number of publications (judged in terms of a series of prestige factors), amount of external research funding brought in, etc., and which carries significant financial reward for the employing institution if its researchers get top marks. The need for concrete outputs within a short period of time in order to secure public research income, means that long-term research projects, ones that last more than 3 or 4 years, have become increasingly difficult to conduct among western researchers, except as a quasi-private leisure activity, a factor that has hit the humanities somewhat more than the social sciences. Research assessment, in terms of external research funding achieved, has also propelled researchers increasingly to seek such external research funding — funding that is competitive, and where researchers also spend more and more time preparing bids that are then not funded.

7. Where national research funds have become quickly exhausted under this competitive strain, researchers have begun to look to the international arena to provide research funding and there, too, we begin

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6 The RAE website http://www.rae.ac.uk provides full details of this process and its findings.
to see the pressure of the sheer number of applicants, with application-to-successful bidding ratios in steady decline\(^7\).

8. Research funders operate in different ways but one of the trends we are seeing is the demand for policy relevance which of course means having to fit into cycles of political governance, and one result of this has been the rise in western countries of project-based research, conducted over 2 to 3 years, and with pre-specified outputs and outcomes. Such research is, of course, much more common among social sciences than among humanities disciplines and has led, in some respects, to an even more chronic under-funding in the humanities than in the social sciences.

9. One effect of this turn to international research funding seeking, cemented by the converging research agendas and, of course, also, by globalisation and the recognition that many issues are global rather than local and need global solutions, has been an enhanced drive towards international collaboration, and, as a result of changes in perception of what research in the 21st century requires, there has also been an increasing drive towards interdisciplinary and collaborative research\(^8\). Again, many humanities disciplines have little experience or tradition of conducting research in that way, and can therefore find themselves severely challenged by these new trends. In relation to the issue of interdisciplinarity – which I shall not define here – it is also the case that researchers in so-called cognate areas, e.g. in assorted social sciences disciplines, can find it much easier to work together than researchers working across radically disjunctive disciplines. There are arenas such as HCI – human-computer interaction – where researchers from art and design, social sciences, engineering and mathematics work together to develop things such as intelligent fabrics – but these arenas are relatively new and collaboration has to be worked at\(^9\).

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\(^7\) The success rates under FP7 can be found at: www.kpk.gov.pl/statystyki/7_pr/raporty/FP7-SuccessRatesMaj2008-applicants.pdf. Its average is around 22%.

\(^8\) We reported extensively on this phenomenon in an EU-funded project on the integration of social science and humanities research methods (see: http://www.york.ac.uk/res/researchintegration).

\(^9\) A good example of this kind of interdisciplinary collaboration occurred in some of the projects funded under the ‘Designing for the 21st Century’ programme which was co-funded by Arts and Humanities Research Council (AHRC) and the Engineering and Physical Sciences Research Council (EPSRC) in the UK. For further details see: http://www.ahrc.ac.uk/FundingOpportunities/Pages/Designingforthe21stCentury.aspx; and http://www.design21.dundee.ac.uk
I would finally like to mention two other current developments that impact on research collaboration:

10. One of these is the increasing incorporation, in Western countries, of professional training into universities so that the arts, for instance, but also nursing and paramedical professions, have become part of contemporary research cultures. Note that I have decided not to define what social sciences and humanities are or encompass. It is the case that these knowledge domains are defined somewhat differently across the diverse European countries, and we could spend many happy hours debating their parameters. I would like just to point out that arts agenda, or disciplines such as literature, performance arts or visual/media culture are becoming more and more important in collaborative research terms. One reason for this absence may be that since the 19th century certain Humanities and Arts disciplines have been strongly associated with nation building and ethno-specific agendas, and we are here to discuss international rather than intranational research collaboration. However, it should be noted that in the Internet age, arts and humanities increasingly function through and on, and are researched via, the globalised phenomenon that is the Internet which is also, especially amongst younger generations, the premier point of cultural engagement and exchange. To reflect, and reflect on, this trend, it is therefore critical that these arts and humanities disciplines are activated in international, interdisciplinary collaborations.

11. My last point under the first broad heading: The rise of research entities – agencies, consultancies, SMEs – that operate outside the university or publicly funded research centres, either privately or semi-privately, or funded by foundations, charities and other such bodies [6]. This also implies the deregulation of academic work, its increasing privatisation and commodification.

All of this, I would like to suggest, has to be borne in mind when one considers issues of international research collaboration between Russian and EU-country social sciences and humanities researchers, not least because I am fully aware that the trends I have just outlined, are

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10 See reports on http://www.york.ac.uk/res/researchintegration/Comparative_reports.htm for further details.
not necessarily the same in the Russian context. In this regard it should be mentioned also that lack of knowledge about that Russian context among western social science and humanities researchers is a critical issue in thinking through possibilities of collaboration.

2. CURRENT TRENDS IN INTER/DISCIPLINARY SSH RESEARCH

Partly in response to the current context regarding social sciences and humanities, and partly in response to other factors I have not yet addressed such as the rapid developments in the various fields of technology — biotechnology, nanotechnology, etc. — we have seen over the past thirty years, there are a number of discernible trends in current western research in the social sciences and humanities. I shall briefly focus on the following six:

1) Technologisation in and of the social sciences and humanities;
2) Ethics (applied philosophy);
3) Issues of citizenship;
4) Europe in the world;
5) Environment and sustainability;
6) Intellectual property rights (IPR).

This means that I shall not address current trends in SSH research to do with, for instance, changes, global and local, to the economy, or the new demographics, or the new research on emotions and affect in socio-cultural contexts [7] — but then it is not possible to cover everything in a short paper.

Technologisation in and of the social sciences and humanities.

A major current trend in a variety of SSH disciplines is their technologisation, both at the level of methodological innovation and at the content level. Methodologically, in the social sciences in particular we are seeing the rapidly advancing production of large data sets and uses of systems such as GIS — geodemographic information systems — to create new forms of very detailed, highly descriptive transactional data analyses that are, _inter alia_, intended to offer predictive information about behaviour patterns in the economic and political marketplace [8; 9]. The hardware requirements of such methodologies are often beyond the financial means of many publicly funded universities, and data and indeed technology
share across the public/private domains for social sciences and humanities, a practice already common in the so-called hard and natural sciences, are becoming increasingly important but also problematic as different bodies (industry, the public sector) have diverse interests in these data sets. Very interesting research remains to be undertaken into questions of the utility and meanings of such methodologies and the datasets they yield in different types of societies, and Russia and different European countries make very useful points of comparison here.

At the level of content, too, we have seen major changes in arenas such as science studies, the sociology of organisations, research on the relations between different forms of changing technologies such as biotechnologies and their impacts on cultural and social phenomena, where both the transformative effects of such technologies and their interrelation with other knowledge domains may be productively researched through interdisciplinary, international collaboration. The question of biotechnology and its relations to culture, ethics, social structures is just one such phenomenon. Teams of lawyers, social scientists, cultural theorists and applied philosophers are increasingly coming together to explore the changing meaning of biotechnological change in terms of, for instance, the flow, regulation, interpretation and cultural representation of organ harvesting and transplantation, gene databanks, IVF and cloning, etc. In this context the relation between those who conduct research and the laboratories in which they conduct it, is itself under new forms of scrutiny as questions of the relationship between the human, the technological, the material and the immaterial are being re-framed to re-think Enlightenment ideals, and to question the sovereignty and boundedness of the human. From the work of anthropologist Sarah Franklin [10] to that of Bruno Latour [11], we are seeing the impact of technologisation on social sciences and humanities research.

**Ethics.** This neatly leads on to my second point here, ethics, which has become an increasingly important area of research in the field of applied philosophy, and which has much to offer in interdisciplinary, international social sciences and humanities research. As biotechnology

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11 There is an EU-funded network working specifically on this issue, see: http://www.eureth.net.
For additional information, see also: http://www.biotechethics.ca
and http://www.pub.ac.za/links/ethics.html
has moved ahead so questions of the ethics of this development have been raised as\textsuperscript{12}, indeed, they are also raised in the context of, for instance, food security, decision-making in medical contexts, consumer choices, etc. Applied ethics has become a major new research field in western funded social sciences and humanities research, not least since it relates directly to questions of legitimation and of regulation of all manner of economic, social, cultural, technological and political phenomena. What, for instance, are the ethics of bailing out major financial institutions that collapse due to poor financialisation? What is an appropriate ethical framework for legislating on gene technology nationally and internationally? What ethical framework should be applied in medical contexts as the techno-pharmacological possibilities of sustaining life become more and more extended? What ethical frameworks should underlie the priorities set by governments in apportioning public funding? All of these are research questions newly and differently raised in Western European countries as the welfare states are being reformed, and the boundaries of the public sphere change and in some respects contract, in favour of a neoliberal focus on individual choice, market economies, and from my perspective rather dubious notions of self-determination. Whatever one’s ideological disposition, these are the arenas where new research is occurring and where funding opportunities exist.

\textbf{Citizenship.} These arenas also, in interesting ways, link to the third trend, specifically in social science research, I want to mention here, on new notions of citizenship where we have seen a proliferation of typologies and arenas of citizenship in the past two decades or so\textsuperscript{13}. While political and, starting in the early 20th century, economic citizenship are familiar notions, a number of societal transformations have recently led researchers to explore a variety of types of citizenship — including, for instance, ethnic, religious, sexual, scientific, and bodily citizenship — and to question and revisit traditional political citizenship from a gendered, subaltern, minority, or migrant perspective. This new research trend relates both to the ways in which different forms of migration — not just

\textsuperscript{12} In the UK, the Human Fertilisation and Embryology Authority seeks to regulate biotechnological interventions. See: http://www.hfea.gov.uk

\textsuperscript{13} Femcit is an EU-funded project that explores these new forms of citizenship: http://www.femcit.org
economic migration but also, for instance, medium-term post-retirement migration or migration for medical purposes — are shaping the European sphere as a political entity (for instance, in terms of the very different ways in which different nation states within Europe treat different types of migrants in terms of citizenship [12]) and to the interrelationship between European nation states and their membership in the European Union which subjects them to the European Court of Human Rights, for example. In the context of bodily citizenship, for instance, people who have been denied a certain bodily sovereignty in their own countries, in relation to biotechnologically based issues such as IVF, to access to particular forms of treatment, to the right to take their own life when suffering from a terminal illness, have sought redress at the European Court of Human Rights. Here questions of citizenship intersect with questions of applied ethics, suggesting the need for research that involves teams of lawyers, philosophers, cultural theorists, economists, etc.\textsuperscript{14}

\textbf{Europe in the world.} This is also a context where ‘Europe in the world’, my fourth area of emerging research, is important, partly because of European integration and what that means in terms of the complex interrelationships between European and member state institutions such as their respective courts of law, for example, but also, if you like, much more immediately for us perhaps, because of what European integration means for the interrelations between European research institutions and national ones. That relationship is being re-written as I speak and as questions such as how much Europe should spend on applied as opposed to basic research are being thrashed out. You will all be familiar with the phrase ‘provincializing Europe’ [13; 14]. One of the challenges Europe faces, and where SSH research has been critical, is in its positioning \textit{vis-à-vis} the world at large. European research on its colonial histories in the fields of migration studies, sociology, literature and the arts — in some contexts known as postcolonial or subaltern studies — is now, although a relatively recent phenomenon — well advanced, but how Europe is viewed by the rest of the world — as a cultural, social, political, indeed economic entity, is much

\textsuperscript{14} For details of cases, etc., see: http://www.lib.uchicago.edu/~llou/humanrights.html
less clear, especially and importantly in relation to newly emerging
powers such as China and India and, dare I put it like that, Russia.
There is still very little research where the gaze is reversed, so to speak,
and Europeans seek to understand themselves in terms of how others
see them, as opposed to how they see others.

At the same time and on a different level, European integration in
many ways offers an intriguing example of by and large peaceable inte-
gration — what role can this play in Europe’s relation with the world
at large? Further, what is Europe’s role in the contexts of conflict re-
solution, post-conflict reconciliation and reconstruction? These are all
questions on which new research is emerging and needed, and the very
different histories that different regions of the world have in this
respect offer significant opportunities for fruitful collaboration across
the social sciences and humanities.

Environment and sustainability. This is also true of questions of
the environment and of sustainability, which are the fifth area I want
to address briefly. For the first time in history, the majority of people
globally now live in cities and the unprecedented and accelerated rise
in the economic power of countries with very high levels of populations
such as China and India, as well as, for example, particular histories of
waste dumping, have begun to raise significant question about climate
change, sustainability, global cities, post-industrial cities, new forms of
urban governance, and the vulnerability of what one might describe as
‘stuck populations’, that is those who for various reasons lack mobili-
ty. Resource-richness or resource-poverty within the global context are
becoming increasingly important research arenas, connected to ques-
tions of ethics and values, to responsibility, to distribution and
exchange, etc. A recent report by the Stockholm Environment Institute
at my own university, York15, on the ways in which reductions in car-
bon emission at national level are accounted for, for example, conclud-
ed that, and I quote, “if ‘outsourced’ emissions produced in countries
like China on goods which are imported into the UK are included in
our total carbon footprint, (the UK’s) total greenhouse gas emissions

15 For details see: http://www.york.ac.uk/inst/sei/welcome.html
are 49% higher than currently reported” [15]. Such findings raise important questions not only in biochemical terms but also in political, social and cultural ones, for instance about the values populations and communities attach to the sustainability of the environment, the changes that have to be undertaken at individual, community, state, and global levels to preserve the environment, etc. These issues have produced interesting new research, not least in the arts and humanities where there has been a recent rise in, for instance, what is called eco-criticism [16] as both a representational manifestation and an interpretive framework. It has led to compelling new work on forms of spatial citizenship, the semiotics of space and environment and much more. It has also raised important questions about IPR, for instance in connection with gene pools of populations, both human and non-human.

**IPR.** Intellectual property rights, an arena very differently developed and understood in diverse European countries and the world at large, is undergoing massive changes. Not only is the nature of what can be claimed as intellectual property changing — we now have social scientists patenting ideas, for example — but so is its governance in a globally networked world where modes of distribution are rapidly diversifying, data creation, selection, and preservation are significantly challenged, not just changed but challenged through, for example, the deterioration of data preservation formats and their rapid obsolescence, and questions of ownership are being redefined. This is not just a legal issue — it is much more fundamentally an issue of how knowledge is understood, at a philosophical, cultural and social level, an issue of how so-called knowledge economies organise, understand and protect themselves, of how knowledge is distributed, etc. Research in this fast-changing area has only just begun, and there is room for significant more international, interdisciplinary cooperation here.

There are many other emerging research trends in the social sciences and humanities that I have not begun to address but I want to come to my third and final broad area.

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16 See also the *Journal of Ecocriticism: Nature, Society and Literature* (available at: http://ojs.unbc.ca/index.php/joe) and similar publications for details.
3. ISSUES IN CONDUCTING CROSS-CULTURAL RESEARCH

There are without question significant opportunities in terms of research areas and funding opportunities for conducting cross-cultural research between SSH researchers from Russia and EU country scientists. However, there are also significant barriers to this and I want to briefly discuss four of these with which, I am sure, you are very familiar. These are:

– Knowledge of researchers;
– Knowledge of, and an understanding of, the different research environments;
– Differences in academic cultures;
– Language and data issues.

I want to discuss these because in my view unless we face up to and address them, such research collaboration will develop only slowly and unevenly. I address these, of course, from the point of view of a researcher working predominantly in the Anglophone world and realise that you may well have very different views and experiences. The first is the lack of knowledge European country researchers have of researchers in Russia. I would argue that most European SSH researchers would be hard-pressed to name just one Russian researcher in their own, never mind another, research field. There is, therefore, in my view, significant work to be undertaken to make the work of Russian researchers known across Europe and vice versa. This is not just a matter of databases. Many European cultures, indeed many researchers, do not practice what in English is described as ‘cold-calling’, but are what I call ‘face cultures’, meaning that they like to deal with others face-to-face, in person, rather than remotely, and I would argue indeed that Russia itself is among such countries. Researching together is not a given — it is achieved. It is built on knowledge and trust, and if one does not know a Russian researcher in the field one wants to work in, it is just as easy to find someone from another country. This may sound hard, but it is the truth. There needs to be investment into enabling Russian researchers to forge connections with researchers from European country academic communities and vice versa, through mutual mobility schemes, for example. Another way forward is, of course, for Russian researchers to publish in journals and
with publishing houses widely read and distributed among European academics. One can clearly see the differences in collaboration in European countries among researchers used to doing this compared to those not used to doing this. For instance, the Nordic countries and Germany have had a long-term investment in the internationalisation of their research, and their research strategies have, in various incentivising and regulating ways, expressed this, including through the requirement of publishing in internationally distributed journals. France’s Académie française, on the other hand, has strongly invested in the preservation of its national research traditions, with the effect that French researchers are significantly under-represented — relative to their numbers — in European research collaborations. This is not to say that France does not have academic stars internationally renowned. But it is to recognise that much collaborative research is undertaken by academics, who are not stars, and in this arena the French are frequently notably absent within the European frame.

I come to my second point, knowledge of, and an understanding of, the different research environments. I would argue that on the whole Russian research environments are not well understood among European-country SSH researchers. We do not know Russian research infrastructures, bureaucratic constraints, or working conditions well. I want to give an example of something that happened to me which illustrates some of the difficulties. About four years ago I secured a large EU grant on a particular project in which an academic from an old, well-known East European country with an advanced economy and well established research culture was a partner. I had asked this academic to be involved because I had met her at a conference where I had been deeply impressed by her paper. After we had secured the grant she pulled out. She told me that her institution had said that they did not have the administrative resources to cope with an EU grant. I found this really difficult. In the preparation of the bid it had been difficult to make contact with her because like many academics in Eastern European countries she had several jobs to keep herself going and was therefore not readily available to produce the information necessary to secure the grant. I understood that and worked around it. But her pulling out of this grant once it was actually
awarded came as a real surprise. It also then necessitated lengthy negotiations with the European Commission, and therefore much work, to reframe the grant. When I subsequently told this story to a senior Russian researcher, he said to me that he himself had been told to pull out of a large EC grant he had secured because other members in his department had no such grant. Such experiences of necessity make one wary of collaboration with certain partners. In many EU countries academics face pressures not of multiple jobs, making economic ends meet, or inaccessibility but of accountability for their time and effort in relation, for example, to research grants. They often cannot afford the time and effort to establish a research collaboration with an uncertain outcome. We have all become time-poor. Not long ago I talked to a Russian social science researcher, now running his own social science research company, who told me that in Soviet times when he was effectively unemployed as a dissident, he and his friends had at least had the time to discuss ideas whereas now people were hard-pressed to make time for such activities. What I am saying is that it is important to understand the material and time constraints under which SSH researchers in both Russia and the EU countries work, and sometimes especially in the process of establishing new research collaborations, this requires explicit exchange about one’s research conditions. Pulling out of an awarded grant is not a good way to secure future collaborations.

I come to my third point, difference in academic cultures. We all know that academic cultures across Russia and the EU member countries differ, and differ widely. What constitutes an appropriate academic style in one country is considered quite inappropriate in another. To give you a couple of concrete examples: the German academic style is characterised by compound nouns, the use of the passive voice and indirect tenses, Latinate phrases, and convoluted sentence structures — the more subordinate clauses a sentence has the better since this indicates depth and complexity of thought. In the Anglophone world sentences are in the indicative, and convoluted sentence structures show up in computer programmes as a stylistic error highlighted — in order to be corrected — as a ‘long sentence’. Italian academic style tends to be speculative, focussed on ideas rather than evi-
idence, as does, in some respects the French one, whereas the Anglophone empiricist tradition demands evidence-based arguments, with lots of references. Anglophone critics of writers such as Michel Foucault, for example, often ask, ‘Where’s the evidence?’ and point to the lack of references as an indicator of the purely speculative nature of Foucault’s work. The point is that when one collaborates one needs to find ways to blend and approximate academic styles, not least because individual researchers need different things from collaborative research. For UK researchers, for example, publications of a certain kind are a must. These requirements, which derive from differences in academic cultures, need to be understood for effective collaborations to take place. In collaborations it is therefore important not only to discuss such requirements and to make them explicit but also to understand how these might shape the collaboration and the research conducted. This also goes for questions of methodology, of what constitutes research as such, of what is recognised or not as a valid method in a given research culture, for example, and different attitudes and histories in relation to, for instance, quantitative versus qualitative research methods.

I come to my last point, issues of language and data. We all know about the problematic in international, indeed interdisciplinary collaboration of different understandings of concepts, etc., so I shall not spend time here discussing these — merely to flag up the fact that language barriers are an issue [17]. More importantly, perhaps, there is the question of data and datasets which — in the current climate of the technologisation of SSH — poses important issues in research collaboration. The veracity and reliability of data, their comparability and interpretation is a significant point of debate among researchers from all countries. Cross-cultural research augments these issues, and at present both the acceleration of electronic data capture and a simultaneous mistrust of the data captured and their meaning go hand in hand. This in itself is both a significant opportunity for research collaboration — as a topic in its own right that might be explored culturally and socially — and it also is a barrier to collaborative research. To give you a couple of related examples: whilst it is standard procedure in demographic and other surveys in the UK to ask about eth-
nicity, this is not allowed, for obvious historical reasons, in the German or the Italian context. In the UK you can ask about sexual orientation but not in Hungary. Such socio-cultural constraints impact on data collection and shape research collaborations, as do questions of different practices and understandings of research ethics that govern research processes.

The trends in SSH research I have discussed here are very much rooted in EU country perceptions, and, of course, questions therefore remain of how these trends map onto parallel or other trends in SSH research emanating from Russia.

References


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SOCIAL SCIENCES AND HUMANITIES IN RUSSIA

PROSPECTS FOR INTEGRATION INTO THE EUROPEAN RESEARCH AREA

Wide international cooperation has become an integral part of modern science. As a herald of busy international contacts in various fields of human activity international cooperation in scientific research has had a long history, from simple exchange of scientific results to organising big international research teams and performing joint online research.

International contacts permeate through almost all aspects of research activity. Foreign outsourcing has become one of the main lines of setting up a science resource base. Researchers become increasingly mobile across the borders, while research itself is more and more frequently financed at the expense of inter- and transnational companies, foundations, associations, etc. It is on an international basis that many unique tools of scientific analysis are created and operate, and information resources of study mostly rely upon international exchange of data and documents through global communication networks. Resulting aspects of scientific activity also require joint research efforts in different countries as regards both formulation of a research agenda and efficient dissemination of scientific results throughout the economy and society.

International contacts help to improve the interaction between science and society, particularly as regards wide propagation of science as a professional activity and research results, representation of scientific views in the mass media, and the general public’s participation in setting scientific priorities. Interstate relations most naturally include coordination of national S&T policies and working out research strategies for supranational organisations.

The general trends in the international scientific cooperation expand to the social sciences and humanities as well. However, trends,
forms and intensity of cooperation in this field reflect some peculiarities of the said scientific disciplines. Among them are:

– an intimate relationship between research (as regards both its organisation and content) and national political, economic, socio-cultural, philosophical, and other characteristics;

– serious difficulties in developing a universal conceptual and categorial apparatus;

– a wide range of research paradigms conditioned by a considerable diversity and dynamics of subjects under study;

– a significant role of the human factor due to the specific character of research in the social sciences and humanities;

– a huge scientific informarium, with wide dispersion and limited capability for compression of information;

– an increasing engagement of social scientists with different political and social structures;

– relatively low cost research as compared to the natural and hard sciences.

Although the scale of international cooperation in the SSH appears to be nominally rather small as against that in the natural and hard sciences, the importance of humanists’ collaboration for the fortunes of nations should not be underestimated. It is social scientists of different countries who are bound to jointly identify, comprehend and interpret for practical needs the main trends of future human development, as well as to highlight the positions of different nations, social institutions and individuals in a futuristic model of the globalising world. International contacts of social scientists may largely contribute to the intensification of intercultural dialogues, facilitate mutual understanding and common visions of global prospects by people with different views and traditions. What is more, combining national SSH research capacities may foster analysis of international cooperation *per se* and its patterns in different areas, including science, technology and innovation.

While on the subject of integration of Russia’s humanists into the international (in particular, European) research area, it seems reasonable to make a start from the historical tradition of Russian social thought. Over the course of the 18th and until early 20th centuries, there got established (and further recognised within the world scienti-
International collaboration: challenges, perspectives and practices

Outstanding scientific schools in many social disciplines in Russia. Among the distinguishing features of Russian scientific thought in the SSH were:

- versatility (i.e. tendency to extend the research front as far as possible);
- all-inclusiveness (i.e. multiple-aspect, comprehensive approach to the subject of study);
- cosmological character (i.e. incorporating discovered facts into the general picture of the world);
- axiological character (i.e. interweaving research activities with spiritual values);
- societal character (i.e. interpreting society not as a set of individuals, but rather as a dominant systemic force which determines individual practices);
- polyfunctionality (i.e. organic combining scientific ideas with traditional values of other forms of consciousness, as well as participating in their development);
- social scientists’ active societal and civic stand which often involved sharp criticism leveled against the governing authorities.

In the years of the totalitarian Communist ideology, the official claims that Marxist-Leninist social conceptions should be solely true radically restricted the capabilities for social sciences and humanities research, including development of Socialist ideas themselves. Channels of access to the world social sciences were restricted to a higher degree not to say obliterated. Some SSH disciplines, e.g. sociology, were thrown off the official list of research areas for decades. Bearers of ideas that were objectionable for the authorities were repressed in every possible way up to physical extermination.

The collapse of the Communist regime opened the space for conceptual pluralism in social sciences as well as for reception by Russian scholars of social doctrines developed in social sciences all over the world. However, along with productive theories and recommendations, various pseudoscientific ideas also became wide-spread and competed with those of the scientific community in a struggle for the brains of Russians. In some cases proposals for transformation of society were based on postulates already discredited in various regions of the world.
A drastic reduction in the governmental financial support of S&T became destructive for the social sciences and humanities as well. Research was significantly distorted in favour of certain disciplines, such as economics and political science, contracted by various ‘wealthy’ structures. The gap between SSH research in the capital cities, such as Moscow and St. Petersburg, and those carried out in the provinces increasingly widened; as a sequence, many social processes that developed in regions of renewed Russia were left without proper scientific reflections. The erosion of requirements imposed upon research personnel and postgraduate training was also especially detrimental for the humanities where, for certain prestigious reasons, those who are far from science, have better chances for obtaining an academic status. The crisis of the 1990s in Russian social science and humanities was slightly alleviated due to the creation of the Russian Foundation for Humanities whose activity is based on the principles of competition and peer review of research applications. In the last years, before the present-day global downturn, the general improvement of economic situation made it possible for social scientists to address again to the deeper insight into the problems of Russian society as well as global civilizational trends.

The following prerequisites seem to be necessary for full-fledged participation of Russia in the international cooperation in social sciences and humanities:

— self-identification of Russian social sciences as bearers of unique research traditions and their active positioning in the arena of international collaboration;
— development of national and international research infrastructure and providing equal access to information systems, research foundations, etc., for scholars from different regions of Russia;
— sufficient allotment of finance for purchase of foreign books and subscription to academic journals in the social sciences and humanities across the country;
— proper representation of the SSH in the governmental S&T policy, and proper justification of their research value;
— revival and consolidation of Russian schools of humanistic thought, recruitment of the gifted youth to the SSH, etc.
It is our point that interdisciplinarity may be one of basic platforms for convergence of research paradigms of Russian and European scholars since it takes into account both the above-mentioned specific features of Russian research traditions and the main directions along which the western social science looks for responses to contemporary challenges. The need to consolidate efforts of researchers from different disciplines is determined by a number of factors: First, society as an object of study is permanently getting more and more complicated, with growing interdependence between heterogeneous substrates and trends. Second, the problems researchers face are also of a growing complexity. Effective governance in society is presently impossible without a syncretic scientific basis. Third, along with the improvement of methodology and methods of particular social disciplines, effective universal instruments are developing, which may be illustrated by the intensive penetration of digital technologies into virtually all fields of SSH research.

It should be stressed that wide utilisation of interdisciplinary approaches involves differentiation and further development of the very notion of interdisciplinarity. This category that presupposes investigation of an object with the help of methods borrowed from various sciences, can be supplemented by such definitions as multidisciplinarity which implies getting a complex image of an object; polydisciplinarity, laying more emphasis on integration of research tools; and transdisciplinarity, dealing with mutual transfer of approaches between different fields of research. The very architecture of interdisciplinary ties changes as well. Research fields of different disciplines can intersect, overlap, supplement each other, etc.

Several lines of effective strategic cooperation can be shown. The first is a critical utilisation of European countries’ experience for modernisation of Russia. To give some examples, let us mention a number of topical problems (for resolution of which recommendations of European scholars may be of real benefit).

In the nearest prospect, the most important goal for Russia is an innovation turn of economy and society with overcoming its actual hypertrophied orientation of production and export to fuel and raw materials. The task is not, as it may look at first glance, purely eco-
nomic. Coping with it presumes radical transformation in social organisation and psychology, political activities, and other life spheres.

Analysis of diverse European national innovation models that differ in terms of both concentration of innovation resources and roles played by different actors of innovation sphere (research labs, universities, transnational corporations, medium and small innovation enterprises, governmental structures, the public, etc.) is exceptionally valuable for developing practical measures aimed at this end. In particular, European practices of accumulating financial assets from different sources and mobilising public efforts to support innovation development deserve special attention. Of special interest are approaches to making long-term risky innovation investments under conditions of relatively high conservativeness of European financial institutions. The European practice of promoting innovative styles of life is also worthwhile for Russia.

A solution of regional, location-specific problems of economic and social organism would be the primary determinant of stabilisation in Russia. The unique size of national territory; the considerable differentiation of natural, climatic, and socioeconomic conditions in various regions, as well as diverse specialisations and levels of economic development and quality of life there; the country’s multiethnicity and multiconfessionalism — all these put in the agenda the development of a spatial strategy that would ensure the integrity of Russia’s economic complex and social areal, even access of population and economic actors in different regions to material and non-material benefits of civilisation, advanced technologies and various elements of infrastructure.

In this respect highly instructive is the half-century history of the European integration of nations that are rather diverse in terms of welfare and traditional culture. It should be stressed that special programmes of ‘pulling up’ underdeveloped and backward regions (also through boosting innovations) have been highly successful with both the national states and the EU agencies. Russia should adopt Europe’s rich experience in creating regional, including high-tech, economic clusters marked by a high level of global competitiveness. European colleagues could provide a useful help to Russia’s social scientists in apprehending the interaction between federal and regional governments, and
also the role of local governments in solving territorial disparity problems.

Russia’s full-fledged integration into the world community and global economic and social processes is an important prerequisite for the country’s sustained development. At the same time hazards of loss of national identity in the course of internationalisation and globalisation should not be underestimated. The theoretical discussion on the relationship between the autochthonous and foreign (borrowed) in Russian economy, politics and culture has had a long history and has been recently resumed with new force [1; 2]. The European political practice has at its disposal an effective set of tools that can cut short destructive external impacts on the European cultural diversity (such as language, cultural tradition, social values, etc.). Being scientifically reflected, generalised and adapted, the European experience could help Russia to find ‘the golden mean’ between the integration into international dimension and national security interests, and to apply global paradigms and technologies with a glance at the national spirit and identity.

Collaboration with European science could also contribute to solving such a complicated research problem as analysis of social stratification dynamics. The recent advance of many European countries in fighting poverty, lending state support to creating high-paid jobs, and developing other forms of social security has been generally recognised. No doubt most of this practical experience could be well exported to the Russian ground. Russia’s social scientists also focus their attention on the problems related to the formation and extended reproduction of middle class as the main stabilising force in society. Russian and European collaboration in the SSH could conduce a better understanding of the middle class in modern society: a comprehension of its economic and structural characteristics of consumption, social activity and participation in civil society, as well as the middle class’ role in the formation of national socio-cultural tradition.

There is another vital issue in today’s Russia, namely formation of the new social elite capable of becoming a driving force that would restructure the country along the innovation lines and act as a model for the majority of the population. This task can be fulfilled, on the
one hand, through securing a high social image to outstanding intellectuals, and on the other hand, through stimuli to the positive transformation (education) of the hedonistic and exploitative quasi- and pseudo-elite that emerged in the early years of the market transition. And in this respect, the European understanding of elite criteria, ways to develop and support new elite, maintaining feedback between the elite and society, and possibilities of ‘upbringing’ the Russian elite directly following the respective western models are of equal interest.

However, it would be wrong to consider Russian and European cooperation in the SSH as one-way traffic. European interest in SSH studies in Russia is determined by at least the following considerations. First, establishing good-neighbourly relations with Russia implies a clear understanding of Russian mentality, social habits, and peculiarities. Second, symbiosis of West and East European intellectual resources can be a powerful tool in achieving pan-European competitiveness in many fields as opposed to other economies and cultures of the world regions (North American, Asian, etc.). Third, the propagation of Russian humanist paradigm elements in Europe could help to alleviate some negative consequences of excessive rationalisation and pragmatisation of social and individual consciousness which appears to cause some anxiety even in the western societies.

Another strategic benchmark of the cooperation under analysis is represented by exchange of resources, experience and ideas as regards particular problems common to Europe and Russia that regularly emerge in the course of economic and social development. This can be best shown by the example of joint search of a way out the current global economic crisis. What has to be found is a rational correlation between individual and united efforts of European countries to overcome the actual difficulties. Today’s crisis developments may allow Russian and European scientists to take a new look at the role of technological, economic and organisational, and social innovations in both quantitative and qualitative growth characteristics. Collaborative Russian-European research could also result in finding efficient social regulators capable to dampen depressive tendencies.

A less timeserving, and therefore more long-term, problem of the sort is improvement in decision-making practices at different levels,
INTERNATIONAL COLLABORATION: CHALLENGES, PERSPECTIVES AND PRACTICES

from an individual to a country’s and international institution’s top administration. Progress acceleration accompanied by a highly increased nonlinearity and stochasticity of technological and social change, new interconnections and relations among differentiated subjects, phenomena and processes have made for a qualitatively new depth of impact of administrative actions and time horizons of their effects. This in turn requires that science, in particular social science, elaborate effective mechanisms for coordination of interests of diverse organisations, of expertise procedures, of comparison and choice of alternatives, and of iterative calculation of resulting a posteriori conjugations. This field is so topical and integrated that there have been recently put forth proposals that yet another branch of science be instituted — a science that would embrace research pursued solely for governance and administrative needs.

Russia and other European nations developed particular research traditions conforming to their mentalities, culture of expertise and decision-making. Mutual enrichment of these traditions promises new approaches which, for instance, could make it possible to strengthen the role of intellectual and rational component in functioning of the administrative apparatus and resolve the contradiction between democratisation of governance and increasing technological complexity in decision making that limits its comprehension only to a closed community of experts.

The third, most extensive cluster of problems that requires international and interdisciplinary approach is formed by the global challenges the humankind faces at the beginning of the new millennium. Ecological problems remain as topical as before. The discourse upon anthropogeneous burden on the environment has transformed from a predominantly engineering discussion about transition to resource-saving and nature-conservative technologies into a global humanist forum aimed at permanent search for a balance between limited biotic resources of the Earth and the demands of developing civilization, as well as protection of ecological conditions for future generations. The necessity for transition from occasional discrete environmental measures taken by particular states to a system of internationally coordinated actions and institutions penetrating diverse social structures became obvious. The concep-
tion of sustainable development worked out by the world community of nations is waiting for a new impulse that, we think, will be based on a harmonised combination of the postulates of ecological balance and the principles of geopolitical and socio-economic stability.

In Europe, large-scale measures have been undertaken to embed ecological restrictions into economic relations, to popularise environmental awareness among the general public, including children and the youth. The mechanisms are tuned for elaboration and implementation of strict technological standards ensuring the protection of the environment and health of consumers, with serious progress achieved in supporting biodiversity. Scientific and analytical synthesis of European ecological practices could make a significant contribution to building the nature-conservative architectonics in Russia where the environmental problems are expected to become more and more topical as the economic revival steps up the tempo. At the same time, Russia is able to replenish the international ecological depository by providing not only experimental world-conservation polygons of still existing natural biocenoses, but also results of well-established schools of thought in such fields as human-nature co-evolution. Traditions of universal understanding of the planetary mission of man that goes back to Vladimir Vernadsky, Nikita Moiseev and others are based upon conceptions of noosphere, collective mind and extra-galaxy intellect seem to provide a solid philosophical framework for new environmental constructs.

Not only relations between man and the biosphere, but the very foundations of social life activity nowadays face global bifurcations. Adequate intra- and interdisciplinary research is called upon to reflect radical transformations and new realities across the whole ‘person – society – state’ triad.

In regard to studies of formation and development of the human personality, the post-industrial age suggests the following research foci:

– complex analysis of demographic problems concerning ageing and aged population, including issues of welfare system and prolongation of active life; socio-psychological aspects of facilitating intergenerational interaction; philosophical reflection on longevity, etc.;
– radical transformation of educational systems and learning processes aimed at transition from mere transmission of knowledge to
lifelong learning models, such as formation of habits necessary to master knowledge on one's own and use them effectively in practice, innovative thinking and behaviour, and life-long replenishment of personal intellectual resources;

– shift from treating an average statistical individual as a unit of labour force to presenting him as a bearer of unique knowledge, habits and opinions; further conceptual developments of human capital in accordance with the new realities;

– deeper understanding of creativity and search for new ways to stimulate creative self-expression and self-realisation of the individual;

– comprehension, forecasting, and correction of transformations in the quantity and quality of needs and consumption owing to individualisation, informatisation, ecologisation and other determinants of the present; development of microeconomic analysis of individuals as economic actors;

– further improvement of our understanding of the individual's inner world and the role of the unconscious, intuitive and transcendental in individual psychology; theoretical mastering of subjective and virtual phenomena; selection of positive elements and results of individualisation as opposed to negative egoistic aspirations;

– applying the SSH ideas and methods to analyse ergonomic and psychological limits of human adaptation to rapid changes and informational intensity of modern life; investigating prospects for partial substitution of human intelligence by artificial analogues;

– rethinking of personal freedom under the conditions of speedy development of ICT;

– studying the ways of human survival in extreme conditions and adaptation to them; investigation of algorithms of human actions in stress situations as well as causes of deviant and conflict (destructive) behaviour.

We assume prospects for Russian-European collaboration are determined by fruitful combination of the western approach to a person as Robinson Crusoe *sui generis*, an isolated atom of society possessing personified needs and interests, with the Russian tradition of considering a person as, primarily, a bearer of collective social practices who grows in the course of material and spiritual interaction with the external
world. It seems also reasonable to draw the attention to the Russian experience of manifesting covert capabilities and self-perfection under crises and cataclysms.

Joint research on the contemporary societal developments is deemed to be focused on:

- a variety of economic and social modernisation models and interconnection between them; interference of social aggregates in the course of international contacts;
- differentiation of range and authorities of social institutions; entrusting them, in addition to their regulatory functions, with innovation tasks of matching individual creative activities with public interests;
- finding proper ways to ensure an adequate level of tolerance in relations between diverse social groups and strata, cultures, confessions, etc.;
- intensification of self-organisation processes in the society based in particular on civil awareness and inclusion of citizens into public governance for establishing future prospects for the society;
- gradual replacement of hierarchical, centralised social constructions with embedded horizontal communications;
- analysis of emergence, quantitative and qualitative development of various social networks;
- theoretical interpretation of substrates underlying formal and informal (charismatic) leadership, as well as principles of social responsibility of outstanding personalities in different spheres of social life;
- research on emergence, differentiation and transformation of universal, national, and local values, and on replacement of consumerist attitudes by such orientations as intellectual wealth, stability and consent;
- modification of scholarly conceptions of mind on principles of intersubjectivity of human consciousness and conventional nature of knowledge;
- development of gender studies and synthesis of feminine and masculine principles in different areas of social life;
- proper balancing of disintegration and consolidation, centrifugal and centripetal forces under conditions of ICT exponential growth.
I

INTERNATIONAL COLLABORATION: CHALLENGES, PERSPECTIVES AND PRACTICES

Russian and European partnership in the above mentioned sphere could contribute to identification of national communities via comparative analysis. Moreover, it could imply convergence of the liberal conception of society as a freedom-based and self-restricting association of individuals aimed at improving their life conditions and of the integrative and creative tradition of dominant collective substance that sets up boundaries of individual practices and attitudes, as well as defines the general vector of historical process.

Speaking about the role and place of state institutions in renovated socio-economic organisms, the following points of concentration of research efforts in the SSH should be mentioned:

– possible areas and shifts in delegation of authority from nation states to the international and global levels; overcoming narrow national approaches to responding to global challenges;
– prospects for dispersion of the part of state functions among non-government economic and social institutions;
– foundations of legitimising state institutions in post-industrial society by putting more emphasis on long-term, strategic, and innovation aspects of state policy;
– reformation of the bureaucratic system (i.e. reducing the degree of the state bureaucratisation. – Ed.);
– usage of ICT for the perfection of state governance and for providing adequate feedback between the citizens and the government (e-governance. – Ed.);
– combination of the administrative and powerful on the one hand, and intellectual and organisational principles on the other, in the functioning of state apparatus;
– transformation of paradigms of sovereign state governance under erosion of the economic and socio-cultural national borders; balancing domestic, international and global factors in the drawing up and implementation of political goals.

From the viewpoint of analysis in the state institutions dynamics, the superposition of traditional Russian emphasis on the spiritual and consolidating role of the state, on the one hand, and instrumental, utilitarian western approach to the nature of the state, on the other hand, also seems rather promising.
Close to the issues of relations between the state and society are issues of national and international security that also outline a broad field for cooperation between Russian and European social scientists. In particular, analysis of correlation between military and civil (economic, scientific and technological, ecological, informational, ethnic, etc.) components of security is of extreme importance. Then, the problem of communicative aspects of security, such as mutual understanding, existence of common interests, assets, preferences, etc., takes its place in the agenda. Special attention must be paid to building a system of inter-institutional mechanisms for timely detection and early elimination of various threats to economic and social stability at national and international levels.

The times when organisation of life in different countries and world order in general change radically inevitably stir up interest to forecasting both among the public and within scientific community. Forecasting instruments become more effective and complicated; quantitative extrapolations and finding cyclic regularities and qualitative ‘leaps’ are combined with different modelling approaches, various methods of expertise, etc. Besides improving methodology and particular methods of scientific foresight, prognostication obtains a useful function of social integration. It is not precise identification of future parameters of economy and society that comes to the fore, but rather reaching a common view of the future shared by representatives of different nations and socio-economic actors. Without doubt, synthesis of Russian-style forecasting oriented mostly to socio-economic factors with western conceptions based predominantly on scientific and technological determinants [3] would strengthen the futurological potential of modern social knowledge.

In the long run, the cooperation between Russian and European social scientists would have, as one of its major outcomes, a certain global project incorporating both autonomous and collaborative results. This project may be suggested to the world tossing in search of new orientations. In its core the above scientific and instrumental construction may have, for instance, such elements as societal and humanitarian balancing of financial and economic mechanisms that ensure economic competition, diversification of individual and collective consumption through popu-
lарisation of non-material values, synthesis of unification and divergence processes in the global socio-economic and cultural space.

Neither can one neglect such pivotal component of Russian and European cooperation as organisational improvement and enlargement of a range of forms and mechanisms of collaboration. First, human resources exchange should be oriented not only to scientists’ familiarisation with research practices of partners, but to its enrichment and interlacing of paradigmatic components of scientists’ research cultures. It is important to develop ICT capacity in order to create international networks for a kind of social monitoring in the interests of both the scientific community and other social institutions. It seems advisable to orient research efforts towards elaborating in a foreseeable future a specific Russian-European research style in the social sciences and humanities which could serve as a substantial platform for self-replication of collaborative relations.

To finalise our consideration of possible directions for collaborative research, we would like to dwell briefly on joint explorations in the science of science which, in view of digitisation and cognitivisation of global development, is now of primary significance. In the field of metascience we single out several topics as main lines for cooperation.

Both in Russia and many European countries intensive discussion about the future of fundamental science (this relates to basic and advanced research in the government sector. — Ed.) is currently evolving. There is a great temptation, under conditions of deficient resources, to cut those funds that are allocated for advanced research and do not promise quick and immediate commercial return. Institutions carrying out basic research are required to further diversify their activities for providing partial self-repayment. Western scholars often consider such attitudes as infringement on the academic freedom and threat to substantial and value identity of cognitive activity. For Russia, an excessive pragmatisation of science is fraught with destruction of the unique research front which has been one of the national distinctive features. Restoration and consolidation of the image of fundamental science is possible via cooperation along the following lines:

— theoretical corroboration of the science’s significant contribution to the economic and social development, both historically and in the future;
— diversified exploration of the impacts of science as far as their types, terms, and spheres of implementation are concerned;
— studies on basic research as a depositary and consolidator of ideas ensuring the integrity of diverse applied research and technological development;
— democratisation of the primary role played by the social institution, such as fundamental science, in creation of a favourable innovation climate and cultural conditions, underpinning sustained development in the socium;
— incorporation, through different communicative channels, of the scientific world view and values into the minds of those representatives of different spheres of life activities (politics, business, culture, etc.) who benefit from scientific achievements;
— creation, around advanced research, of a quasi-commercial ‘protective belt’ adequate to the content of research activity (expertise, educational services, etc.);
— establishment of science and society partnership which presumes not only science’s response to the economic, political, and social needs, but also the acknowledgement of scientific concepts and values by society;
— mutual international support of basic research.

Another topical theme for international cooperation is recruitment of the gifted youth in science. Regretfully, an academic career is losing its attractiveness in both Eastern and Western Europe. In addition to mutual efforts to raise the social status of research, we need also special measures such as: stimulation of international and interdisciplinary mobility that may transform the brain-drain into the brain gain; positioning the training of younger generation of researchers as one of the main indicators in the evaluation of research institutions; providing isomorphism between academic carrier and that in other spheres of intellectual activity (politics, management, etc.); search for proper and attractive forms of labour relations. A unifying paradigm of Russian-European cooperation is silhouetted against the interlacing of career-bonus and value-spiritual preferences that determine the choice of one’s course of life.

From this angle it makes sense to consider the problem of personification of the already mentioned phenomenon of interdisciplinarity that is so pivotal for the development of science in the 21st century.
INTERNATIONAL COLLABORATION: CHALLENGES, PERSPECTIVES AND PRACTICES

Formally, we can regard as bearers of interdisciplinary knowledge those who, for instance, have got educational certificates in various disciplines, or changed one and more spheres of activity in their personal career, or participated in complex interdisciplinary programmes, research projects, etc. Nevertheless, of special importance is the task of upbringing a new generation of science integrators who would possess the gift of universal vision of research problems and synthesis of heterogeneous scholarly approaches. According to the available assessment given by science analysts, the number of such integrators ought to be approximately 10% of the overall number of researchers. International cooperation contributes much to the achievement of this goal because the global view on social dynamics is characteristic of the international style of research.

Another cluster of problems that become more and more critical is formed by issues of science ethics and safety in spreading of research results. Fears are increasing in society that concern such overt and covert threats peculiar to rapid development of technologies as destructive interference into natural biological processes; infringement of privacy, in particular, unendorsed access to personal data; malevolent manipulation of mass consciousness, up to turning people into ‘zombies’; irresponsibility of politicians and businessmen in respect to human health and environment; new technologies of terrorism; subversion of stabilising grounds of the human psychic world; deliberate correction of genetic mechanisms of human reproduction; etc. Voices of those who protest against the admissible level of the so-called digital inequality, or ‘digital gap’ in access to information and communication channels and technologies for different countries and social strata are getting more insistent.

While in Europe every of the above-listed aspects is thoroughly discussed, for Russia the generalised discourse of social trust in science and possibilities to direct its achievements into a positive vein is more characteristic. We assume that Russian-European cooperation in the SSH will facilitate the elaboration of a qualitatively new approach to these problems based on clear distinction between the transforming power of science per se and the improvement of means of incorporation of its results into the socio-economic organism.
It also seems reasonable to mention here the progress in nanotechnologies which is positioned as a critical scientific and technological priority for the nearest future in Russia and in the countries advanced in S&T. A silhouette of collectively formed nanoethics implying the study of possible effects of nanotechnologies is already discernible. Researchers are to comprehend the impact of nanotechnologies not only on the resource base and the essence of production processes, but on the convergence of scientific and technological trends, co-evolution of science and society, life-styles, the understanding of meaning of life, etc.

Interdisciplinarity is inherent to the research context of interrelations between science and society at the core of which we find problems of formation, adjustment and implementation of public science and technology policy. Let us touch upon two aspects of this complex institution. Both Russian and European economies need to accelerate transfer of scientific results to practice, to increase demand for research product on the part of industrial and other consumers. While European researchers tend to focus mainly on internal and external factors of cooperation between science and industry, in Russia one can see lack of mutual trust between respective economic actors and significant disparity between their innovation subcultures that Russian researchers consider to be the main barriers to scientific knowledge transfer. The same dichotomy is also characteristic in the application of such policy instrument as priority setting in S&T. Western science analysts usually approach priority problems from the angles of costs and results, and detailed procedures. In Russia, priority setting is commonly viewed as an interaction between economic and social forces, a highly integrated research area, and a ‘public forum’ for various research fields.

Researchers engaged in science studies will have to bear the brunt of analysing and prognosticating emerging trends in the knowledge-based economy and society. At present the most heated debate is held about the criteria of the latter concept. To assess the maturity of a knowledge society researchers suggest indicators based on S&T contribution to economic growth, as well as the scale of ICT spread in the society. We assume the use of crosscutting political, social, economic, ecological and other criteria with a glance at national peculiarities, nation states inclusion into international communications, and know-
knowledge characteristics as such (codified vs. tacit, personified vs. universal knowledge, etc.) in order to monitor emergence and development of a knowledge society. Besides commercialisation and other kinds of knowledge utilisation, integral attributes of a knowledge society are: transfer of intellectual norms and values to everyday activities, availability of adequate infrastructure for knowledge circulation. It is also important that the collective intellect should become a true regulator of social processes along with politics, economic and financial instruments, cultural traditions, etc.

The key to understanding the knowledge society institutionalisation is the conception of national innovation systems (NIS) that was conceived in Europe a quarter of a century ago. Initially, the NIS was considered as a system of social and economic institutions aimed at generating, diffusion and practical use of science-based or technological innovations. Acceleration of innovation processes in recent years challenges to rethink this definition in the context of industrial-engineering, managerial, and social innovations that constitute national innovation culture. The regular character of innovation exchange between economic actors as well as the formation of particular interests and values in the innovation sphere appear to be essential prerequisites for such approach.

The NIS concept enables researchers to draw a detailed map of the niche occupied by science in the innovation assembly line, reflect the transition from the linear innovation cycle model to the iterative one which comprises germs of national knowledge ‘turnover’, and develop the idea of ‘trainable’ (learning) organisation which presupposes that virtually every social and economic actor is considered as a ‘hub’ linked to the knowledge (cognitive) network disposed of internal and external relationships.

The NIS theory gives an insight into the crosscutting inter-institutional connections as regards both the research sphere per se and its interaction with the socio-economic environment. It also provides the basis for enhancement of science’s role in determining the future make-up of different nations (through participation in scientific expertise, sophisticated prognostication mechanisms, round-table conferences, etc.). Embedded in the architectonics of different national innovation systems, international scientific cooperation acquires and exhibits new facets.
The NIS doctrine is profitable also from the viewpoint of relations between science and other forms of mass consciousness, in particular religion. Transition to a knowledge society implies not a weakening, as one may think, but reinforcement of interrelations between knowledge and faith. Post-non-classical understanding of cognition puts forth the task of building its ethic foundation while the spiritual perfection of an individual accompanied by comprehension of the aprioristic, axiomatic imperatives (in particular, in the form of religious postulates) is supported by his/her growing intellectual and communicative store.

The same kind of symbiosis is observed also in interrelations between science and art. On the one hand, scientific achievements make a significant contribution to the instrumental arsenal of creative artistry and allow a better and more profound understanding of its secrets. On the other hand, significant scientific results are more and more often obtained via utilisation of creative instruments immanent to art, through building of imaginative constructions, and sometimes with direct support from creative fiction and fantasy. Interdisciplinary inte-
In the process of social sciences and humanities, the cooperation between Russian and European scholars in the foreseeable future will proceed under the aegis of three inter: internationalisation that leads to the development of common European research paradigms; interdisciplinarity that allows to obtain universal portraits of societies; and interinstitutionalisation aimed at involvement of different political, economic and social structures into the turnover of social science knowledge.

References

Science is not ideology, and scientific communications have nothing to do with ideology, since they are established because of the necessity and with a view to solve scientific problems. This statement does not raise doubts on the one condition that communications exist in a social vacuum, not in the real society, where people with different views and psychological characteristics live and act along with large groups of people that pursue their social interests reflected in ideology. There exist no societies without ideology. Ideology is part of the spiritual atmosphere in which science exists and develops. Social and human sciences are especially sensitive to ideology.

1. SOCIAL SCIENCE AND IDEOLOGY

Science (and social science as well) is aimed at providing society with objective or reliable (Robert Merton) knowledge. New knowledge is the product of universal labour, i.e. a social product created on the basis of the labours of their predecessors and in cooperation with their contemporaries (Karl Marx). Therefore, communications form part of the nature of science as a social institution, the primary aim of which is to generate new knowledge.

International scientific cooperation is a variety of scientific communications. Cooperation between scientists from different countries strengthens science and its cognitive capabilities. Consequently, most scientists seek such cooperation. In order to establish such connections, we need mutual interest in collaboration and understanding, since no effective cooperation is possible without them. This interest is raised by common and promising subject areas, the level of scientific development and its research capabilities in the country and the presence of individual scientists and research teams with whom such collaboration is desirable.
In practice such cooperation (especially if we are talking about research teams) is complicated by different institutional, financial, and other difficulties. Therefore, specific and strong motivation is needed, to encourage people to establish such scientific connections.

We need to take into account the meaning and influence of an ideological factor that may encourage international scientific cooperation or hamper it. There is no unambiguous theoretical solution of the problem of correlation between science and ideology. However, we may say that two polar views on this problem are presented by the Marxists and Weber. This opposition reflects the difference in their political and philosophical views. Marx followed Hegel, who considered science and philosophy, faith and morals to be forms of knowledge, whereas Max Weber followed Kant who distinctly separated knowledge and values.

Karl Marx wanted to base his philosophy on historical reality, which is studied by science, not ideology. Ideology may be described as illusive consciousness based on false ideological interpretation of social phenomena and historical events. Friedrich Engels characterised derivation of reality from different notions as an ideological method.

However, by the end of the 20th century the Marxists came to understand ideology differently. The spread of Marxist ideas in the labour movement, and the development of the parties that defined their programme goals in conformity with these ideas, meant that Marxism acts as an ideological force that unites the masses. This function was defined as an ideological one. Vladimir Lenin called Marxism a scientific ideology, a mixture of scientific and revolutionary nature. The scientific ideology concept was presented as the reflection of the underlying interests of the working class. At that, its social and class conditionality was not deemed to cause subjectivism. On the contrary, such conditionality enabled objective scientific reflection of reality, since class interests coincided with the objective course of history. Therefore, the working class is interested in an objective cognition of reality, and Marxist ideology protects the science and is based on it.

This logically consistent concept acted as substantiation of the party principle realised in the sphere of social sciences.

Weber also supposed that the purpose of science in general, and social science in particular, is the obtaining of objective knowledge.
This very knowledge is the content of science. Evaluative judgments (for instance, ethical judgments) are the subject of faith, not knowledge and, therefore, we may not refer them to the sphere of science. Science is based on facts; it studies them and gives them order. “Empirical science can not teach anybody what they should do, it only describes what they can do and want to do in certain circumstances” [1, p. 350].

Weber considers scientific knowledge to be free from values and evaluative elements. Values and ideals (and we may add: everything that refers to ideology) exist in another dimension altogether. Truth and value are different products of consciousness and culture. This is a distinct Kantian position. In the field of philosophy the difference between them is reflected in the fact that the truth is studied by the theory of cognition, whereas values are examined in the sphere of axiology.

Weber supposes that a scientist, just like any person, may accept or reject certain ideals and values; that this is his personal choice. The scientist may be guided by these values and ideals, but that has nothing to do with science. Freedom from values means that, for example, a professor who reads lectures in a specific field of knowledge should not encourage students to follow certain parties, political principles or values, but teach them ‘intellectual honesty’. I do not think Weber is being consistent, since honesty is also a moral value. Another example Weber draws is effective cooperation of the staff of a scientific journal who all have different political views [1, p. 356–357].

I agree with Weber when he draws a distinction between knowledge and values, saying that these are phenomena of a different nature. However, I can not agree with his insistence upon a huge gap between knowledge and values. The world of knowledge and values, science and ideology interact and influence each other.

If we regard science as a searching activity aimed at obtaining the knowledge, and not ready-made knowledge, then such science is exposed to values. The acquisition of the truth is a great value for any cognitive subject. The cognitive subject’s orientation to the truth and to obtaining reliable knowledge is a type of value orientation. In this sense moral values also participate in the cognitive process. The same refers to ideology.
Values are universal in nature. The ideas of freedom, justice, truth, humanity and human rights are values that may be accepted by different social groups. However, within the ideology of each group values are interpreted in their own way, and only then the modified values are accepted and used for ideological servicing of a certain social movement. Thus, Marxists denied the idea of abstract humanism and universal values in general for a very long time. They were officially recognised during Perestroika, but this new position was by no means accepted by all.

The idea of justice and a just society as a social value acquires ideological resonance when it is combined, say, with the idea of socialism and filled with a specific content as one of the goals of the socialist movement. The idea of human rights is also used for ideological goals.

One of the characteristics of ideology is its connection with social movements and structures, their interests, activities, and policies. It divides people into those who accept it and those who reject it.

There is another way to establish ideology, when social theory appears as the reflection of the specific social interests of a certain social group and is therefore positioned as ideology from the very beginning. In this case its content is determined not only by its knowledge domain, but also by social conditions and the interests of a given social structure, group, and class.

If these interests are narrow, egoistic, or mercenary, it is better not to expose them in such an undisguised way. Ideologists then have to camouflage them, posing their own interests as universal with the help of the existing system of values of that society. The abstract nature of any values allows for such mimicry, and it is widely used.

Each ideological system strives for sustainability and self-assertion and, at the same time, it does not remain unchanged. Ideology reflects, evaluates (positively or negatively), supports or discourages social and political processes, social changes and clashes of interests, and so on.

Social science is not a detached spectator of these processes, as it shows its attitude towards them; social science is not apathetic, it somehow reacts to these processes and very often it reacts under the influence of a certain ideology. Science and ideology have points of contact. Ideology influences science, and science influences ideology.
Ideology in its core is a totality of ideas, notions, and concepts that are theoretically comprehended and grounded. However, all of the above does not mean that ideology is always strictly rational. Irrationalism also finds ground in the sphere of ideology. Moreover, ideology interacts with another level of consciousness – social psychology and it can arouse certain feelings, moods and different emotional states. Therefore, a whole sphere of ideas and representations is formed in society; these ideas and representations express, justify, approve and service the social reality that gave rise to them, and they also substantiate the need for its transformation.

Modern science has always been influenced by different (both positive and negative) ideological factors, which impacts its development. This is especially evident at the beginning of its way, when it was trying to gain ground, established its authority and fought for the rights to exist legally and engage in free research. In the 18th century the foundations of the modern project were laid that determined the status of science in society and its role in social life and development. Development of social and human sciences in the 19th century raised the question of their specifics and their relationship with natural sciences. Philosophic thought of previous centuries moved between the two extremes when trying to solve these problems: a naturalistic approach that erased borders between natural and social sciences, and a cultural and historical approach that strictly separated these sciences. The founder of positivism Auguste Comte introduced the notion of sociology as a science about society that crowns the hierarchic classification of sciences that he developed. Just like natural sciences, sociology studies general laws that govern the development of the society. Herbert Spencer constructed his model of society based on an analogy between social and biological bodies. This is obviously showing a bias towards naturalism.

A naturalistic tendency in the social sciences acquired ideological characteristics only when used to substantiate ideological constructions. For example, biologism approaches to social life support racist ideology.

On the contrary, Heinrich Rickert defined the principal difference between the sciences about nature and the sciences about culture, since cognition of the social life is value-oriented, while sciences about nature are neutral in relation to values. Wilhelm Dilthey developed his own
version for differentiating the ‘sciences of spirit’ from natural sciences within his philosophy of life. His views are connected with the ideas of hermeneutics, growing accustomed to the object of cognition with the detachment of understanding and explanation.

In the 20th century Karl Mannheim, one of the founders of the sociology of knowledge, interpreted ideology as false consciousness. He deems ideology to be a false consciousness which expresses the position of a certain social class or group and which is directed towards the consolidation of the existing social structure, whereas utopia is directed at its negation. Only intellectuals are able to show scientific objectivity, as it is not connected with specific social conditions and positions of certain social groups.

On the contrary, the theorists of the Neomarxist Frankfurt school of thought equated science with ideology based on the assumption that both are a tool of exploitation.

In the second half of the 20th century, within the framework of post-positivism and together with productive sociological approaches to social conditionality of knowledge development, a trend arose to absolutise this factor and use sociological methods to analyse the very content of scientific knowledge. This point of view was held particularly by supporters of the so-called cognitive sociology of science. Science is not deemed to be “something self-sufficient and self-valuable that can be characterised as a specific sphere of human activity any more. Therefore, concepts that view science as one of the systems of beliefs (like myths, religion, ideology, and so on) begin to gain popularity, moreover, it is now stated that there are no principle differences between the science and other systems of beliefs in the means of substantiation and ways of functioning” [2, p. 163].

These are the outlines of a complex image of different solutions to the problem of correlation between science and ideology.

2. SCIENTIFIC CONNECTIONS IN THE ERA OF IDEOLOGICAL CONFRONTATION

After the Second World War, the strenuous post-war political and ideological confrontation of the two social systems increased the influence of ideology on the international connections in science. Science gave
birth to the atomic bomb — a weapon of mass destruction. However, scientists were the ones who warned the world community of the threats of nuclear war and the possible annihilation of humanity and life on Earth. However, each party, whilst assuring all that it stands on the side of peace, continued the production and accumulation of nuclear weapons and improvement of means of their delivery. The arms race has not stopped. Many organisations and movements were established in the scientific sphere and attracted the most prominent scientists (for example, the Paguosh movement) that tried to exert influence upon governments and public opinion to prevent situations in which armed conflicts could break out. In the middle of the 1950s the Russell – Einstein Manifesto was published that encouraged our society to form a ‘new way of thinking’, oriented to universal values and preservation of the universal peace. Words and acts by prominent intellectuals helped to solve the problems of nuclear weapons limitation, non-proliferation and control, etc.

In this situation the influence of an ideological factor gave rise to three categories or types of relationships in the social sciences: scientific collaboration of scientists who: a) represent opposite ideological positions; b) share the same ideology; c) ignore ideological differences if there are any.

The first type of collaboration was characteristic of the relationships of scientists from countries with different ideologies. Naturally, special attention was paid to their ideological component. Ideological control, characteristic of the inner life of Soviet science, was to a certain extent transferred to the sphere of international connections.

Here, the party principle was complied with strictly. Though this principle was positioned as one that does not hamper scientific objectivity, in practice things were far from being as plain as that. ‘Protection of interests’ led to subjectivity, suppression of undesirable information and protrusion of ‘useful’ information. The party principle was used as a tool that helped to suppress vivid and creative thought, impose dogmas, and cease discussions when they crossed ‘established boundaries’. Even if we do not plunge into analysis of the many particular cases, we can say in general that the interference of the ideological component in scientific discussions hampered the deve-
Development of scientific communications between scientists who represented different social systems and sometimes even put paid to such development.

Behaviour of the Soviet scientists at international scientific conferences was influenced by political and ideological aspects. However, as a rule, this was caused by pressure from official party leaders, not by the personal beliefs of these scientists, who were interested in discussion and resolution of scientific problems. For example, they were made to ‘fight off any charges’ against the USSR, its policy and ideology, brought at scientific conferences and workshops. This resulted in a very complex combination of scientific discourse and ideological confrontation.

However, no party in this situation was faultless. Soviet scientists often faced a cold and even hostile attitude from their western colleagues that was barely veiled; certainly, such an attitude discouraged the establishment of scientific contacts. Therefore, we may conclude that both parties set barriers to scientific cooperation. Scientific connections were significantly weakened. Soviet scientists sensed that they worked in a certain isolation from the rest of the world. They participated in international scientific conferences and meetings, but co-authorship and cooperative research were strictly limited; even if it took place, it was primarily based on personal relationships, mutual respect, and common scientific interests.

However, despite such differentiation, scientific and cultural collaboration was still developing; international scientific connections did not only break, but became wider over time. For example, in 1955 the USSR was a member of 18 international scientific organisations, while in 1964 this number increased to 108.

At the same time, the situation encouraged Soviet scientists to develop closer links with the scientific society of those countries that formed the commonwealth of socialist states. Scientific collaboration was initiated and realised on the following levels: the state, universities, academies, scientific institutes, and personal relationships.

Here I can also refer to my personal experience in developing scientific links in theoretical sociology and the sociology of science. I was employed at the Institute of Philosophy of the USSR Academy of Sciences and then I worked at the Institute of the History of Natural
Sciences and Technology of the USSR Academy of Sciences (from the mid-seventies). In both cases broad links were established in the science of science and the sociology of science with our colleagues from Bulgaria, Hungary, the German Democratic Republic, and Czechoslovakia. The development of empirical sociology in the sixties fostered effective collaboration with Polish sociologists and scientists of science. By that time these research fields were already well-developed in Poland. A number of large-scale collaborative empiric research projects were carried out and contacts between the scientists became permanent. Links with Romanian sociologists of science were not so close.

Scientists of different countries carried out research based on the same agenda but in different countries, published and composed books together, acted as co-authors, held seminars and conferences; foreign scientists attended training courses at our institutes. Scientists and experts remained in permanent contact. All in all, this was active and productive scientific collaboration.

The common nature of ideology meant that efforts could be concentrated on solving purely scientific problems. However, even in this case, ideology haunted the scientists and sometimes appeared in unexpected and quite unpleasant forms.

At the end of the 1960s and the early 1970s a team of Soviet scientists from the above-mentioned institutes were working on a collective monograph, *Human – Science – Technology*, aimed at theoretical comprehension of the scientific and technological revolution, in collaboration with experts from the Institute of Philosophy and Sociology of the Czechoslovak Academy of Sciences. Academician Kedrov headed the Soviet team; Academician Richta — an intellectual and smart person — leaded the Czechoslovak team. Richta gained international recognition after a group of experts from the Czechoslovak Academy of Sciences, under his lead, published a book called *Civilisation at the Crossroads* that defined problems appearing in the course of the scientific and technological revolution.

We worked on our monograph in a friendly atmosphere. Texts were prepared and discussed together. Therefore, we all had to spend a reasonable amount of time in another country during the project. No conflicts ever developed between us. The book was ready after a while. We
planned to publish it in three languages: Czech, Russian, and English, but suddenly we learned that Radovan Richta could not sign that work, even though he played an active part in its creation and was one of the authors. The ban has come from above. Later it turned out, that the communist fundamentalists of the time could not forgive him for saying during the Prague Spring that there might be different models of socialism. They did not stop him from publishing his works, but deprived him of the right to put his name on the publications. Such Jesuitism is an expression of outrageous injustice towards a person that strikes at his human dignity and self-respect.

Naturally, all of us refused to sign that work and it was published without the names of its authors and editors. The only name that was mentioned in the foreword was the name of the former Director of the Institute of Philosophy of the USSR Academy of Sciences Kopnin. He was one of the initiators of that project, but did not participate in it. He had passed away by the time the book was published. This example is a good illustration of how significantly ideology may distort scientific collaboration.

Incidentally, Richta was later condemned for cooperating with Soviet scientists. This proves that reverse ideological criteria are still valid. We have the fondest memories about this bright personality and our cooperation with him.

Forms and goals of scientific cooperation on a personal level vary greatly. Such cooperation may develop even if some ideological differences exist, if it is possible to set scientific problems and interests as priority. The commonness of ideology removes these barriers and encourages scientific communication. Mutual support, assistance in the search for necessary information, establishment of new scientific contacts, and cooperative development of the scientific problems that are of interest to scientists limit cooperation to a very narrow circle of experts who are really interested in working with each other. The notion of the *invisible college* appeared in the sociology of science as early as the 1960s. This notion was used to name a group of scientists that worked in different places but developed common scientific problems in a common sphere of knowledge and systematically exchanged information. Preprints were used for this before; now scientists
exchange data by e-mail. The data being exchanged between the participants of the invisible college differ from publications in scientific journals where final results are described, as a rule. When the participants of an invisible college exchange information, they share data about how the research progresses, what intermediate results have been achieved, and all this enables scientists to unite their efforts and accelerate problem-solving, which is of great importance for scientists.

Different forms of collective discussion such as seminars and workshops are also widely used on a personal level.

Personal communications are based on the mutual interests of those establishing these contacts. If one expert has no interest in another, he will avoid him instead of establishing contact. On the other hand, if scientists are interested in each other, if they are the carriers of knowledge and personal qualities that each of them needs, it removes many barriers to communication. At times, however, ideological barriers separate people irrevocably.

3. THE IDEOLOGICAL FACTOR IN MODERN SCIENTIFIC COMMUNICATIONS

The demise of the Soviet Union in the early 1990s and the consequent collapse of the world socialist system became one of the most important events of that époque. Moreover, it led to the destruction of the well-arranged system of international scientific cooperation with former socialist countries; Russia lost practically all scientific links with experts from the former Soviet republics, especially in the sphere of social sciences.

On the other hand, ideological confrontation ceased, the Cold War ended, and principles of democracy and ideological pluralism were officially recognised in Russia. Marxist theory and ideology were heavily criticised, although this criticism has not always been valid and qualified. Some political writers used the current political situation in order to mythologise the nation’s history once again. Marxism preserved its influence as one of a number of ideological doctrines. The structure of social and human knowledge underwent a number of changes. The disciplines that descend from Marxism and are interconnected with it lost
their ideological orientation and either survived as independent disciplines or were included in the traditional areas of scientific knowledge.

The ideological press in the post-Soviet Russia was separated from social sciences, but the social determinant’s impact did not become a thing of the past. Earlier, our society was considered a united whole and only one common interest was legitimate, but now the attitude towards the past and present social reality of different social layers and age groups differ significantly. Ideological differences are also caused by economic differentiation and the current political situation. These factors promote different attitudes towards the nation’s history and the desire to manipulate the masses. Mass culture that is not always ‘clean’ from a moral point of view is spread amongst the masses. The scientific approach towards reality is often substituted by perfunctory writing. Certainly, people work and social science develops, but its impact on society does not coincide with the scale of problems that society has to face. Development of international cooperation in social and human sciences may strengthen their position in Russian society and improve the quality of scientific research.

Economic reform also had a strong negative impact on Russian science. The number of scientific workers in the country decreased more than twice, the material and technical base deteriorated significantly, the level of research in a number of areas of knowledge lowered and applied science was seriously damaged.

On the other hand, the formation of a market economy, civil society and constitutional state increased the social demand for economists, financiers, lawyers and psychologists. These became ‘fashionable’ professions and the number of students majoring in these subjects increased dramatically. International contacts in these fields of science and education also widened.

As we approach the twentieth anniversary of the reforms in Russia, the national government has announced that the only possible means for its future development is an innovation-based strategy, involving a transfer from raw materials to innovations. Natural and technical, social and human sciences are all striving for a solution to this problem. It is obvious that the innovative process in the course of which new technologies are created requires social and economic resources and
servicing. The social and economic infrastructure for innovative activity performs this function, but at the same time it requires the efforts of specialists in social science, as well as managers who are familiar with modern management technologies. Such an innovative system is formed on the basis of a market economy. This is a new process for this country and, therefore, we need to prepare people afresh, to service this innovative infrastructure. It is impossible to launch the innovative process without establishing a social and economic infrastructure.

However, we are not only talking about infrastructure. Taking an innovative approach touches upon all spheres of social life. A significant role is played by spiritual culture and the creation of a social, psychological, and moral atmosphere that encourages the development and use of new technologies and excludes possible purely technocratic solutions to problems that may arise.

Innovative development helps form an economy based on knowledge and, in a wider sense, a society of knowledge. This should be a society with a human face, dressed in human spiritual clothing that enables each personality to develop and realise its potential.

The combination of science and humanism values, the humanistic orientation of science, is also a way to link science with the ideological component that distinguishes the human meaning of social cognitive activity. If we approach the problem from this angle, then full deideologisation is equal to spiritual impoverishment and a spiritless society is inhuman. However, we should not overestimate the meaning of ideology either. Some areas of human life and activity are deideologised and the sphere of ideology is therefore limited. However, from the general historical perspective, we do not need deideologisation of science; rather, we need its human orientation.

Therefore, Russia needs strong and current social science that is able to cope with the challenges of its time without rejecting the traditions in order to achieve its strategic goals.

However, it does not seem possible to achieve desirable results without international scientific cooperation, use of experience, accumulated in developed countries, especially if we are talking about spheres of knowledge that have not been developed or have never existed in this country.
The political situation in the world and the ideological atmosphere are quite favourable for this. Ideological barriers are removed, people can freely move in and out of the country, there exists a great need to strengthen scientific connections in traditional spheres of social sciences and the development of international scientific collaboration that will enable us to solve the actual social and economical problems the country faces.

The attitude of our foreign partners in politics and science towards Russia impacts the promotion of these processes greatly. As mentioned above, our experience shows that no full deideologisation of our international relations has occurred, and Russia sometimes shows greater openness than our western partners are ready to accept.

Russia often has to deal with the Cold War beliefs and views that exist in the heads of some westerners as the remnants of the previous époque. The same approach is observed in the field of science as well. Not all former Sovietologists and Kremlin watchers are ready to change the way they see this country. People whose work does not bring them close to these issues consider such views to be authoritative expert opinions.

Some people are guided by purely scientific considerations when they avoid scientific information exchange and do not hurry to engage Russian scientists in the development of certain problems. Russian social science is considered to be underdeveloped and unable to solve problems at a contemporary level.

It would be incorrect to give such an unambiguous evaluation of our science. There are spheres where Russian scientists lag behind their western colleagues, but in other spheres they can boast equal or even greater achievements. What is needed is analysis of a specific situation. Certainly, Russia looks weaker than the influential superpower that the USSR once was. That is the way history took its course. However, those who think it is possible to deprive Russia of its sovereign right to realise its independent policy that meets its own national interests, are deeply wrong.

This is a purely ideological subject, though it is connected with science, and it obliges us to evaluate objectively the current situation in the world. Instead of the former ideological confrontation between two
systems, we are now faced with a non-systematic and more diluted ideologi-
ocal confrontation between a Russia that tries to defend its sove-
ignty and the right to determine its future and those layers, groups, 
individuals and states that wish to see it weak, humiliated and depen-
dent, a country that will always play a raw-exports role, a kind of 
colony of developed countries. Two completely opposite goals clash on 
the world arena, i.e. there is an ideological confrontation and Russia 
has to reckon with it.

International scientific cooperation is a specific type of international 
relations. It is impacted by state policy and the political relations 
the state establishes with other countries. Russia has first-hand experience of these relations. At the same time, one can not interpret it unambiguously. As we have seen, political and ideological components appear differently on different levels of scientific relations, sometimes these components can simply come down to nothing.

References
The problems of the theory of science and scientific links present practically no interest to me. My research and teaching interests lie in the sphere of moral philosophy and normative and applied ethics. Over the last twenty years within this sphere and in connection with it I have gained considerable experience of establishing international scientific links, cooperation and collaboration in many different forms and roles, including the role of coordinator of international projects, though these projects were not too large in scale, the number of participants, and the volume of funds attracted. I would like to draw from this experience and compare it with the experience of my colleagues in order to analyse some trends in the structural changes of international scientific collaboration, its barriers, objective and subjective agenda, as well as preferable ways for its future development.

Though my current experience of international links is extensive, I often recollect my first experience of international professional meetings at the end of the 1970s and 1980s that was rather rich and diverse for that time: I participated in bilateral and international conferences held in Moscow with academics from the countries of Eastern Europe, and collaborated quite closely with American professors who visited Moscow with medium-term visits and whom I had to accompany and escort because I knew English; I also made short visits to the universities of Eastern Europe. Even those sporadic meetings that were taken as a great opportunity since they were so rare, and limited collaboration that sometimes followed, enable me to evaluate the specific effects of international links. First of all, it helps broaden one’s professional and cultural outlook, exchange information and knowledge, research and teaching experience. It also indirectly promoted new ideas, research and education initiatives. If we look at the situation from a wider perspective, such international links supported and strengthened
the scientific communities. Besides, it should be noted that an important secondary or background effect of international scientific links (and especially international scientific collaboration) is the development of popular diplomacy and, therefore, the strengthening of understanding between peoples.

My own experience shows: long talks with professors of philosophy who visited Moscow at the beginning of the 1980s and meetings in 1987 at my first international conference (most participants were from Western Europe, the USA, and Canada) transferred into promising research developments, subjects of research publications, whole sections in the lecture courses, and the contacts I managed to establish then continued into the 1990s and 2000s and helped me to develop interesting joint projects. I can not imagine my career in science today without those contacts, links, collaboration, and cooperation.

I am talking about my own experience in order to acknowledge the obvious: international cooperation is an important factor of the professional development of a scientist, an additional incentive for research and teaching initiatives and it is another means of creative self-realisation.

1. INTERNATIONAL COOPERATION AND RESEARCH AND EDUCATIONAL POLICY

I have never heard someone with an academic background voice their doubts about the importance and relevance of international cooperation. At the same time, my purposeful information search for any strategic documents about the priorities in international cooperation issued by the Ministry of Education and Science, the Academy of Science or any university yielded practically no results. My experience of communication with different people and my knowledge about what is going on in the regional and provincial universities in particular, enable me to say that over the last fifteen and especially eight years there has been a sustainable trend to broaden and strengthen international links in research and education. This applies no less and maybe even more to the social and human sciences, than the natural and engineering sciences. All Russian universities and research centres implement certain
programmes of international collaboration within the framework of which exchange programmes are arranged for students and postgraduate students, trainees and professors and where joint research, education, and, to a lesser degree, publishing initiatives are realised. However, if one wishes to find out what the universities strive for in their activities called ‘international links’, this would not be an easy thing to do. To see this, one needs just to analyse the rather monotonous and plain information that international departments of different universities publish on their websites.

I have already mentioned the evident unanimity about the relevance of international collaboration. However, what agents of collaboration are we talking about? It seems that the priorities and prospects of collaboration ‘formatting’ will be different at the level of individual researchers and professors, at the level of primary research and pedagogical teams, or universities and scientific centres or institutes. The motivation of those researchers and professors who seek to establish and develop international contacts is almost always evident: they want to broaden the sphere of their activity, receive additional opportunities for their professional career and creativeness, and so on. As the observed practice of international collaboration shows, people who are responsible for such collaboration at the level of universities hardly ever have any ideas about the strategic guidelines of this collaboration; moreover, they rarely understand what the collaboration at the level of universities or institutes should be like and, consequently, how it should be planned. My purposeful discussions on the subject with many acquaintances (university professors from different regions of this country) show that the situation is practically the same everywhere. None of them could recollect that the questions of international collaboration were discussed at the university administration meetings or faculty councils, especially in the context of the university’s mission, its educational and research priorities. Judging by what universities write about their international links, one may suppose that institutional tasks directly connected with research and education are not that important to them. I was told about two able vice-rectors who were responsible for international cooperation and made some interesting suggestions, clearly realised the prospects of this sphere of university activity, knew English
and could communicate with their foreign partners directly. Both stories were told in the past tense, however. It is significant that when these people left their posts of vice-rectors, the international links they had established broke down, the projects they launched ceased and since the successors of these vice-rectors were not so prominent and active, international activities at the universities adopt a purely routine form.

My first suspicions about the lack of political clarity in the heads of ministerial officials and other superiors arose at one of the stages of an innovative educational programme realised within the framework of the national priority project *Education* [Obrazovanie]. This programme attracted significant funds and pursued large-scale goals. Under this programme a task was set to develop the educational methodology for preparing experts in different specialities (Master’s degrees) at the Lomonosov Moscow State University. We may say that one of the components of this programme was quite unprecedented: its participants received an opportunity to visit foreign universities to test the prepared teaching materials, exchange experience, and establish creative links. This part of the program is unprecedented in two aspects. First of all, the Russian academics were offered an opportunity to freely choose the university (or universities) they would visit, and I didn’t hear about any restrictions. Second, the privilege of the so-called academic mobility was not limited to a narrow and selected circle of employees, as it often happens; as far as I understand, dozens of Russian professors were able to make such trips in 2006–2008. These trips gave them everything that I have already mentioned: the broadening of their cultural and professional outlook, exchange of experience and information, establishment of personal contacts and support of creative connections, etc.

Why then did I get the impression of a lack of understanding about the supertasks of the academic mobility programme on the part of ministerial officials and university superiors? Because I know how these trips were organised and what requirements were set for the professors who wanted to go abroad. I do not even want to mention the fact that the full responsibility for organising the trips, obtaining visas, and purchasing tickets was placed upon the professors and the fact that they had to make a huge advance payment from personal funds (no material assistance was provided by the programme organisers). Some pro-
gramme coordinators even dared to say that they would decide whether they would compensate the professors’ expenses when they saw their scientific reports, and they were not joking, either. The superiors in education and science made the Russian professors, who had developed the unique teaching materials within the shortest possible period of time, bring references about these materials (composed in Russian) by their foreign colleagues. The professors were recommended to exchange experience only and avoid making reports or lectures during these trips; participation in any scientific events was discouraged. Such control measures demonstrated distrust in the good faith of the professors. However, I think it was caused not so much by the narrow-mindedness of the superiors in education and science, as by the fact that they had no clear understanding of for what these trips were needed. Both requirements showed the utter disrespect of the professors by officials in different ways. Moreover, the second requirement demonstrated clearly that these officials did not understand the creative nature of the activities of the professors or/and researchers and did not realise that the desire of those who took these trips to make a public speech before their western colleagues, to present the results of their teaching activity within an innovative programme and the results of their individual research and developments were only natural. Free creative communication is something that helps establish real personal and professional connections, gives birth to the ideas of further cooperation and possible collaboration.

It is quite natural that the professors acted as they deemed appropriate. For example, a wonderful trip to the UK, in which I participated, enabled the Institute of Philosophy of the Russian Academy of Sciences and the philosophy faculty of the M. V. Lomonosov Moscow State University on the one side and the Institute of Applied Ethics of the University of Hull on the other to launch a project aimed at the organisation of bilateral research seminars with a view to publish a joint book over the following two years, and I am deeply grateful to the national project Education that gave such an opportunity to my colleagues and me.

The very fact that we received this opportunity is indicative of the changes that occur in this sphere. Absurd requirements set by the offi-
cials and the scant organisational basis of the programme, considering its generous financing, prove the fact that positive changes in strategic thinking were not supported by the necessary transformations in tactical thinking and organisation. This is a federal programme. At a regional level even strategic thinking, if it is appropriate to discuss this notion, is constrained by narrow-mindedness.

When I discussed the experience of academic mobility gained in the innovative educational project with one of my colleagues from the N. University, one of the largest regional universities in Russia, he just smiled bitterly and said that he was familiar with that programme, since they had also engaged in the development of innovative teaching materials, but that ordinary members of staff could hardly, if ever, participate in the academic mobility programme. A certain quota of funded trips was granted to each university, and almost all these trips were made by members of the university administration and very few faculty deans. Nobody knew what principles were used when choosing the countries and universities for these visits. The universities received no information about the outcomes of these trips. On the other hand, there were other cases. After the World Philosophy Congress in Seoul that the person I was talking to was able to visit after literally wresting the financing from the University administration and having received several additional tasks that he had to fulfil at the Seoul University (for example, to study the experience of teaching philosophy gained by the professors there), he expressed a desire to talk about the Congress at the academic council meeting of the philosophy faculty. The dean did not show any enthusiasm in response to this suggestion and the speech of my colleague about the congress was constantly postponed as something of minor importance until three months later when his speech had lost any topical relevance.

Linked with my assumption about the general lack of concepts of international cooperation, the experience of the M. University in one

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1 All examples in this paper were provided by my informants in the respective universities. For ethical reasons I drop the real names of the informants and universities. Although I had an opportunity to present in person only in two cases, I dare to say that my examples illustrate the common state of things in many Russian institutions of higher education.
of the Northern European regions of Russia is noteworthy. At first sight, if we analyse the information presented on the university website, the ‘strategic programme’ has been realised at the university for some years already, and this programme is aimed at ‘internationalisation of science and education’. It is considered to be designed to use international resources for the improvement of the quality of education, the adoption of the principles of the Bologna Declaration, promotion of innovative processes and structural changes at the university. This educational institution actually cooperates with 19 universities in 11 countries. In 2007 alone, the university signed collaboration agreements with five universities in Serbia, Ukraine, Sweden, and the USA. According to the information presented at the university’s website, these and other agreements are aimed at the development of joint educational programmes (including those that provide for joint diplomas or double diplomas for the participants of these programmes), educational and research projects, partial integration of human, information, material and technical resources and the attraction of grant funds of different foundations for achieving different goals. However, there is no way to get acquainted with the strategic programme.

When I talked with the professors of the M. University I learned that the ‘strategic programme’ is nothing more than a calendar plan of different events composed on the basis of information gathered from faculties and departments. This university does have interesting collaboration projects, however they have been developed either due to the proposals made from western universities or individual scientists, or on the personal initiatives of individual members of the university staff. The university only acknowledged these projects and the summary document of the international department carries no mention of them. These projects are treated as a private initiative of the professors who launched them. You are probably interested, then, what information the summary document contains. For example, it says that over a hundred students and about a dozen of professors participate in the programme of the Oxford Russia Fund (ORF). However, is it justified to consider participation in this programme to be international scientific

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2 For details, see the ORF website: http://www.oxfordrussia.com/index.asp?lang=en
collaboration? This is a scholarship programme and it is not at all specialised. These scholarships are granted not by ORF, but by some Russian commissions in Moscow who take into account the representations of university administrations and make their judgements on a formal basis (certain level of academic progress), not by content; such a policy is not likely to give any positive results. ORF renders charitable assistance to students and young professors from the Russian regional institutes of higher education. However, I can not quite understand the philosophy of this programme. Neither can I grasp the logics of the universities who take pride in participation in such charitable programmes in essence and consider such participation to be part of their international cooperation.

Another interesting fact from the experience of the International Department of the M. University concerns what is highlighted as the results of developing international links. The main effect of such project and grant activity is considered to be... ‘financial and economic’ advantages: the improvement of the material and technical base of some departments that participate in the project to the sum of over 2 million roubles. The foundation of many new computer centres that are to promote the introduction of new information technologies in the educational process and to help broaden the international links of the university are considered to be one of the main results of this activity. It is the material effects of ‘international cooperation’ that are in some way illustrated. We can only guess, however, what such notions as ‘professional and personal mutual enrichment’, ‘inter- and intra-university cooperation’ and ‘increase in academic mobility’ really mean.

At one of the colleges of the M. University, under IREX support an international consultancy centre was founded with a view to develop international activity. The contribution made by IREX into the development of education is well-known, however, I did not manage to find out what the substantial results (those that are connected with

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3 IREX, founded in 1968, is an international non-profit organisation providing leadership and innovative programmes to improve the quality of education, strengthen independent media, and foster pluralistic civil society development. For further details, see: http://www.irex.org (IREX Russian website: http://www.irex.ru).
the educational process proper) of the IREX programme were for this university.

All programmes of international cooperation realised at the M. University are developed due to financing provided by western foundations and universities. This is understandable, given the scant financing that regional universities receive. However, with this in mind, it is difficult to understand why any efforts to establish and develop actual professional international connections and develop collaboration are deemed by the university administration to be a private goal of those who make these efforts and why they do not receive any practical support even as a part of existing technical and financial opportunities, however small they may be (especially considering the fact that administrative and organisational opportunities of the university are significant).

One of the graduates of the historical faculty of the M. University decided to continue her education and applied for enrolment to the MA course at the Central European University (CEU) funded by the Soros Foundation in Budapest. Based on the results of the examinations, her university diploma was only classed as being equivalent to a GCE, i.e. higher education received at her university was evaluated as the same as a secondary education qualification. She was enrolled to the preparatory department of the CEU and had to take an intensive English course. The graduate did not receive the ‘red diploma’ in Russia, but most of her credits were excellent and she was shocked by the results of her CEU enrolment examinations.

Actually, this fact, if it become known to the rector of the M. University, should have encouraged critical analysis of what the university is really occupied with. One can not simply brush such facts aside. On the contrary, such facts should determine the goal and substance of priorities for international cooperation. The competitive advantages of graduates at the labour market, the qualification that enables them to continue their education are the main indicators of all

*‘Red diploma’ is an informal name of honors diploma. It originates from the red cover of an honors diploma. Ordinary diplomas of higher education in Russia have blue covers; the respective informal name for them is ‘blue diploma’ (Here and after the editor’s notes are marked by asterisk (*)).
types and spheres of activity (including the development of international links) of a university as an educational institution. Not all universities claim to be scientific centres. However, those that do should accept the fact that another important criterion for evaluation of their activity is the competitiveness or the rating of research results, which sets additional priorities for international links as well.

Of course, all this gives rise to more general questions. In order to evaluate the competitiveness of a graduate, we need to have a well-developed labour market; in order to evaluate the quality of education provided by the university, we need to have an educational services market; in order to be able to define the level of scientific research conducted by the university, we need to have the appropriate evaluation instruments, at least something like a national citation rating or some other ratings, such as a patenting rating.

All these facts taken separately may seem particular and even exceptional cases. However, all of them taken together reflect the real state of affairs, characterised by the obvious lack of any system and consistency in the policy pursued by the universities in international cooperation in science and education, as well as the lack of a well-founded strategy and well devised tactics. But how can one really expect universities to pursue thought-over policy in international collaboration without having a rational and strategically grounded educational policy and without the appropriate well-developed social institutes, i.e. institutes of the civil society — mass-media, professional and business associations, independent (non-governmental) associations of institutes of higher educations, etc., that make the absence of such policy impossible?

2. PRIVATE INITIATIVES

Liberalisation of social life over the last 15 years has promoted greater freedom of international movements of Russian citizens. Nowadays people may plan their mobility depending on their material circumstances, personal taste and fantasy. This should be taken into account when evaluating the possible positive factors and educational and professional development of a person, not reducing the person’s freedom of movement and communication to the sphere of a mere satisfaction of recre-
The professional level of an expert depends on his or her education, open-mindedness, and inner freedom. This mostly concerns the creative professions and the research and teaching professions in particular. Common sense dictates that universities should be interested in the high professional qualification of their employees and, therefore, they should encourage all forms of furthering professional qualification, including those that are connected with academic mobility and the broadening of academic communication. The problem that arises in this connection is two-faceted and concerns the following: first of all, what can be done to render assistance to researchers and professors; and second, what can be done to make the individual and professional development of a professor or researcher to have a positive impact on education and science?

One of the professors of the K. University who hold positions of a dean of one of the faculties and of the vice-rector of the international college of the K. University, a prominent expert in philosophy and the logics of science, told me with annoyance that he had to reject invitations to international conferences only because he had no time for one-day visits to Moscow to apply for visa and then to receive his passport with the visa. The international department of the K. University is entitled to render visa support, but only the members of the university administration and people who have close personal connections with it may benefit from this. When the above professor turned to the academic council of the K. University for help with obtaining a visa for a trip to an international conference, he was told that participation in the conference is his ‘private initiative’, and that it was not in the competence of the international department to render such assistance. Of course, such position of the university administration hampers the development of international scientific and pedagogical links.

Let me tell you another similar story. There is a rule observed at the K. University, as well as at the above-mentioned M. University and many other institutions of higher education: if an employee goes abroad for training for a period of up to 3 months, his or her salary decreases, and should the training take longer than three months, his or her salary payments are temporarily suspended altogether. It is understandable
that this way the universities and research centres (it doesn’t matter whether they do it by their own initiative or by the order of the Ministry of Education and Science) are saving funds. Such a state of affairs significantly restricts academic mobility and, therefore, the professional growth of the academics.

There are universities that provide funds for their employees to participate in foreign events, because they consider it to be an important factor of the creative and professional growth of their employees. Unfortunately, this is neither a common practice, nor a reflection of some sustainable order that is equally open for all.

The question of whether universities should (and if so, then to what extent) support their employees in their private initiatives, aimed at establishing and developing international professional links, is still open to discussion. The answer to this question depends, first of all, on the different financial capabilities of different universities. Undoubtedly, the existing order should be transparent and always open to discussion; the situation at the N. University (when the existing limited opportunities were used arbitrarily, and conflicts of interest and corrupt practices were evident) will not be repeated.

It is well-known that even large-scale inter-university projects usually start from modest roots of personal contacts and in this respect they really are ‘private initiatives’ of individual employees, as the rector of the K. University said. This is the most natural and efficient way of establishing international links and developing collaboration. However, we need to work out mechanisms that encourage the establishment of primary personal contacts and support these contacts. In this respect the fundamental stand of the French National Centre for Scientific Research (CNRS) is of interest. The strategic document (this is exactly what the CNRS document On the forms of international collaboration is and how it is called) says: “International collaboration is mostly based on personal ties and contacts that were established by academics during international congresses, summer schools, seminars or by electronic correspondence. However, effective collaboration and additional funding are only possible when such links are structured and formalised”\(^4\). CNRS is an

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\(^4\) For further details on CNRS international collaboration see: https://dri-dae.cnrs-dir.fr/spip.php?article1095
organisation that renders support in this area. Forms and addresses of such support vary and correlate with the different types of research and cooperation initiatives.

In Russia, this function is actually fulfilled by the state foundations: the Russian Foundation of Basic Research and the Russian Foundation for the Humanities (RFH). (Other foundations function in Russia as well, e.g. international organisations and foundations such as CNRS, DFG, and others.) In 2008, the RFH, in cooperation with foreign research foundations and organisations (from Belarus, Vietnam, Germany, Moldova, Mongolia, Taiwan, Ukraine, France, and Estonia) announced 11 calls for proposals with an incredible total budget; the amount of funds allocated really impresses if we add the grant money provided for participation in scientific events abroad to this budget\(^5\). As always, there are no sufficient finances; undoubtedly, researchers need more funds and more research foundations. However, on the whole, the trend observed in the grant support for international cooperation projects is certainly a positive one.

Considering the limited financial opportunities of the universities, it would be practicable to distribute these funds inside the universities on a competitive basis with a transparent procedure and openness of evaluation results. The substance of international links should also be transparent while the benefits of these links should be available to all members of the university staff.

In the late 1990s some Russian researchers in the social and human sciences formed an opinion that is still there today, “Europe (the West) not being eager to enter cooperation with us”. This view gained ground at the beginning of the 2000s after several international funds (and, essentially, the Open Society Institute – Soros Foundation) suddenly ceased their activity in Russia. It should be noted that the Soros Foundation made a huge contribution in supporting Russian science. I do not think that view formed of its own accord and without particular reason: in the 2000s, after several years of exclusive preferences on the part of the West towards Russian academics (significant funds were granted for trips to scientific events, summer schools,\(^5\)

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\(^5\) The information on RFH joint calls is available at: http://www.rfh.ru
training courses, etc.), the stage of normal relations gradually set in. They were normal in the sense that these relationships were not pre-defined by ideological, political and confirmative preferences any more. Not all Russian academics and professors were ready to accept the fact that after several years of practically hothouse conditions, the funds and opportunities for international collaboration were provided on standard conditions, i.e. on a competitive basis.

That is when we realised what the main obstacle that hampered the international contacts and links actually was. This obstacle is not the lack of financing, though it is quite significant, not bureaucracy in education and science (one can not deny this either), not the difficulties researchers face when he or she want to receive visas for going abroad or obtain official invitations for hosting foreign partners, though there are significant complications and problems in this sphere, too. The main obstacle is presented by the academics themselves.

If we talk about private initiatives, it should be noted that subjective obstacles (in comparison with the above-mentioned administrative, institutional, and political barriers) are of much greater importance for international collaboration. These obstacles are, first of all, the overall low level of foreign language proficiency, even if we are talking about the academics of the highest rank and young academics, and second, the intellectual labour culture and methodology that differ significantly from those in the West.

Differences between the national intellectual traditions, styles of thinking, writing and speaking (the discourse) and the differences between the systems of research and development management are only natural. Such differences are also observed between the European national academic communities, and these differences are often significant. However, they do not hamper inter-European scientific collaboration. Of course, the differences between the Russian and European traditions run deeper. This is explained by another educational basis, especially in the social and human sciences: Over the decades we have studied different literature and, to a great extent, we continue to do so; we have different teaching styles and different learning cultures (like self-education). We have a completely different discourse culture. When the Europeans talk about the differences between the Italians,
British, Germans and French, I suppose they mean that debates and discussions, as well as collaborative research of specific problems, holding international congresses and publishing joint works, etc., may assist in overcoming and neutralising these differences. Joint projects may also help to level the differences in the discourse cultures and educational bases.

However, what if the main obstacle making the participation of Russian academics in international projects impossible is the low level of foreign language proficiency? This is a primary and principal negative factor. The differences between the educational bases, intellectual and discourse cultures are relative and therefore not fundamental. We can not talk of successful cooperation if the participants of this cooperation do not know any foreign language, English in particular. Lack of language knowledge is not only an obstacle in communication and mutual understanding, but also a factor that makes participation in discussions, presentation of own scientific achievements to foreign colleagues and preparation of own scientific publications very difficult.

The 22th World Philosophy Congress, held in summer 2008 in Seoul, made this obvious. Russian participants dominated at the Congress in number, despite the fact that about 20% of those who had sent applications and had been included into the programme, could not participate in the event. The coordinators of the Russian Philosophy Society that made a great contribution to such active participation of Russian philosophers in the Congress may be proud of this decent number of participants from Russia. However, I can not share this view. Nominally, Russian is the working language of the world’s philosophy congresses. However, the participants are provided with simultaneous interpreting only during plenary meetings. Reports at the section meetings are usually presented in English. Most delegates from Russia did not manage to present their reports in English; only some of those who did not know English thought it practicable to prepare an English version of their reports beforehand and hand them out to the participants of the corresponding sections. Sometimes two sections were held in the same problematic area, one of which was a completely Russian-speaking section, since only
Russian participants presented their works there. It is known that according to the Soviet academic tradition (we should note that this is now weakening) reports that are not presented in text form are rated more highly (in Soviet times the reports that were not presented ‘by text’ were a kind of oratorical and esthetical alternative to the reports, read ‘from paper’ at Communist party meetings). In the international academic tradition a report to a conference that is not supported by written text is considered to be a demonstration of carelessness and disrespect towards the audience. Most participants of the Seoul Congress from Russia did not even have texts in Russian. The Chinese participation in the Congress was not so numerous. If Russia was mostly presented by people over middle age, most participants from China were young. The theoretical level of their reports was probably the same as that of the Russian papers. However, all Chinese reports (as far as I remember) were presented in English and read ‘by text’. Certainly, this is quite a formal criterion but, nonetheless, young Chinese philosophers demonstrated a higher level of incorporation into the international academic community. Many of the Chinese participants had taken courses at western universities and understood that the quality of arguments was equal to or greater in importance than the quality of the ideas suggested in the paper. The reports of the Russian philosophers proved the opposite, since they, most probably, thought that the idea that seemed interesting to them was worthy of attention per se and that such an idea proved itself right without any arguments. During the Seoul Congress I heard many new ideas about the ‘particular way’ of the Russian philosophical thought and spirit, about the ‘unity of faith and mind’, about the ‘unified science’ from my Russian colleagues who were preoccupied with searching for ways to make these ideas clear to those who did not know Russian.

3. WAYS TO PROMOTE INTERNATIONAL COLLABORATION

There are at least two types of agents of international collaboration: individual and institutional. The experience gained shows that institutional forms of international links and collaboration usually develop on
the basis of established personal contacts. Scientific and educational institutions should create favourable conditions for the development of personal links. Such cooperation may be ‘opportunistic’, aimed at stimulating and supporting links that already exist, and possibly promising as well, aimed at creating conditions for the establishment of such connections in the future, aimed at the formation of the ability to establish such connections, to be exact.

Considering the above, a radical improvement in the level of foreign language teaching at the universities should be considered a primary objective. It is not for me to judge the way this system should function, but I suppose that it could be not an obligatory, but an optional course at pre-diploma or Bachelor’s level, maybe, even a paid course, but where the fee should be divided between the university and the students, and the better the student’s achievements are, the less he or she have to pay for studying foreign languages. The study of foreign languages at Master’s level should be obligatory and perhaps an additional differentiated fee should be introduced for it. This is my first idea.

Second, we need to restructure the system of university education with a view to create conditions that will help students develop the skills that are needed for active and efficient independent research work. Our higher education, for very much the most part, is of a traditional, non-creative nature. The level of education and learning on the whole lowers because of the decrease in the level of education, ensured by the secondary education and, certainly, because students lose reading skills even of the most general nature, not even mentioning active and thoughtful reading skills.

Third, there is a need of a federal programme that would support graduate and postgraduate study of the Russian students abroad on a competitive basis.

Then, I would like to mention as the fourth factor the need to develop nonspecific (as it may seem at first sight) programmes fostering the development of intra-Russian scientific links (for example, like those that were initiated at the end of the 1990s – early 2000s by the Open Society Institute – Soros Foundation, and within the framework of the megaproject Education, in particular). We should contribute to the activation of scientific life inside Russia that has still not yet achieved
the level of scientific life in the USSR. Intra-Russian scientific life is a promising resource of international cooperation.

Fifth, we need to develop foreign training programmes for academics of all ages. It is understood, that all such programmes should be realised on a genuinely competitive basis.

At the same time, considering the weakness of existing academic potential, owing to the low level of foreign language competency, it seems practicable to found federal and regional (on the basis of the universities) centres that would contribute to the development of international links and collaboration. I know of such precedents. For example, I can name the Centre for International Collaboration and Academic Mobility at the Mordovian State University\(^6\). The Centre was founded in 2005 with a view to render information, reference, bibliography, consultancy and organisational services (I suppose most of them were paid services) within the framework of international collaboration promotion (though the Centre had its own, quite specific, understanding of such collaboration). It appears practicable to create an integrated information base of such centres in the future.

It also seems reasonable to develop regional programmes that would promote and popularise the research results of Russian academics in the social and human sciences. There are different ways to promote them. The easiest and the cheapest way is rendering information support to the Russian academics and the ideas they offer by means of specific web-resources. A more serious problem is to establish core bulletins and journals with the translations and digests of the articles published in Russian. The journal *Russian Studies in Philosophy* has gained such experience already, but it is published in the USA\(^7\) and pursues its own

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\(^6\) More detailed information about the Centre is available at: http://intoffice.mrsu.ru:80/rus//center.shtml. The Centre is oriented to educational programmes as well as most resource centres of this kind; see, e.g.: The Bureau of International Programmes in Education "Direct Talk": http://www.directtalk.ru/cgi-bin/issue.cgi?action=cat_article&cat_id=12

\(^7\) The *Russian Studies in Philosophy* belongs to the American publishing company *M. E. Sharpe Inc*. The journal contains unabridged translations of articles from a number of Russian philosophical publications such as: *Voprosy filosofii* (Problems of Philosophy); *Filosofskie nauki* (Philosophical Sciences); *Vestnik Moskovskogo Universiteta, seria filosofii* (Moscow University Herald, Philosophy Series); *Vestnik Leningradskogo Universiteta, seria ekonomiki, filosofii i prava* (Leningrad University Herald, Economics, Philosophy, and Law Series); see: http://www.mesharpe.com/mall/results1.asp?ACR=rsp
INTERNATIONAL COLLABORATION: CHALLENGES, PERSPECTIVES AND PRACTICES

publishing policy. There is no way to develop such journals on regional level. However, the federal universities that have been recently founded in Russia could take up such mission, since they are set a specific task to teach up to 20% courses and publish a certain number of articles in English.

This is not likely to require significant funding. However, first we have to achieve political clarity: What do we need it for? What education and what science would we like to have? And, all in all, in what society would we like to live?
II

PHILOSOPHY OF SCIENCE: METHODOLOGICAL ASPECTS
HANS LENK

HIGHER LEVEL INTERDISCIPLINARITY
BY METHODOLOGICAL SCHEME
INTERPRETATIONISM

AGAINST METHODOLOGICAL SEPARATISM BETWEEN NATURAL,
SOCIAL AND HUMAN SCIENCES

1. INTERDISCIPLINARY INTERCONNECTIONS IN
THE INFORMATION AND SYSTEMS TECHNOLOGICAL WORLD

It is well known that most of the topical problems of our times cannot be addressed in clean disciplinary separations or total disciplinary make-up, but they are only successfully to be addressed in interdisciplinary or transdisciplinary or even superdisciplinary manner. For instance, ecological problems are not just natural science questions, but of course they are not only cultural or social humanities areas either. In the overriding and comprehensive problems of our society and age we encounter a complex of not only internal interaction and interconnection if not mashing of the prospective disciplinary areas. We need more abstract plus disciplinary methods, disciplines and technologies, so to speak generalised operational techniques in order to get a more formal or abstract or methodological perspective we will discuss below. This is even true for the humanities in the narrow sense. It is quite obvious that in the last decades the techniques of information processing, electronic data retrieval and processing as well as other information techniques have penetrated also the humanities. We deal here generally with information or, to be more precise, interpreted informations as well as processes and results of interpretations. Using a rather technical methodological term, I like to talk of ‘interpretation constructs’ (see for example [1]) or even by the referring to rather artificial ‘objects’ by calling them ‘interpretata’ or even ‘schematisata’, i.e. the results of schematisations or interpretation processes (qua the activation of schemes) amounting to be a rather ‘higher order raw’, if not ‘fine material’ of the sciences and humanities as well as the respective information processing disciplines.
During the last century information and the means and possibilities of processing, transmitting and designing as well as manipulating it have been systematically technologised. Already in 1970 I talked of the information processing becoming comprehensively technicalised and systematised, thereby leading to what I called an information and systems technological age. This is true certainly for the automation of productions and the embedding of systems in operative networks and intersystematic environments as well as for systemic operational processes and systems control generally speaking. We could only then – all the more today! – diagnose a general tendency towards and an approved turn to systems technology. This is certainly true for the representation of realisations and materialisations as well as the symbolisation in information disciplines, information systems, etc. Here we see ever-extending information networks, systems of interconnections embedded in other systems like a Russian doll gaining more and more relevance across traditional disciplinary perspectives. Using computers is of course a main feature in any area of scientific presentation and systematisation, but also in production and operations research and control as well as in administration and social organisation. All these trends are aspects of a rather comprehensive information and systems rationalisation in the highly industrialised societies, which can be dubbed now systems technological societies in the information and systems technological age. These information and systems technologies characteristically cross, overlap, or reach beyond traditional disciplinary borders and limits not only intersecting, but interconnecting and overriding traditional separations between areas and disciplines amounting to a new interdisciplinary frontier of information technological and to systems expanding processes, phenomena and transdisciplinary interactions and interconnections of whatever sort. One may talk of a systems technological or systems technogenic interdisciplinarity. The sharp separations between and by disciplines is not anymore to be upheld, if not just for operative, methodological or methodical reasons. This certainly leads to respective challenges on the side of scientific methodologists on the one hand, but also of social scientists, social philosophers, and moral philosophers on the other. We all know the problems resulting from the handling of documentation systems,
the retrievability of data, the almost unlimited possibility of combining data with respect to data protection problems, respective legislations, etc. Some even fear that we are on the brink of or already living in a computerocracy — being the fate and development of mass societies which cannot be stopped anymore or scarcely be legally checked. This is certainly true since the last one and a half decades with respect to the world wide information systems like the Internet, World Wide Web, and other means of data retrieval and access leading to hardly solvable questions of moral responsibility for the data stored or manipulated which cannot be allocated or assigned to a respective one and only bearer of the responsibility anymore. It seems that human responsibility for consequences and developments in comprehensively interconnected and complex information systems can neither ethically nor legally be borne by a personal individual any longer nor by a rather vague and almost unlimited set of agents whether individual or group-sized. These questions are at the moment beyond any possible idea of a solution, how an operationalisable, practically applicable, ethics or legislation and executive jurisprudence regarding the world wide information systems will look like.

In a sense, we are of course responsible for abiding by what I call a ‘concrete’ or ‘practical humanity’ [4], and the respecting of that idea in the worldwide communicating and trafficking with information and in our typically rather remote indirect contacts with partners and addresses of our actions and their far reaching consequences. Questions of the tradition and development of ‘concrete humaneness’ through moral philosophies and humanities are in charge, but that is not to be discussed here. To say the least, it cannot be the case that the problem areas and disciplines in these overriding fields of worldwide interconnections can be separated from each other. The most important problems of our society as well as life in general do not encounter in a pigeonhole-like separation of individual disciplines. In addition, disciplines cannot be operated rather independently of one another, but they all have to accept the interdisciplinary challenge generally outlined. This is also and all the more true for the humanities. The interconnections of systems in our systems technological age require the application and development of abstract procedures and generalisations as, but
II

PHILOSOPHY OF SCIENCE: METHODOLOGICAL ASPECTS

not only by, formal and functional perspectives of representation. Across disciplinary description and processing as well as practical action portfolios in handling objects, processes, systems and the respective interconnections between them this operational approach is growing evermore important. This can be called interdisciplinary in a true sense. It is now a necessity to go interdisciplinary and supradisciplinary if not even multidisciplinary. This can only be addressed in a rather general form by going methodological, formal and informational at the same time. This means that also a practice-oriented and reality-prone methodology has to be developed an epistemology which can take up these requirements and the interdisciplinary constitution and interconnection of the problem areas in order to consider all these phenomena in a proportional perspective.

It is true, that indeed tendencies of a sort of autonomy or independence of systems operations and systems are notably being in danger of developing a systems technocracy or computerocracy, which can only be counter balance by a cross-disciplinary delimitation, control and safety regulation as well as risk-minimisation reaching beyond any single-disciplinary one-sidedness. Therefore, we need, beyond the extant teamwork of different specialists and experts from different disciplinary schools and approaches, also so-called generalists developing and applying abstract methodologies, methodical and operational approaches which can be used in rather different areas. This is even true also for the so-called specialists for the universal, the universalists approaching the problems of societal aims and social values as well as the methodological and epistemological basics of the respective disciplines and their interrelationships.

This interdisciplinary constitution and the interconnection problems are confronted in the intersection area of many classical disciplines. These problems are only to be addressed across and beyond the single disciplines. There is a necessity to develop interdisciplinary and supradisciplinary approaches in practice and also from a higher level methodological perspective. Classical single disciplines are as a rule overcharged by the postdisciplinary phenomena, processes and problems of an inter-areal type. The multiplicity of disciplinary perspectives and the incompatibility of many judgements by the experts from a single
disciplinary perspective would typically lead towards important organisational and methodological problems going beyond the pigeon-hole separation of the respective disciplines. This is especially true for the traditional humanities with their once fashionable distinction between the alleged ‘two cultures’ of the ‘natural’ versus the Geisteswissenschaften, or historical disciplines. Therefore I shortly turn to these questions.

2. THE TRADITIONAL ‘TWO CULTURES’ PROBLEM

In the second part I would like to say something rather methodological regarding the development of the so-called humanities and historical sciences in difference but not by contrast to the natural sciences. During the 19th century there seemed to have opened up a total cleavage between the humanities understanding themselves as ‘the understanding disciplines’ (verstehende Wissenschaften) which provocatively thought themselves in a certain kind of contrast to the so-called explanatory sciences dealing with law explanation and a law-covering model comprehensively applied in the theoretical and systematical natural sciences.

To be sure, there are also descriptive natural and historical disciplines like traditional descriptive botany or biology and geography, but these are also under the grip of law-covering sciences, at least, since a century now.

The methods of the law-covering sciences were said to be totally different from those of the humanities. For instance, people said, that the humanities and the humanists (Geisteswissenschaftler) would only ‘understand’ (verstehen), but not ‘explain’ (erklären) something and that vice versa the natural scientists would only ‘explain’ but not all ‘understand’. Already this ironic contrast shows that this cannot be right, even if after a first glimpse of plausibility.

The separatism of the disciplines and methods culminated in this contrasting of Verstehen and Erklären and even led to a critical contrast rendering the so-called two-cultures separation and a respective thesis after C. P. Snow [5]. This two-cultures separation was enthusiastically hailed by the hardcore ideologues of both sides, although
Snow originally did not contrast the ‘natural sciences’ and the ‘humanities-bound’ culture, but the ‘natural scientific’ and the ‘literary intelligence’ — which is a rather different contrast indeed, however not a contradistinction of the kinds of sciences. This was notably overlooked in the debate. Indeed, it became current opinion that the intellectuals and especially the educated ones in literature would be hostile against the natural sciences. They were somehow considered reborn machine stormers. Inversely, these again would hold the natural scientists to a certain extent as cultural barbarians. The question of the border-crossing regarding the knowledge of the Second Principle of thermodynamics was, according to Lord Snow, rather coolly and disrespectfully received and answered by some representatives of the humanities and literature — like on the side of the natural scientists, the provocative question whether and how much they had read Shakespeare, respectively. Snow submitted merely illustrative examples from the Anglo-Saxon countries, but we can also find respective experiences on both sides in the continental debate.

Indeed, these are often repeated and modified, but mainly past contrasts and limitations, which have become much more flexible and dynamic during the last half century in the course of the mentioned developments and cross-disciplinary perspectives.

These separations were and are indeed too rough mostly because they accentuated this contrast from the beginning. But this dichotomy did not fit well even in the past. Mathematics, being a pure Geisteswissenschaft, or logics did not fit into this dichotomy anyhow. Linguistics and social sciences are neither pure natural sciences nor pure Geisteswissenschaften. A notorious example certainly is psychology always sitting between the different branches of a quasi naturalistic, experimental or behaviouristic branch, and humanistic and person-oriented branch, on the other hand. (At least, since the last half century particularly cognitive psychology was obviously sitting between these poles).

Some authors try to establish social sciences as a third (or even fourth or fifth) scientific culture in the sense — like Wolf Lepenies and Walther Zimmerli. True, there were always mixed discipline, special cases, phenomena in between the psychological branches leading to dif-

II
PHILOSOPHY OF SCIENCE: METHODOLOGICAL ASPECTS
ficulties for the universal polarity. In particular, there are and were also in the humanities special formal disciplines such as logics (even symbolic logic is a *Geisteswissenschaft*) or formal and theoretical linguistics, or subdisciplines like mathematical psychology and mathematical sociology. Conversely, also in the natural sciences we have historical disciplines like palaeontology, cosmology, biology, etc.

Consequently, the methodological separatism between ‘explanation’ and ‘understanding’ in the sense of disparate and separable if not even incompatible or not combinable procedures of different science cultures is obviously false, outmoded and ideological, a distortion or misrepresentation leading to a caricature of the relationship between the different sciences and disciplines. Do and did the natural scientists not understand anything or do or can the *Geisteswissenschaftler* not explain anything whatever?

The traditional ‘either-or’ has to be replaced by a proportional ‘as well as’ in a more differentiated and well analysed relationship between the two or three or four kinds of disciplines. Separatism leads to a sort of dogmatism, and any dogmatism whatever is an end of analysis with regard to the most interesting questions addressing the urgently required interdisciplinary ‘diplomatic relations’. Therefore we should not retreat to dogmatism.

Sometimes it is true that provocative and even polemical formulations may lead to a further development: for instance, neopositivism has certainly contributed to the quality and philosophy of science in an important sense meeting the requirements of the first half of the last century being heuristically and motivational very fruitful for the development. But these stances remain sterile, when the dogmatic hardening by the representatives on both sides and the unfruitful self-limitation or self-restraint with its thinking within fences and blinders. It is much better in the sciences and in the surrounding disciplines even in everyday knowledge to proportionately acknowledge elements and moments of both methodological traditions and to develop the rather fruitful interconnections and mutual relationships, even the cross-disciplinary aspects and the crossing of dogmatic limits. This was certainly known by the greatest theoreticians of the methodology of the humanities and social sciences — like e.g. Max Weber.
3. TYPES OF INTERDISCIPLINARITY

There are a series of examples from new research areas being \textit{ex ante} in a certain sense interdisciplinary – like, e.g., environmental research or science of science – not to mention again the two branches of psychology. Peter Weingart has called science of science a ‘multidisciplinary aggregate science’. The research areas of this discipline are history of science, sociology of science, economy of science, psychology of science, organisation theory of science, methodology of planning, parts of political science and, of course, philosophy of science (\textit{Wissenschaftstheorie}, including scientific methodology and also different philosophical approaches like social philosophy) dealing with a lot of values and ideas or a methodology which the scientists of science would entertain. As yet there seems to be obviously no direct possibility to develop a truly interdisciplinary theory, therefore the term ‘aggregate science’.

How is it possible to differentiate various disciplines and types of disciplinarity and interdisciplinarity from one another?

The disciplines are traditionally distinguished with respect to the following criteria or markers:
- objects and fields or areas;
- methods and arsenals of methods;
- ‘interests of knowledge’ (\textit{Erkenntnisinteressen}, after J. Habermas);
- theories and their systematic interconnections and networks;
- ‘theories and their historical interconnections and developments’ (according to A. Krüger);
- substantiality vs. operationality vs. formality of theories, respectively [6];
- system holism vs. specificity of domains;
- \textit{a priori} or analytic formality of methods vs. empiricism;
- explanatory and systematising patterns (e.g. descriptive vs. explanatory, historical vs. systematising);
- cognitivity and normativity (descriptive vs. normative disciplines);
- fictionality (virtual realities, ‘cyber worlds’, e.g., the so-called second life) and secondary reality (social validity or \textit{Geltung}) vs. primary reality (see the concept of ‘impregnation’, below).
Very important in my mind is the difference between substantial and operative theories [6] where the latter ones concern procedures, operations, programming, and model-making. Substantive theories would be, e.g., gravitation theories after Newton or Einstein. Operative theories would be, for instance, information theory, mathematical game theory, or general formal procedures and analytic instruments which can be applied in very different sciences. Information-technological and information-theoretical approaches are obviously operative theories and very sensibly applied in interdisciplinary research. Formal theories are, of course, those which elaborate formal ideal-language concepts like mathematical theories, e.g., and the new developments as fractal geometry and chaos theory.

An important differentiation is also the fashionable but usually rather dogmatised polarity between patterns of explanation and other systematising or theoretically generalising theories, on the one side, as against rather descriptive historical approaches of the so-called understanding (verstehende) disciplines, on the other. As was mentioned already there should not be a dichotomy of contrasting these approaches in a total and exclusive sense but rather a differentiating combination and approach of dealing with both of them, as the respective research areas may require like, e.g., the descriptive disciplines like palaeoanthropology, descriptive geography on the side of the natural sciences or linguistic theories and semi-lattices in the formal theories of linguistic.

A rather important distinction, appearing to be much more than an absolute or total distinction between different sorts of disciplines, is the distinction between cognitive and normative ones. Cognitive descriptive disciplines are certainly the only ones in the natural sciences proper, whereas, e.g., jurisprudence has to be largely taken as a normative discipline, although there are descriptive and cognitive parts and derivations as well as knowledge perspectives that are also important here leading to what can be called nowadays a supplementation of jurisprudence by some modern sciences like sociology, neuroscience and, traditionally, psychology and even criminology as auxiliary disciplines. (These auxiliary disciplines being in a much more important stance nowadays within the legal disciplines in general.)
II
PHILOSOPHY OF SCIENCE: METHODOLOGICAL ASPECTS

An important difference seems also to be the distinction between real and material objects vs. fictional or soci(et)al objects which are by definition produced by human ruling, or linguistic or language structuring, and categorising of a social provenance.

All these perspectives — particularly those explicitly mentioned as important — lead to different types of interdisciplinarity which are listed in the Table 1 below.

Indeed, these ten different possibilities and aspects or types of interdisciplinarity are useful, because for example pure ‘gathering disciplines’, loosely covering a practical field of research in a complex interaction of different scientific approaches just bound together by practical requirements, are quite another thing than an exact interdiscipline like physical chemistry, or like mathematical operation theory such as mathematical game theory. Here, we have to take into consideration clear methodological distinctions and differentiations.

For all these aspects, however, it is necessary that the scientists are required to have a certain kind of secondary competence in the neigh-

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<th>Types of interdisciplinarity</th>
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<tr>
<td>1. Interdisciplinary cooperation in and between projects</td>
<td>The simple interconnections of projects in interdisciplinary research cooperation are certainly the most important sort of interdisciplinary teamwork of experts of different orientations (for instance, in city planning or any environmental research dealing with natural, and human-made and manipulated systems). This is, however, a rather short-lived not systematic, or systematically, or theoretically interconnected cooperation or aggregation of experts' work and contributions according to the respective planning or development programme.</td>
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<tr>
<td>2. Bi-disciplinary or interdisciplinary research field</td>
<td>There are bi-disciplinary aggregations or cooperative network within a research project, obtaining between two disciplines, e.g., between architecture and sociology in city-planning.</td>
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<tr>
<td>3. Multidisciplinary aggregate(iv)e science</td>
<td>More generally, a respective multi-disciplinary cooperative network of projects within a whole field, as, e.g., in environmental research which seems to have become by now a kind of 'gathering' discipline between different contributing disciplines.</td>
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<tr>
<td>Types of interdisciplinarity</td>
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<tr>
<td>(Genuine) bi- or interdiscipline</td>
<td>This might be a bordering case towards what P. Weingart calls ‘multi-disciplinary aggregate science’ (his example is science of science).</td>
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<tr>
<td>Multidiscipline (with multidisciplinary theoretical integration)</td>
<td>From such an aggregative cooperation is certainly to be distinguished a genuine specific interdiscipline as, e.g., molecular biology, or biochemistry, or even more traditionally physical chemistry.</td>
</tr>
<tr>
<td>Generalised interdisciplinary systems theories (general systems theory)</td>
<td>There are the generalised interdisciplinary disciplines of a formal or model-based character as for instance generalised systems theory, mostly known as “General Systems Theory” (after L. Bertalanffy).</td>
</tr>
<tr>
<td>Mathematical theories of abstract and complex dynamical systems</td>
<td>The purely formal and abstract mathematical theories of complex dynamic systems of the reality are notably involved nowadays in progressive developments in dealing with systems of deterministic chaos or fractal geometry within these approaches.</td>
</tr>
<tr>
<td>Supradisciplinary applied structural and operations disciplines (e.g., operations research)</td>
<td>Supradisciplinary applied structural and operations disciplines as those found in economics in the form of the so-called operations research are pretty old. (However, there are also new ones like the before-mentioned chaos theory if applied.)</td>
</tr>
<tr>
<td>Methodological-metatheoretic supradisciplines</td>
<td>There are methodological and metatheoretical supradisciplines of a higher level like traditional philosophy of science or also a higher-level approach to science research (Wissenschaftsforschung, or science of science) on a more conceptual basis.</td>
</tr>
<tr>
<td>Philosophical, epistemological and methodological metadiscipline</td>
<td>Finally we have to mention and probably first of all to develop the philosophical and methodological metatheoretical field of debates of the respective systems connections and the whole set of the disciplines, and to charge under a specific holistic or higher level-methodological perspective as for instance offered by methodological interpretationism or scheme-constructionism (to be discussed in the next section).</td>
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\[\text{a \ There are not as yet stochastic or probabilistic chaos theories or models beside some sketchy applications and economic approaches to a chaos-theoretical interpretation of social sciences and humanities which would be indeed rather probabilistic instead of the extant deterministic ones.}\]
bouring respective science or discipline. Lastly, it is obvious that the
philosopher of science, who wants to deal systematically with methodi-
cal and methodological problems of biology, should be somehow up to
date in biology proper. He or she need not be a productive researcher
in biology, but he or she should be able to evaluate the present state-
of-the-art. Secondary competence would also be required then for study
programmes in philosophy of science and notably in doctoral pro-
grammes. Such an education of plural or many-sided competences
would mean to delve into different or diverse sciences involved in
which is possible for an individual only in a very limited measure.
Again, the development of the more general systems competences as
mentioned — especially of those abstract and formal methods of the
generalists and even the capabilities of the universalists beyond these
specific disciplinary orientations — is and are necessary conditions for
being able to do research, analyse and discuss overriding problems of
values and norm systems, etc. The relatively best solution conceivable
is of course not the one springing from the encyclopedic brain of the
universalists, but mostly a cooperative production and cooperation
within and by teamwork of scientists from different provenances.

Heckhausen said that research in the humanities in any case is essen-
tially interdisciplinary oriented, because everything is historicised and
one has in the last analysis always but different text bases yet that the
research method would be rather uniformly the same [7, p. 135]. I think
that this is not true anymore today. However, it is true that the stronger
contacts, historical traditions, etc. are involved in the approaches to be
taken the more frequently this aspect of the contributions of different
disciplines will become relevant. In the humanities and social sciences
there is today a requirement of an especially high interdisciplinary chal-
lenge and qualification, be it in research or education.

It seems necessary to draw some short theoretical consequences
from the sketched problem situation. I would like to do this by cri-
tically reviewing the implications for social and human sciences under
the perspective regarding the traditional separatism of methods
between natural sciences and humanities and our social sciences. I
mentioned already that Charles Snow did not mean the human ‘sci-
ence-culture’ but as mentioned he talked about a ‘culture of litera-
ture’ and a respective mentality of the intellectuals versus the ‘culture of the natural scientists’. He did not in fact criticise the contradistinction or contrast between kinds of sciences, but a contrast between more general activities of intellectual provenance. This is another contrast which is not incompatible with an overriding methodological viewpoint, say, from a higher level meta-theoretical approach of methodological provenance which might be relevant of most of the sciences and their theoretical schematisations as well as on this abstract level also for some systematisations as they are also to be found in the social sciences and even in the humanities of historical categorisations.

Indeed, the traditional dichotomies are not only misunderstood but also too rough and superficial to be possibly refined in order to give an adequate image of what goes on in the different landscapes of scientific disciplines and their interdisciplinary relationships.

It is true, that at least the ‘third culture’ (according to Lepenies), namely social science, has to be supposed to (have) overcome the mentioned polarity. Indeed there are additional mixed disciplines and many other sorts of interdisciplinary areas and methods on diverse levels as mentioned before so that even some formal and operational sciences (like mathematics, or logics, or game theory, chaos theory, etc.) have to be identified as special types of interdisciplinary approaches as done before in our list of the types of interdisciplinarity. The same is true for descriptive and historical disciplines as well as linguistic research areas between the perspective traditional borderlines of the natural sciences and, say, the linguistic disciplines. For instance, in the history of the development of language in the evolution of the primates and australopithecines we would find an example of such a mixture of different approaches from very diverse school and faculties. The traditional separatism has to be rejected. It is, methodologically speaking, false and also not only outdated by practice, but also rather skewed by ideological lenience.

This is also true I think for the traditional distinction between ‘understanding’ (Verstehen) and ‘explaining’ (Erklären). Who would say that natural scientists only explain but don’t understand anything – or the other way around that humanities would only ‘understand’ but ‘explain’ nothing? This is senseless. Instead, it is possible to go beyond this
II

PHILOSOPHY OF SCIENCE: METHODOLOGICAL ASPECTS

dichotomisation by entering on or ascending to a higher meta-level. It
is time to bridge these cleavages and allegedly absolute distinctions and
differentiations between the different methodologies in order to come to
a certain kind of basic, if higher-level union.

The general perspective of a constructive theory of scheme inter-
pretations, and scheme activations, and scheme constructions to be
sketched in the following passage seems to be a way out which prom-
ises to be conducive to gaining a certain kind of overriding method-
ological and rather abstract unity within a problem field of interdis-
ципinary perspectives and approaches.

4. TOWARDS A SYSTEMATIC
SCHEME-INTERPRETATIONISM

Any sort of cognition, perception and action is necessarily shaped by
(re)activation of ‘schemata’. Any interpretation is schema
(re)activation. Schemata are epistemologically speaking ‘structural’
activation patterns which can be, psychologically and neurologically
speaking, accommodated, adapted, ‘learned’ by (co- and re)activating
neuronal assemblies.

Indeed, in our cognition of any kind we are obliged to use frames,
forms, shapes and constructs as well as schemata or schemes. This is
true for all sorts of grasping something, may this be by a process of
recognition and categorisation or of normative structuring or planned
acting. Applications of forms and frames are schematisations or schema
interpretations as I would like to call these interpre(ta)tive constructs
and their activation in order to distinguish them from the usual text
interpretation in the hermeneutical sense. Schemata might be used con-
sciously or activated subconsciously. Any kind of interpretation what-
soever is connected with or bound to an activation of such schemata.
This connection might be characterised by core features and core sti-
muli the selection of which is necessary, even though some of these are
conducted subconsciously. Even here, on the subconscious level, cogni-
tive quasi-constructs are used to render the profiles of contrast and the
structural differentiation by activating the functions of the respective
sense organs or their processing units of perception and cognition in the
brain as well as the integrating poly-modal and combining yet hypothetical centres. They are partly due to hereditary and evolutionary development, partly developed by early ontogenetic interaction with the world, partly learned by experience and instruction.

Generally speaking, I call these abstract constructs of frame character schemata or schemes. Schemata are developed and applied on different representational levels in order to integrate individual experiences, single activities and sense data or stimulations into a more general frame, pattern or similarity structure. Any recognising and generalising, particular conceptual knowledge is thus bound to cognitive schemata which can be understood as more or less abstract constructs which are projected onto and into the seemingly direct sense perception and the respective experiences by recognising Gestalten or constituting objects, processes, events, etc. Any seeing and recognising shapes and forms are dependent on and guided by schemata. Any cognition whatsoever is thus schematic. This is true not only for recognition, but also for actions, i.e. not only for rather passive sorts of ‘grasping’, but also for rather active kinds.

It was Kant who developed in his Critique of Pure Reason (CPR) the concept of schema for epistemology by conducting within quasi operational procedures of instantiating as well as developing schemata of a connection between sense reception, on one hand, and conceptual recognition, on the other [8]. Kant defined a schema as (the author’s translation) “product of the power of imagination (Einbildungskraft), which is not attending to individual images or imaginations, but towards the ‘unity’ of sensations and intuitions (Anschauungen) and the determination of sensuality… which is rather the imagination of a method to imagine according to a certain concept in an image than the image itself… Now, this imagination (Vorstellung) of a general procedure of the power of imagination to render an image for a concept, I call the schema connected with this concept” [8, p. 179–180].

Kant related the concept of schema as a concept of such an operation of the sensual and conceptual shaping and framing not just to sense perception like the sensing and seeing of figures in visual space, but also to the imaginative substantiation of the ‘pure concepts of reason’ (categories). The respective abstract — ‘transcendental’ — schema is
“but the pure synthesis, according to a rule of the unity following concepts in general (category)... In fact, at the foundation of our pure sensual concepts there are not pictures of the objects, but schemata” [8, p. 181]. He termed the procedure, to render to the categories their ‘image’ or mental image, a transcendental schema and calls the respective mechanism of coordination transcendental schematism.

However, Kant applied this procedure of coordination and therefore also the concept of schema also to ‘imaginative’ and mental representation of any objects of experience whatsoever, i.e. of their images: “The image is a product of the empirical capacity of the productive power of imagination, the schema of sensual concepts (being of the figures in space) is a product and so to say a monogram of the pure power of imagination a priori, by which and according to which the images are rendered possible at all, which however have always to be connected with the concept only by using the schema which they designate and with which they per se are not totally congruent” [8, p. 181].

Kant anticipated the process of developing and establishing as well as applying cognitive constructs for the imaginative realisation, visualisation of mental configurations and models, i.e. of cognitions. Cognitive psychology has only since few decades in the wake of theories and concepts of Gestalt psychology rediscovered this concept of schemata as ‘imaginative’ cognitive constructs [9]. Schemata or schemes are called by Rumelhart ‘the building blocks of cognition’. Psychology discovered that not only visual conception and sense perception general, but also conceptual and common sense or naive theoretical cognition operated in terms of the developing and applying schemata, i.e., any cognitions, interpretations, knowledge whatsoever were bound to the application, selection, and activation as well as checking of schemata [10; 11]. The process of interpretation is basically to be seen in or even as the selection and activation of possible configurations of schemata which are verified under the perspective whether or not they are congruent with thought data-fragments of memory. Beyond that, this process is an active process of searching for and structuring information.

In general, we use mental representations of frames or data features or contents which are typified, generically distinguished, and concentrated to relevant features which are retrievable from memory.
One may well ask whether or not the expressions and concepts of ‘structure’, ‘construct’, and similar concepts like ‘strategy’, ‘script’ (after Schank-Abelson [12]), ‘frames’ (after Minsky and Goffman [13]), ‘configuration’, ‘conceptual schema’, etc. are essentially referring to the same concept, namely schema. There is no explicit, really non-circular definition of schema; therefore Rumelhart concentrates on developing a schema theory which proceeds by giving essential features within hypotheses and thereby an implicit or functional or ‘operational’ definition of the functional concept of schema.

Rumelhart compares the concept, role, activation, and function of a schema with similar concepts of structured activities: for example, schemata are like theatre staging: the instantiation or activation of a schema is like the staging of a drama, the internal structure of the schema referring to the script or plot. Similarly, schemata can be compared with theories, computer programmes, parsing analyses in linguistics, etc. In all these cases we have procedures and functional shaping of reconstructions which comprise variations, checks, ramifications, and extensions as well as a judgement about fitting or falsification, substitution or modification of a construct by another one. It is characteristic that schemata are connected with other schemata and subschemes in a certain hierarchical architecture, and that schemata have variables connected with different aspects of the environment and the diverse instantiations of the schema. For instance, the schema BUYING admits of the functional roles and schemata of BUYER and SELLER as well as the media MONEY and GOODS as well as the subschema BARGAINING. The instantiation of such a schema may indeed be considered as an analogue of the staging of a drama whereas however the concretisation and instantiation of the variables allow for greater flexibility and openness than interpretation by the actor or director.

Schemata however are more abstract and general than a drama or its plot and script. Schemata may be applied to things, objects, shapes, and events as well as any spatial, static, or functional relationships and constellations.

It is important to notice that schemata consist of subschemes. The activation of a subschema is usually immediately related with the activation of the schema itself and the other way around. The comparison
of schemata with programmes, networks, etc. is certainly fruitful and can be visualised in flow charts and related structural means admitting of state and point identification of the constituents and the ramifications of such structures. The encompassing set of the schemata we use to interpret our world would represent and comprise in a sense our ‘private theory’ [9] of the nature of reality. Schemata represent or mirror so to speak our internal models of the respective situations in the world. Methodologically speaking, (schema) interpretation is but the (re)activation of schemata. It is true that according to modern cognitive psychology the interpretative structuring of sense perception of the comprehension of texts, as well as memorising and the solution of problems, is essentially dependent on the selection, (re)activation, and instantiation of schemata. Not just the interpretation of a situation, but also active information seeking as well as the integration into contexts and the development of strategies for problem solving will follow the lead of partly concept-guided, partly data-guided application of schemata. The mutual activation of schemata and subschemata is essential. In general, the concept of schema or cognitive construct or even interpretational construct is a rather fruitful instrument for developing a cognitive psychological theory, but beyond that also for a new methodological epistemology. Cognitive constructs, schemata and interpretational constructs are really ‘the building blocks of cognition’ (according to Rumelhart) and of any mental representation or information manipulation.

As Kant had already recognised, the dynamical and structural as well as functional visualisation of abstract constructs is schema-dependent and this is not only true for empirical procedures of grasping, i.e. cognition and action, but also for methodological constructs. One may develop a sort of non-foundational transcendental philosophy of the fundamental conditions of any development, application, and stabilisation of any procedures of structuring by any kind of representation, be it by frames, concepts, orders, unifications, configurations, etc. Interpretation is indeed the development, stabilisation, and activation (application) of mentally representing constructs or schemata. Interpretation (in a wide sense) is basically scheme-interpretation and founded on this as well as grounded in schema activation. Therefore,
I talk of *schema*- or *scheme-interpretation*. We can even conceive of a basic axiom or principle of methodological (scheme-)interpretationism stating that all kinds of grasping, cognition, and action are interpretation dependent, i.e. founded on the activation of schemata. This is true far beyond psychological theories and epistemological perspectives, but rather a totally general methodological comprehensive approach comprising the philosophy of knowledge (traditionally called epistemology) as well as philosophy of action and representation. We can call this approach a methodological and transcendental construct or scheme-interpretationism overarching even the modern split between natural and social sciences as well the humanities, since all these disciplines would structure their fields and objects according to the activation of schemata by using procedures of establishing, stabilising, and activating schemata as cognitive constructs in order to structure the respective world versions and sets of objects or events, structures, procedures as well as projections.

It is interesting that schema interpretation admits of levels of categorisation, as well as according to the variability of the respective schemata, i.e. whether or not they are hereditarily fixed or conventionalised or flexible, whether they are subconsciously developed and activated or consciously conceived and used. I developed a hierarchy of levels of interpretation consisting of six different levels or planes of interpretation, shown in the Table 2.

The philosophy of schema interpretation is a philosophy of interpretative constructs as an epistemological model which admits of a certain kind of meta-theoretical and meta-semantical self-application in the form of a sort of ‘meta-interpretation’. This is certainly an asset and epistemological advantage compared to a few other epistemological approaches including critical rationalism after K. Popper, a theory which does not admit and conceive of the precise conditions of being falsified itself. The human being is indeed the ‘meta-interpreting being’ (see e.g. [14]), capable of ascending to ever higher meta-levels of (scheme-)interpretation.

To be sure, in our cognition, even in all actions and behaviour of any kind we are indeed obliged to follow or use patterns, structures, frames, forms, shapes, scripts, and constructs as well as schemata or
II
PHILOSOPHY OF SCIENCE: METHODOLOGICAL ASPECTS

**TABLE 2. Levels of interpretation**

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<th>Levels of Interpretation</th>
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<td><strong>IS1:</strong> practically unchangeable productive primary interpretation ('Ur-interpretation') – primary constitution or schematisation, respectively</td>
<td>IS1 comprises the practically unchangeable productive primary interpretations of primary constitution which might be represented by subconscious schema instantiation. They comprise the hereditarily fixed or genetically founded activation of selective schemata of sense perception (e.g., contrasts of dark and light, etc.) as well as the interactive, selective activations of early ontogenetic developments like the stages of developmental psychology discussed by Piaget. Also comprised are the biologically hardwired primary theories which we cannot alter at will, but which we can (only) problematise in principle. For instance, we have no magnetic sense or capacity to trace ultrasound like the bats. But we can conceive of conditions in which we could have these senses or at least devise technological means for substituting these.</td>
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<td><strong>IS2:</strong> habit-shaping, (equal) forms-constituting pattern interpretation (ontogenetically habitual(ised) form and schema categor(ali)sation and preverbal concept-formation)</td>
<td>On level IS2 we have the habitual, quality forming frame interpretations and schema categorisations as well as 'categorialisations' that are abstracted from pre-linguistic discriminatory activities, experiences of equality of shape, similarity of presentation and experience, etc. Establishment and discriminatory capacity of pre-linguistic conceptualisation and development of concepts about language is to be formed on this level.</td>
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<tr>
<td><strong>IS3:</strong> conventional concept formation transmitted by social, cultural and norm-regulated tradition</td>
<td>On level IS3 we have conventional concept formation, namely socially and cultural traditional conventions and norms for representation and forms of discriminatory activities like the explicit conceptualisation of framing the world according to natural kinds, etc.</td>
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<td><strong>IS3a:</strong> ... by non-verbal cultural gestures, rules, norms, forms, conventions, implicit communicative symbols</td>
<td>In so far as this is not related already to language differentiation we can think of a sublevel (IS3a) on which pre-linguistic convention(ali)sations are characteristic.</td>
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<td><strong>IS3b:</strong> ... by verbal forms and explicitly representing communicative symbols, metasymbols, metaschemata, etc.</td>
<td>On the other hand (IS3b) we have the explicitly linguistic conventionalisation or the differentiation of concepts by means of language.</td>
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## Levels of Interpretation

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<td>IS4: applied, consciously shaped and accepted as well as transmitted classificatory interpretation (classification, subsumption, description by 'sortal', generic formation of kinds, directed concept-formation)</td>
<td>Level IS4 would comprise the consciously formed interpretations of embedding and subsuming as well as classifying and describing according to generic terms, kinds, etc. It is the level of ordered concept formation and classification as well as ordering and subsumption.</td>
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<tr>
<td>IS5: explanatory and in the narrow sense 'comprehending' (verstehende), justifying, theoretically or argumentatively substantiating interpretation, justificatory interpretation</td>
<td>Level IS5 would go beyond that by rendering explanatory, or in the narrower sense comprehending (Verstehen) interpretations as well as justifying a theoretically argumentative interpretations in a sense of looking for reasons and grounds of justification.</td>
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<tr>
<td>IS6: epistemological (methodological) metainterpretation (plus meta-meta-interpretation, etc.) of methods, results, instruments, conception of establishing and analysing interpretative constructs themselves</td>
<td>Beyond all that, however, we have also a level (IS6) of the epistemological and philosophical as well as methodological interpretations of a meta-character, overarching and integrating the procedures of theory building and theory interpretation, methodology and the models of interpretation in the sense of methodological scheme-interpretationism itself. One could call this a metalevel of interpretation and explicitly speak of epistemological meta-interpretations. However, this level is cumulative and can be considered as being open towards further meta-levels. The model and approach of epistemological interpretationism is itself certainly an interpretative one and can be described and developed only on a certain respective metalevel which is to be seen within the level IS6. Therefore, we have the possibility of a self-application of the interpretational method to interpretative procedures itself.</td>
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schemes. This holds true for all sorts of grasping any objects, whether concrete or abstract ones, maybe by recognition and categorisation or by normative interpretation or planned acting. Applications of schemes are schematisations or schema interpretations as I would like to label
Interestingly enough, modern neuroscience is on the brink of giving a naturalised theory of schema development, schema activation and stabilisation as well as schema reactivation. Brain researchers think of the brain as an ‘interpretative system’ [15, p. 120; 16] or of ‘brain constructs’ (Hirnkonstruk) [17] which are based on the establishment and development of plastic (i.e. flexible though relatively stabilised) neuronal assemblies [18; 19]. The forming and the establishment of neuronal assemblies is hypothesised as being a building-up and stabilisation of the frequency of oscillatory reactions of different overlapping co-varying and co-oscillating neuronal entities and the neuronal assemblies or networks which are activated simultaneously and selectively on adapting to a certain rhythmic ground oscillation of 40 Hertz and a respective process of synchronisation of these oscillations which are starting to oscillate in common phase. Such a theory of the synchronicity of building up and dynamically stabilising a certain kind of oscillation pattern and initiated impulses in the physical sense seems to be a potential explanation for the recognition of patterns, representations of forms and recognition of mental states of activities as well as mental imaginations and retrievals from memory. Therefore, we have special grounds to hypothesise about the neural biological and neurophysiological foundations of the schematisation processes and establishment of constructs within the brain and in interaction with the external environment of stimuli and representational ‘encodings’ as well as ‘active’ interaction and intervention with it. This can also be related to the development of neurons and perceptual as well as cognitive capacities in developmental psychology and physiology, cognitive science and neuroscience and may potentially render a naturalised basis of the processes of formation of knowledge, perception and cognition in general. I don’t think that all semantical programmes of meaning and epistemological problems of intentionality can be naturalised in the strict sense. We are not yet able fully to straddle the ‘semantic lacuna’ – even not in teleological-functional approaches like Millikan’s well elaborated one [20].
and even biochemical sublevels, mainly in the neo-cortex, but also beyond or ‘below’ that in overarching reaction, behaviour and action systems or by the ways of subcortical centres as, e. g., the limbic system. Schemes can be analysed from an epistemological point of view taking a broader take-off than in Kant’s approach; more generally they may be modelled as methodological constructs.

Again, whenever we try to compose phenomena and the results of categorising them under generic and generalising perspectives, e. g. by using general or abstract representations, if ever equalities of form or shape and similarities as well as analogues of all these are at stake, we use more or less general concepts like those of kinds, natural or conventional ones. Whenever we try to identify, retrieve, recognise shapes transcending a particular phenomenon ‘within’ the so-called qualitatively given, we would necessarily rely on the activation of such schemes. Each particular conceptual knowledge, any recognising and generalising process is based on or at least bound to cognitive schemes which can be conceived of as a sort of abstract constructs (interpretative constructs) which are developed or designed and then projected by us into representations and actions as well as, if mostly subconsciously, into the apparently direct sense perception and the respective experiences by recognising seemingly organised patterns, shapes (Gestalten) or in the process of constituting objects, processes, events and so on. Any activity of seeing or recognising shapes and forms is dependent on and guided by figurative schemes. Any cognition is therefore schematic. This holds true not only for cognition and recognising knowledge, but also for actions, including kinds of grasping objects.

5. INTERPRETATION AND HERMENEUTICS

What I said about schematisation, constituting and even construing in the narrow sense can also be extended beyond linguistic and hermeneutical approaches, as we have seen in connection with the structuring and schematisation of grasping of all kinds. It means that you can even expand Wittgenstein’s model of ‘language games’ towards schema games [21] beyond the limits of the verbal and pure-
II

PHILOSOPHY OF SCIENCE: METHODOLOGICAL ASPECTS

ly linguistic. This is easily also gained by insights of the new neuro-
sciences [22].

You may even, following Kant with his famous slogan “Thoughts
without content are vacant, intuitions without concepts are blind”\(^3\),
formulate a similar variation of that: Scheme-interpretations without
activation, without interactions and even interventions are vacant and
interactions as well as interventions without scheme-interpretations
are blind [4]. Interpretation notably in the form of scheme-interpre-
tation is almost always dependent on interaction and intervention and
vice versa. All this amounts to a new collusion or collaboration
between the traditional methodological perspectives of action theory
and epistemology. I think that here might be also a bridge between
the scientific approach of structuring by theories and concepts and
everyday knowledge and structured actions, though at the price of a
more abstract analysis and by descending to a higher metalevel. This
is true also for the bridging between different sciences, e.g., the
natural sciences and the social and human disciplines, in particular of
the truly hermeneutical humanities. Methodologically speaking, there
is a unity or at most connection between the forms of knowledge if
analysed on a higher metalevel which nevertheless allows some par-
tial methodological differentiation or even separation between the dis-
ciplines to be bridged. (As we saw, methodological separatism is too
superficial.)

The approach of schema-interpretation is a rather general, abstract
but it is a pragmatic and comprehensively applicable interdisciplinary
methodological, even meta-methodological approach which overarches
the conception and building of theories, concepts, and hypotheses of
most diverse disciplines.

Certainly there are differences and incompatibilities below the
abstract higher level unity or methodological parallelism. This is not
to be denied. For instance, the humanities would frequently concen-
trate on objects, which are at least in part produced by interpretation,
i.e., fictive or virtual objects and fictionalised ones – like also the
social sciences in dealing with human-made institutions, social struc-

\(^3\) Originally: “Gedanken ohne Inhalt sind leer, Anschauungen ohne Begriffe sind blind” [8, p. 75].
Already by Chladenius in 1742, who conceived of knowledge according to the selection, distinction, and comparison and usually if not always from a point of view. He would even speak literary of a Sehepunkt \[24, p. 187\]. He also directly mentioned ‘perspectives’ indeed, in the humanities as well as in other disciplines relying on interpretation of whatever kind. A certain kind of perspectivism is necessary involving some kind of constructivist approach. Chladenius saw clearly \[24, p. 518\] that he would be obliged to have taken over this Sehepunkt in all interpretations under a perspective or constructivist approach and may itself be analysed by using models of a higher level. In so far you can say that scheme-interpretationism is a higher-level bridge between the allegedly separated ‘science cultures’ à la Snow as well as between cognition and action. It may resume and reinstall a higher-level unity between the different polarities. This seems to be the main message and may even be exemplified with regard to the history of hermeneutics and the respective humanities.

An overarching common point of view is indeed, that science is also always the work of humans consisting of human made concepts, theories, hypotheses, instruments, etc. (This is true, even in the light of the undeniable insight that scientific constructions are not just at will, but checked on a rigorous basis by experiments, etc.) The unity of the sciences is achieved on a higher methodological level of abstraction under this perspective of a scheme-interpretationist or interpretation-constructivist approach and may itself be analysed by using models of a higher level. In so far you can say that scheme-interpretationism is a higher-level bridge between the allegedly separated ‘science cultures’ à la Snow as well as between cognition and action. It may resume and reinstall a higher-level unity between the different polarities. This seems to be the main message and may even be exemplified with regard to the history of hermeneutics and the respective humanities.

Traditionally it is true that even in the history of hermeneutics a sort of perspectivism was emphasised\(^4\). This constructivist, poetic or object-forming constitutive function of language is already in some sense acknowledged by Schleiermacher; he already speaks of the ‘schematism’ (Schematismus) (again after Kant) and of a ‘communi-

\[^4\] Already by Chladenius in 1742, who conceived of knowledge according to the selection, distinction, and comparison and usually if not always from a point of view. He would even speak literary of a Sehepunkt \[24, p. 187\]. He also directly mentioned ‘perspectives’ indeed, in the humanities as well as in other disciplines relying on interpretation of whatever kind. A certain kind of perspectivism is necessary involving some kind of constructivist approach. Chladenius saw clearly \[24, p. 518\] that he would be obliged to have taken over this Sehepunkt in all interpretations under a perspective or constructivist approach, being a sort of interpretative activity, a kind of art so to speak. The same insight plays a decisive role also in Schleiermacher’s approach who would explicitly talk of a ‘creative synthesis’, a concept as an intellectual ‘schema’ (relying of course on Kant) by which a subject may relate towards an object and by which a thought may be represented as the result of a synthetic and symbolised achievement or result of an intellectual activity.
ty of thoughts and thinkers' (Denkgemeinschaft) [23] within a language community.

The constructive element is even more explicitly emphasised by W. Dilthey. Like Schleiermacher, he talks about the reconstructions in the processes of any ‘given talk’ in the formal rules taking up the remarkable quotation from Schleiermacher: “I do not understand anything except what I can construct and see as necessary” [23, p. 31] (a statement, by the way, already proposed by Vico and Hobbes before). Dilthey would expand this by saying: “Thus originates meaning (or sense), by determining the undetermined by the construction” [26, p. 220]. He is totally convinced that any constitution is constructive and that interpretation is a constructive activity of the acting subject. And he rightly criticises Kant to the effect that the latter had only seen categorisation as a problem of pure knowledge, i.e. of the application of the pure forms of the understanding (Kategorien). Instead, Dilthey thinks that one has also to add the rules and forms of action, rules and forms of lives relating to the fundamental constitution of orientation in the world. This is parallel exactly to the above-mentioned analytic and formal reunification of knowledge and action obtaining not only in modern philosophy since Pierce’s pragmatist approach and in the ideas of the late Husserl (Lebenswelt), but also of the later Wittgenstein in the form of his ‘life-forms’ (Lebensformen) and in some variants of pragmatic realism as well [27; 28]. Indeed, the central idea of the later Wittgenstein is that meanings are to be reduced or at least necessarily combined with us(ag)es of actions, patterns, i.e. rule-confirming sorts of schematised patternings — developments which might be captured by the concept of ‘pragmatising’ semiotics and semantics as well as ‘functionalising’

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5 Herder would criticise Kant for his not having taken into consideration that already primary (external) sense perception would really be ‘schematised’ [25]. Schematisation would not only occur in the capability of the understanding (Verstandesfähigkeit), but would be already meta-schematised (metschema-isiert) in the fact and object itself. Indeed these are analytic or ideal type differentiations of a methodological or epistemological kind, not time-bound successions in the form of phases as already Kant knew ("All knowledge would start with experience"). Unfortunately, the homunculus terminology that the ‘understanding’ would manipulate the sense materials seems to obfuscate these insights a bit.
and somehow ‘socialising’ meaning. It’s important to know that even
the function of relating towards objects or ‘grasping’ objects and
statements by understanding is basically not only constructive and
designative, schematising (in short, interpretative), but in many ways
also activating. Understanding thus also is a sort of disclosing or
unfolding constitution and reconstruction as, for instance, also
Gadamer exemplified by drawing on the example of the constitution
of the works of art or play by analysing these phenomena as the rea-
lication of a certain patterned activity under rules [29; 30].

6. FROM THE ‘TWO CULTURES’ TOWARDS A REUNIFICATION
ON INTERPRETATIVE METALEVELS

In general we have seen that the methodological approach of interpret-
atation constructs or the approach of methodological scheme-interpret-
tationism would offer an instrument or way to see interdisciplinary
relationships in the sciences and humanities as well as their conceptu-
al procedures by representing symbolic activity under a certain kind of
unified perspective, though on a higher metalevel, as a rather abstract,
formally unifying methodological activity of the sciences and humani-
ties under the overall approach of schematisations, scheme-interpre-
tations and (reality-bound) impregnations of knowledge and action. This
sort of a doubly supra- and interdisciplinary format is certainly high-
ly relevant for the humanities and their relationship to the social and
natural sciences.

At the beginning of this paper the problem of the ‘two cultures’ was
broached and the expository question for a possibility of bridging the
meanwhile outdated cleavage between the scientific an intellectual cul-
tures was brought up. It was answered from a higher-level methodo-
dological and meta-theoretical point of view.

However, a more drastic cleavage seems to be between the natu-
reral scientific and literary intelligence including scientific theory
building and complex computer based information technological
approaches on the one hand and everyday experiences and activities
using and being represented and formatted just everyday language
concepts on the other. The question is whether epistemology may have something to contribute to the bridging of this kind of follow-up ‘culture separation’. Some more subspecies might be resumed in the final section. By contrast to the first appearance of an absolute unbridgeability of the above-mentioned cultural cleavage between the natural, social and human sciences, we have seen, that philosophical concepts of natural and social sciences as well as epistemological insights lead us to the result that is a certain more abstract, higher level epistemological approach being capable of bridging the separation of the different disciplines, indeed on a higher level. The bridge is provided by the conception of constructive interpretation or scheme-interpretation and the respective interpretative and schematising activities of action and knowledge by symbols and internal representations patterned also by symbol-analogue functions and patterns. Knowledge and action are mediated by some sort of symbols or quasi symbolic representations as well in everyday activities as also in the sciences and humanities.

Cassirer’s insight that man would insert a ‘symbolic intermediate world’, ‘a symbolic universe’, between himself and the world [31]. Man being the symbolic animal is dependent on developing a ‘symbol system’ or ‘symbol net’ which only allows him now to have access to the world by knowledge and action and even by constituting a world of objects structured in a differentiated manner. Symbol application and symbolic representation are characteristic for the different ways of representing and acting on both sides of the cultural separation as well. Here we have an overarching point of view providing a vantage point for bridging the cleavage on a higher epistemological or methodological level, for all the central concepts of knowledge and action in everyday contexts as well as in the science and humanities are relying on constructing symbols, applying symbols and interpretation of these. They are based on interpretative schematising activities, on supplying schemata which are in part ‘given’ by evolution or so developed, which are in other parts conventional constructions by the traditional cultural or social institutionalisation or by language and socio-cultural schemes in the narrow sense. The development, diffe-
rentiation, and application of this patterning are understood as interpretation in the widest sense, i.e. as scheme-interpretation. (The traditional hermeneutical understanding of texts would, by differentiating contra-distinction, figure as a subcategory of a kind of scheme-interpretations by applying them to texts.) It is true that all sorts of representation and access to the world, to other subjects as well as to the situation of a person and human being in a Lebenswelt are deeply interpretative, structured by scheme-interpretations and in general unavoidably shaped by interpretations and impregnations in the above-mentioned sense. The basic principle of methodological scheme-interpretationism is that all knowledge, grasping and actions are impregnated or bound by scheme-interpretation and that we can only in a schematised manner grasp, conceive of, mean, order, and act in a differentiated way. This fundamental principle cannot be doubted at all. It is the kernel and basis of the methodological epistemology of scheme-interpretation and its respective theories. Even in neurophysiological terms this might be understood as the activation of neocortical and subcortical networks (neuronal assemblies) being a sort of biologically instantiated scheme of interpretation, namely the activation of neuron systems in different parts of the brain. Also here scheme-interpretation is working everywhere, as neuro-biological research has found out even, if not very much can be said at the moment about the processes of integration and syntheses on the higher meta-levels.

Beyond that central concepts of ‘symbolic grasping’, certainly themselves are part and parcel of this interpretative approach: Not only is the model of interpretative constructionism an epistemological construct of a higher level, but also the basic concepts of this methodology and its everyday arsenal of concepts like ‘meaning’, ‘information’ are in turn themselves interpretative constructs like all more general concepts of ‘structuring’ our world and even self-representation. Even the concepts of ‘self’, ‘world’, the distinction between subject and object, of knowledge and action, of form or structure and content are certainly epistemological and methodological concepts displaying an interpretative character.
II

PHILOSOPHY OF SCIENCE: METHODOLOGICAL ASPECTS

At first the present scheme-interpretation constructive approach was conceived as a methodological proposal. However, it can also be analysed in a quasi Kantian traditional epistemology as a Kantian transcendental interpretationism [1; 28]. Beyond that and even beyond Cassirer this approach has to be expanded towards anthropology of the meta-interpreting being [14, ch. 3]. Humans are not characterised specifically enough as the symbol applying and symbol interpreting beings (also primates can do that, though in a residual way!), but humans are distinguished by being able to interpret their interpretations again by interpretations on a higher level, to make cognitions, actions, and interpretations of the objects of a higher level interpretation or meta-interpretation for that. Humans may differentiate, distinguish, and interpret not only within this specific level or stratum of interpretations — say by conceptualising different classes of objects, properties, relations, etc. — but they may also ascend to higher levels of interpretations by making their interpretations as higher interpretations themselves of the object of even higher meta-level interpretations. This is an open overarching of strata and levels not to be finished at this or that specific overall general level, but open for indefinite ascension — though not in practice but in principle. The human being therefore is the meta-symbolic being, the meta-levels the meta-schematising and super-interpreting being par excellence. It is this possibility of emancipation from the application of symbols on a specific object level or in an object language which characterises the human being as the meta-interpreting being.

Epistemologically speaking it is clear that with the conception of scheme-interpretations and of the interpretative schematising activities we have found a rather comprehensive promising attempt and model comprising the hypothetical theories of natural scientists, the conceptions of meaning and understanding of the humanities (also including philosophers and methodologists themselves) as well as of the conceptualisations in everyday life. Of course, some differential distinction or contrasts even incompatibilities in the sense of specific disciplinary perspectives are not to be denied by this. (To analyse these differences would be the task of a special scheme-interpretationist philosophy of science, or hermeneutics, etc.)
HANS LENK

HIGHER LEVEL INTERDISCIPLINARITY
BY METHODOLOGICAL SCHEME INTERPRETATIONISM

In some sense traditional hermeneutics of understanding has developed a certainly fruitful and indispensable approach as regards some methodological interpretative rules (usages and presuppositions of (re)interpretation of texts). This is the kind of hermeneutical methodology being a rather special case of our wider and comprehensive interpretation-constructivist approach⁶. In particular, traditional hermeneutics as well as universal hermeneutics did not succeed in involving the schematising activities on a neuronal and biological (neurobiological) basis, providing the vehicles (neuronal correlates) of all symbolic-interpretative activities of the organism.

By contrast, modern brain research and neurobiology did beyond any doubt underline and verify the fruitfulness of a model of scheme-developments and scheme-applications, be it in the primary interpretations of the sense perceptions and internal patternings like by biological instincts, drives and motivations, be it with respect to conventional, learned scheme-activations and stabilisations of a social and cultural provenance, etc. Under the perspective of a generalised concept of interpretation as schematisation and the activation and stabilisation of schemes we are able to unify, though on a higher level as mentioned, the basic biological and neurobiological patterning of our actions and knowledge with those of symbolic and cultural conventional provenance under a sort of theoretical and meta-theoretical roof. In addition, the same is true of the combination of everyday knowledge, of any action and object constitution, etc. under the general abstract methodological (or, if you wish, quasi-transcendental) per-

⁶ Beyond that however philosophical hermeneutics, starting with Dilthey, but notably being forwarded by Heidegger and Gadamer as well as Blumenberg, supposed to have a certain kind of hermeneutic ‘shaping of the world’ or rather representations of world and even the self. The constitution and methodological concepts as well as presuppositions are certainly to be interpreted as special cases of methodological constructive interpretationism in the mentioned general sense. However, thus far hermeneutics, even ‘world hermeneutics’ remained all too much within and under the spell of text-interpretationism subdued by what I call ‘the paradigm of reading’: the world should so to speak be interpreted as a ‘text’; even actions would only be understood as texts (Blumenberg’s The Legibility of the World as a book title [32]). Universal hermeneutics was fixed to the rather repeated construction of text-interpretation and could only by and large open up towards an interpretational constitutionalism of a more general purview.
spective of scheme-interpretationism or interpretative constructivism of a nevertheless realist sort [28]. We can thus find a certain reunification of epistemology and action theory and their relevant disciplines under a kind of scheme-interpretationist symbolic anthropology, though paying the price of a certain kind of formality and abstractness by reaching the unified result only on higher levels. The unity of knowledge and action is reinstalled on a higher metalevel, namely that of rather abstract interpretative forms, rules, methods, requirements, and results of schematisations, i.e. scheme-interpretations. This is a very relevant and important result not only for the philosophy of the natural sciences but also of the social sciences and the humanities as well as for everyday life.

References


II

PHILOSOPHY OF SCIENCE: METHODOLOGICAL ASPECTS


I shall start with a metaphor by O. Neurath (1932–33): “We are like seamen who have to renovate their ship in the open sea and can not dock it, to be able to use newer and better materials to this end” [1, p. 312]. Indeed, in the course of progress, science ‘renovates its ship’, i.e. changes the foundations of scientific knowledge, research methods, and notion base. The philosophy of science plays an important role in such a change in scientific knowledge. Let us briefly analyse what changes have taken place to date and what scientific problems now stand at the centre of our attention.

Over the course of the entire 20th century, the philosophy of science demonstrated the efficiency of linguistic methods of scientific knowledge analysis. The linguistic turn in the philosophy of science, described by R. Rorty, characterises both phenomenological philosophy and analytical philosophy. The phenomenological philosophy of E. Husserl and G. G. Shpet in Russia is characterised by turning to the word as an analytic unit of research, to its meaning and history (that is why historical semasiology that dealt with historical development of the words’ meaning was a leading linguistic discipline), while analytical philosophy, besides using a special glossary, accentuated propositions – empiric and theoretical sentences, by first proposing the reduction of the latter to the former, and then by suggesting to find the rules of correspondence between them. Such an analytical philosophy agenda became the source of the so-called standard concept of science after World War II. This concept revealed the strategies of logical syntax, of logical semantics (later on) and the pragmatics of the language (under the influence of the late L. Wittgenstein).

From the 1970s–1980s, the philosophers of science turned their attention to supraphrasal structures that form a unity, or a discourse. Depending on how these supraphrasal discourse structures are under-
stood (as text or *discourse between two people*), different conceptual means of discourse analysis are shaped. If we equate discourse and text, we shall use such derivative notions as intertextuality, context, and subtext. If we equate discourse and speech, not a monologue, but at least a dialogue, we shall turn our attention to intercommunication, communicative action, mutual understanding, actor, recipient and so on. The first point of view analyses the language as a regulatory system, while the second (using the achievements of psycholinguistics, speech communication theory, linguistic culture studies and other disciplines) analyses speech as an actualisation of the regulatory system of the language. Moreover, the sociological analysis of the scientific community that gained popularity after the classic works of R. Merton and his school of thought, and T. Kuhn, used a number of purely linguistic notions (for example, a paradigm, formal and informal communications and others) on the way to identifying the scientific community with the speaking community, especially in the sphere of research methodology. This explains the popularity of constructivist methodology in the philosophy of science, when the notions and methods of scientific research, as well as the object of scientific research (including natural science research) were seen as constructed and conditioned socially.

The linguistic conversion of the philosophy of the 20th century, its turn to linguistic models and methods, the distinction between language and speech, interest in the semantic and pragmatic aspects of language functioning and analysis of semiotic activity resulted in the transition of the discipline from studying the types of connections in separate sentences to the understanding of speech as the most important component of human interaction and the cognitive process mechanisms, as a coherent succession of speech acts expressed in different texts and analysed in different aspects (pragmatic, semantic, reference, emotional, evaluative and others). For its part, the linguistics (mostly the linguistics of text) has not only realised the integrity of text, but also turned to *supraphrasal stable unities or discourses*, understanding them as a mechanism of utterances and text production.

Linguists turned their attention to the problems of discourse, understood as a complex communicative phenomenon that includes text and
a number of non-linguistic factors (attitudes, aims of the addressees, their views, self-evaluations and evaluations of others). The principal difference between the discourse and the text is connected with the school of discourse analysis of Teun A. van Dijk. Text was understood as an abstract formal construction that offers opportunities for realisation and actualisation in discourse in a certain socio-cultural context and in connection with extralinguistic factors (attitudes, views, knowledge, aims of the addressee, and others). “A real understanding of discourse depends on the changing cognitive characteristics of language users and the context” [2, p. 45]. Discourse is seen as a complex communicative event and, simultaneously, as a coherent sequence of sentences that are analysed from the point of view of linguistic codes, frames, scenarios, attitudes, contextual models, social representations that organise social communication and understanding. In other words, van Dijk reformulated the ‘text — discourse’ opposition, where text is presented as an abstract field of opportunities, actualised in different forms of discourse.

Ambiguity in the understanding of discourse in linguistics and philosophy of the 20th century is reflected in the fact that it is understood as the monologically developing speech-language construction, for example, speech or text. At the same time discourse is often understood as a sequence or interintentional communicative acts in the language. Such sequence may be a discourse, a dialogue, written texts that contain reciprocal references or are devoted to the same subject matter and so on. We can not speak about discourse outside the acts of human speech. Classical philosophy analyses discourse as a successive chain of actions of elementary reasoning (utterances, propositions), so it was necessary not to violate the rules by which these chains were constructed, while non-classical philosophy analyses discourse as an integral structure with different levels that impact the underlying language and speech levels and their learning. Modern philosophy sees discourse in a radically different way: discourse is now being understood as non-linear organisation of speech communication, where authors of an utterance may differ from narrators, and mutual understanding is achieved by comprehension and evaluation of my own self by the Other, and of the Other by my own self, and so on... In narratology
PHILOSOPHY OF SCIENCE: METHODOLOGICAL ASPECTS

(the theory of dialogical interaction between the author and the reader) different levels of discourse are identified; they depend on narrative instances (the narrator, narratator and actor), on the discourse of its characters, his discourse about my discourse, my discourse about his discourse and so on. Therefore, discourse analysis implies analysis of ‘my own’ and ‘other’s’ words, interintentionality and reflexivity of a dialogue, where my understanding (grasping, ‘conceptuating’) of the speech of another person and his/her understanding (‘conceptuating’) of my speech are achieved.

What do we see happening now?

By the end of the 20th century confrontation between naturalism and constructivism brought victory to constructivism. Over the past few decades we are seeing a backing-off from constructivism and a search for new forms of objectivity that does not boil down to social functions alone. Constructivism became a paradigm of social sciences and, together with the sociological way of thinking, a paradigm of the philosophy of science as well. The constructivist position is first of all represented in the theory of cognition and the philosophy of science. While neopositivism was based on empiric experience, represented in physicalistic language, postpositivism insisted upon the theoretical loading of empiric experience and, therefore, on theoretical constructivity of all scientific knowledge. This premise gave birth to the idea of the incommensurability of scientific theories, since they help to construct not only theoretical structures, but empiric experience as well. Theories possess their own system of theoretical constructs — from ideal objects to scientific notions, their own methodology system and their own empiric content, that is, in fact, the transition of theoretical experience.

The main concept of constructivism is the construct that expresses the theoretical power of scientific knowledge and has neither referents nor the subject of research. Natural things became the objects of theoretical knowledge here, but moreover, they turned into its derivative and combined variables. Thus, W. Quine in the article *Two Dogmas of Empiricism*, wrote: “The whole complex of our so-called knowledge and views, starting from geographical and historical facts that can not be generalised and ending with fundamental laws of atomic physics and
even pure mathematics and logic, are a human construction that adjoins to the experience only on the edges” [3, p. 363]. In his interpretation, even physical objects are “postulated entities that complete or simplify our description of the experience just like introduction of irrational numbers simplifies the laws of arithmetic” [3, p. 340]. He calls the idea about the existence of physical objects “a myth about physical objects” that serves as a method of experiential stream production. Quine discussed the criteria of objects’ existence in the scientific theory and stressed the fact that theory acknowledges objects as existing only if these objects are the values of variables that make theoretical sentences true. This thought is expressed in a famous aphorism, “To be means to be a value of an apparent variable”. However, Quine acknowledges the existence of empiric experience on the edges of correlating theories. Wide use of mathematics in physics and construction of different fictions, abstractions and operators that have no referents complicates the problems of the ontology of science, but still does not justify rejection of the existence of physical objects and does not allow us to build a non-ontological theory of cognition.

The first version of constructivism is radical conventionalism [4; 5]. Sociology and other social sciences see the subject of their examination mostly from the constructivist point of view. All objects of sociological research — from a nation to a social system — are presented as constructs, i.e. they are ascribed the property of existence in reality, but they are not correlated with reality; they are constructed1. Not only symbolic interactionists who consider the social world to be an attribute of a stream of symbolic interactions, but also P. Bourdieu, D. Bloor and others are referred to as radical constructivists in sociology. Therefore, the sociological way of thinking, based on the priori-
II
PHILOSOPHY OF SCIENCE: METHODOLOGICAL ASPECTS

ty of social relations, social functions and roles, is mostly of a constructivist nature. One of the peculiarities of radical constructivism is that priority is given to the acting power, the maker, or the creator of these constructions that can be interpreted differently: as a society, or a community, or a symbolic interaction, or fields of power and so on.

Ethnomethodology that first claimed to perform a microsociological analysis of everyday speech communication between people (in the works of H. Garfinkel), which explains the differentiation between index and objective expressions, and then, later on, claimed to become the general methodology of science, proceeded from the idea that there is no stable and invariable object of social science, that this object transpires to be an ‘as-of-which object’ and its specific meaning is determined by its use in every single social science, by the situations, in which it is included, and its connections with other objects within the scope of the given situation, as well as its functional place in space and time. Later, H. Garfinkel returned from the notion of ‘as-of-which object’ to the ‘orienting object’ [8].

Among the followers of such a version of constructivism are H. Maturana and F. Varela. They introduced the notion of ‘autopoesis’ (‘self-creation’). By dividing all systems into self-referential and hetero-referential and using this notion in their analysis of scientific knowledge, they proceeded from the self-reference property of all living beings and scientific knowledge

Constructivism gained ground in the interpretation of natural science (physics, predominantly), in the 20th century, but to a lesser degree. The enhancement of constructivism is explained by a number of reasons: first of all, the mathematisation of physical and other natural sciences (mathematics is closely connected with the growth of the constructivist aspect of scientific knowledge), the increase of impact of measures and measuring processes in the genesis of scientific knowledge (for instance, quantum mechanics), the turn of the natural science phi-

2 Maturana wrote, “The cognitive system is a kind of systems that set the sphere of interactions on the basis of their own organisation; they can act in this sphere of interaction, not damaging their own identity” [9, p. 13]. They proceed from the idea that both the observer and the process of observing are primary in relation to both the object and the physical sphere of existence. See the critique of constructivism by Maturana and Varela in: [10; 11].
losophy to the social factors of scientific development (including paradigms and scientific communities, after the famous work by T. Kuhn *The Structure of Scientific Revolutions*); such enhancement resulted in the break-up of the scientific society that was consolidated by unified norms of ‘scientific ethos’ in R. Merton’s works into many scientific microcommunities with their own separate microparadigms. Physical reality came to be interpreted as a reality, created in the course of measuring and theoretical mastering of nature; facts came to be understood. I would like to mention the work *Laboratory Life: The Social Construction of Scientific Facts* by B. Latour and S. Woolgar (1979), where facts, revealed in a chemical laboratory, were understood as socially constructed facts, i.e. the constructs of thought and decisions of the scientific community [12].

However, natural things and processes have always offered resistance to radical constructivism: there has always been a certain clearance between a thing and a construction; the things and processes under examination have always had something else, some mystery that could not be constructed, but required a solution and ensured further development of science. Today ever greater recognition is given to the fact that omnipotence of this acting subject (actor) and the one that shapes the human attitude towards the world (whatever you may call it: autopoesis, sociologism, self-activity and so on) is limited by unexpected features and characteristics of materials that are not at all labile, but offer resistance to the actors — designers and architects — and do not allow them to become fully-fledged masters of the substance. Substance and nature are nothing like the clay which is plastic in the hands of an actor who has been compared to the potter from ancient times. The actor shall consider, and actually he does consider, the requirements of the material. The very activity aimed at production of material and social objects shall not be equated with construction, building, creation, fabrication, and other such concepts.

The differentiation between the subject and the object which is now universally recognised in modern epistemology allows us to overcome
II

PHILOSOPHY OF SCIENCE: METHODOLOGICAL ASPECTS

the critical message against ontology, to find its place in metaphysics and build a lot more complex system of notions, the theory of cognition and ontology.

The second version of constructivism is constructivist narrativism (M. Foucault, R. Harre). Concepts of narrative (narration) and discourse are the centre of this theory, as constructivists connect new approaches to scientific knowledge in all its spheres and the methods of consolidation of previously disparate disciplines — natural, social sciences and humanities — with these notions. We are talking here about development of narrative psychology, narrative history, narrative anthro

pology and so on. Narrative analysis is becoming more and more important for the philosophy of science. Such a variant of radical constructivism results not only in esthetisation or rhetorisation of scientific discourse, but also in identification of scientific activity with any forms of symbolic activity, of scientific community — with art and literature groups. For instance, R. Harre believes that this scientific statement is based on faith and persuasive impact, and the scientific community is presented as an elitist moral order, based on faith and trust, forming its inner structure. The results of scientific research are presented in impersonal form and passive voice, and the whole narration is characterised by a specific grammatical form, free from the author’s claims and speaking on behalf of objectivity itself. In other words, the context of discovery, any attitudes and anything personal of the actors who performed discovery, are eliminated from the natural science narrative and discourse. “Serving as conditionality of the narration this grammatical set enables the author not only to speak as One of the Humans, but to speak on behalf of Logic itself. The impersonal power of methodology and logic has helped people receive the grains of truth. Start the machine of science and it will inevitably start giving positive results, unless the incompetent interference of humans prevents it” [14, p. 59]. Together with J. Brokmeier, R. Harre connects the study of the narrative with the introduction of a new paradigm in the philosophy of science and the “significant tectonic shifts in the cultural-logical architecture of knowledge that accompany the collapse of modernist episteme” [15, p. 29]. The turn to the linguistic and rhetoric methods of scientific discourse and the narrative analysis, naturally,
increases the capabilities and the instrument of the philosophy of science, allows comprehension of the open and many-faceted character of the forms of the narrative discourse, but at the same time, the function of the narrative discourse in arts and sciences is not limited to subjectivisation of the world realised by means of interpreting consciousness [16; 17]. Subjectivisation of the world in scientific knowledge faces resistance on the part of nature: when a natural scientist comprehends natural phenomena and processes, the dialogue and discourse is only possible between the actors of the scientific community, not between nature and a group of scientists. When they (for instance, I. Prigozhin) talk about dialogue between man and nature, it is a metaphor, when nature is ascribed characteristics of a human; in this case we observe anthropomorphisation of nature that remains silent, but demonstrates the limited and erroneous character of human understanding thereof by its resistance. It should be noted that in his articles and books, published at the end of the 20th century, R. Harre brought to our attention one very important problem: the status of an object in social sciences. The researcher, though, still claims that “nothing appears in the social world until it is introduced into this world by the social and constructive activity of the human” [18, p. 121]. Inclusion of a material object into the narrative and in the context, in which the choice of type of connections between the objects is made, turns it into a social object. In order to describe the process of such transition, Harre uses the notion of ‘acceptability’, which characterises the space-time disposition that depends on identification of material objects and social situations. Social objects are multiple, since they possess contextually determined acceptabilities, which turn out to be mutually complementary. Material objects that become part of the narrative acquire social relevance and social meaning. Narratives are changeable and unstable and that is why a material thing can become the object of several social sciences, and each one of them plays its specific role in the narration. The identity of material objects is determined by the ‘plots’ of the narrations. The identity of narrative grammars creates the illusion “that everything saved is some thing that is as real as, for example, a mountain range that surrounds a territory” [18, p. 132]. In reality, this is preservation of the same interpretations and their grammars over several centuries.
II

PHILOSOPHY OF SCIENCE: METHODOLOGICAL ASPECTS

In the past few decades we are seeing a turning away from constructivism to the realisation of the need to form a new understanding and objectivity, as well as the object of science. The positions of realistic naturalism lost their influence and became quite unpopular by the 1970s. Only the last decades of the 20th century saw a revival of the attitude that was popular at the beginning of the 20th century and that can be expressed in the slogan “To the Things Themselves!” We may determine this as the revival of naturalism in sociology and other social science in general, but it is more correct to name this process the galvanisation of object-centric sociology and the inclusion of natural objects into social science, as well as the increase of attention in the significance of an object in the social sciences. The turn to objectivity may be interpreted differently — as a revival of naturalism, or the expanding of social reality that includes natural reality as well, or as the shaping of hybrid reality that constructs natural and social systems; with that, neither sociological nor natural science methodology is enough to comprehend these systems. Such hybrid objects or object-centaurs are the peculiarity of scientific knowledge of the end of the 20th and the beginning of the 21st century. For instance, at present ecology deals not only with natural ecosystems, but with human interference in these ecosystems. Modern philosophy of technology deals not only with systems of mechanisms and automatic machines, but also with the role of the human factor in deformation and functioning of technocenosis.

The turn to objectivity in the philosophy of science together with construction of a network model of science functioning in the social and technical systems (the so-called STS model — Science, Technology and Society). Such models do not imply and do not allow for such hierarchy of its components when one of them is fundamental and another is derivative (for example, technology in relation to science).

Such a turnaround is characteristic, for instance, of the research studies of B. Latour and K. Knorr Cetina who defended the positions of constructivism before.

B. Latour supposes that sociology should turn away from the sociologism of Durkheim and return to the ideas of G. Tarde: “The adjective ‘social’ does not mean a substance or a sphere of reality any more
(as opposed to such adjectives as, for instance, natural, technical, or economic), but a way to tie together heterogeneous blocks, a way to transform entities of one type into entities of another type... Artefacts do not ‘reflect’ the society as if the ‘reflected’ society were in another place or consisted of another substance. They are mostly the matter that shapes sociality... They are the ones that make the flesh of society...” [19, p. 350].

The transition to the inclusion of material objects into the social world may be demonstrated by the works of B. Latour, who supposed that “only things that were not constructed will stand the test of time” [13, p. 378]. His attempt to revive and maintain the indisputable authority of reality led to the introduction of new methodology for both social and natural sciences. One such methodology is connected with his development of the notion ‘interobjectivity’ (instead of the notion ‘intersubjectivity’), oriented towards revealing the biological roots of sociality and the actant-network model of sociality.

Latour develops the thought about the materiality of socially important things being revealed when its functional destination collapses, when a thing breaks and transpires to be not a lawn-mower, for instance, but a non-operating machine that takes a certain place in the space of our everyday life, it turns out to be a Cartesian thing — res extensa. This reveals their capability to object to what is imposed on them, to resist the function that is being ascribed to it by the human: “Objects of nature are rebellious by nature” [19, p. 353]. In his opinion, things should be understood as constituents of an action; constituents of a special kind. They should be identified neither with ‘actors’ nor with ‘agents’, nor with the ‘subject’. Analysing the material object in social theories, Latour turns to one of the notions of linguistic structuralism — the notion of ‘actant’, which denotes an object or a subject that acts or exposes itself to action. Material objects possess spatial characteristics which are either local or global, since space is the order of existence of different objects. Following the Leibniz concept of space as opposed to Newton’s absolute space and time Latour speaks of multiplicity of spaces (places) and multiplicity of heterogeneous networks. Arguing with M. Heidegger and J. Habermas, Latour insists on “the objects being rather intermediaries, not means, just like
all other actants” [20, p. 195]. Objects are derivatives from stable networks of relationships and they keep their stability due to an ability to maintain their spatial form.

K. Knorr Cetina, the German knowledge sociologist, also advocates the transition of social sciences to a new understanding of the object. Earlier, she talked about the ‘production of knowledge’ and knowing its own objects; now she insists on the need to create the ‘object-centric sociality’. She does not accept functional identification of things with goods and instruments and develops a thought about the sphere of object relationships being a lot wider; she also mentions that science and technology have played a huge role in the expansion of this object sphere. Sociology should be understood more broadly than before; it should include material objects and their attitude towards each other and the environment. That is the essence of object-centric sociality and sociology. By consequently turning to the new classes of objects, created by science and technology, Knorr Cetina examines ‘epistemic things’ (or objects of scientific research), instruments and goods as “the means of symbolic expression and status confirmation” [21, c. 283], objects of everyday use; she offers her own interpretation of objectual relations, where ‘epistemic objects’ are presented as absence chains, gaps in continuity, and the object — as a structure of absence. Indeed, objects of science and technology are not only objects of specific discourse practices and interpretations, but their elimination and annihilation “may consolidate teams and contribute to an expansion of their practices” [21, p. 290]. Domestic appliances turn into high-technology devices and turn the goods or instruments into ‘epistemic objects’. Knorr Cetina supposes that the turn to objectual relations will allow us to comprehend the role of objects as “partners in the social relations or elements of the environment around us, distinguish between the possible types of sociality with objects and by means of objects, by tying them with interpersonal diversity of social forms” [21, p. 302].

Therefore, one of the trends in the modern philosophy of science is the rejection of constructivism and the turn to a new understanding of the object and the objectivity of scientific knowledge. The object itself is understood as an equivalent partner of social interaction, as one of the blocks in the network of relationships between science, technology
and society, as a hybrid object that includes many factors — from natural to anthropologic. Obviously, we are in need of a broader understanding of the subject matter of different disciplines in the philosophy of science that would enable us to identify the difference between the way they see their own subject content: some sciences deal with natural things, others — with the construct ‘material object’, others — with natural ecosystems, others still — with unobservable material entities and so on. We are yet to create a hierarchy of ontological entities of different disciplines in order not to reduce the existence of all objects to the values of combined variables. The procedure of status definition for the existence of an abstract object that uses logical and mathematical methods does not quite concur with procedures used for the object’s status definition in other disciplines: some of them pay special attention to the procedure of measurement, others — to visualisation, others still — to experimental testing that is only possible after huge technological systems are designed and built, and so on. One can not deny that the criteria of existence differ in different disciplines.

References


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It is well known that A. A. Lubischev found about 30 criteria of existence in the biological taxonomy that, in their turn, depended on whether the biologist proceeded from nominalist and realistic position, which implies acknowledgement of the existence of individual species, varieties, types or classes only as real or constructed entities [22, p. 113–133].
PHILOSOPHY OF SCIENCE: METHODOLOGICAL ASPECTS

III

RISKS
AND GOVERNANCE
IN THE KNOWLEDGE
SOCIETY
1. RISKS IN SOCIO-TECHNOLOGICAL SOCIETIES

In our present and future society, we are dependent on the development of technological infrastructures and on the smooth functioning of those of our technical or technology-shaped forms of life in our societies' very high population density, if not overpopulation, and on the intriguing interconnectedness of technical and socio-technological infrastructures. We are that much dependent on technology that if we would dispense with any of the larger characteristic technologies for providing knowledge, energy and informational management as well as sustenance in general a real catastrophe would be a consequence for the majority of humankind. We may only think of the quality and low standards of living, nutrition and fresh water and also energy in less developed countries. Technology therefore is in a certain sense embedded in larger systems and also in a societal, rather socio-technical framework which cannot be ignored anymore. This kind of dependence on systemic connections of all our societal, political, legal and other

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1 More than thirty years ago I published a book on Philosophy in the Technological Age [1] talking already about the transition from the scientific-technical age and society to the information and systems technological age and, consequently, the information and systems society. The latter age and society would be characterised by such interconnections, interdigitations and intricate developments of and between all technical areas and in particular by larger and larger technological informational systems and information technologies overlapping many realms. At that time (1970) I could only predict in a rather tentative way the huge growth of information technology and the respective information of abstract and managerial technologies of handling information and knowledge as well as systems by electronic information and communication technologies, but I did outline this kind of information- and systems technological society and age which has certainly materialised meanwhile to a drastic extent which I could not have possibly delineated in detail at that time. But I clearly saw the tendencies and some of the implications already prior to, at least independently of, Daniel Bell and other protagonists of the so-called information society. (Some of these authors – like Manuel Castells – took up the topic only fifteen years later...)
III
RISks AND GOvernANCE IN THE KNOWLEDGE SOCIETY

measures regarding safety standards and measures in particular has grown much more explicit to the same extent as technology has invaded into our life forms. The more complex the conditions and structures, organisations, institutions, regulations, risks and decisions in our walks of life in the high-tech society will turn out to be, the more susceptible to external interference will the societal contexts, textures, structures and interactional patterns as well as their elements become, the more the problems of notably human-made risks will stand out and get topical relief. Let us first address some hypotheses about the concepts and models of risks and risking.

Regarding the philosophy of risks and risking I have to admit that I am not an expert in the methodology of risk assessment and risk taking. It seems to me also that philosophy of technology thus far has not paid enough attention to the problems of risking and the combination of risking and responsibility. (An exception as regards general philosophical methodology is Nicholas Rescher’s book as of 1983 [2].)

Scientifically speaking risks are assessed by formal models relying on the amount of damage and the probabilistic hazard and trying to encapsulate the assessment and measuring of risk \( r \) in the formula:

\[
r = d \times p,
\]

where \( d \) would represent the amount of damage and \( p \) is the probability of the occurrence of this respective damage relative to a given time span (i.e. a guessed or at times rather subjectively circumscribed probability obeying the axioms and laws of Kolmogoroff’s theory of probability and a combination of different probabilities allegedly independent of one another).

The Rasmussen Report* (1975) on the risk analysis and risk assessment of nuclear plants — as also the German Risk Study** (1979) — is basically established on this rather formal and mathematical model using formal decision theory and somehow excluding other, e.g. social-

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* Norman C. Rasmussen (1927–2003) was an American physicist. The Reactor Safety Study (WASH-1400) was a report produced in 1975 for the Nuclear Regulatory Commission by a group of specialists, headed by Professor Norman Rasmussen. This study is known as the Rasmussen Report.

** German Risk Study for Nuclear Power Plants was published in August 1979. It applied the methods of The Reactor Safety Study (WASH-1400) to German plants and site conditions.
scientific and individual, dimensions of the humanities and social sciences which are not susceptible to such a quantification in terms of precise probability figures. In these studies, risk is usually considered as (the understanding of) the expectation of safety or security although the individual situations of deciding are not really effectively taken into consideration at all. By contrast, the public debate focused instead on the hugeness of the potential overall damage. However, the same is true for the assessment of risks. Certainly, the risks of high-tech plants like a nuclear ones are not only to be judged by the amount of potential damage multiplied by the probability of the onset of an accident\(^2\). The real risking behaviour and risk acceptance (subjectively judged) would considerably deviate from the alleged linear probability model.

Although there is a certain precision and formal quantification to be ascribed to these models of risk assessment of measurement, I think and will explain that social and human factors are usually downplayed by such formal models and respective quantifications, if or since they don’t take into consideration these other dimensions of human and social life – even in matters of high-tech interactions and systems which, nonetheless, depend in the last analysis on interactions of humans and social groups as well as institutions.

Risk assessment and risk taking are therefore dependent on subjective and social factors, at least, with respective practical applications and situations. (They are, by the way, frequently dependent also on the social status, position and/or situations. The poor and powerless are often exposed to higher risks. That is particularly true with regard to population and contamination problems.)

This social dimension is the reason why the formal models of a qualitative risk assessment are themselves not enough if they are utilised in practical decision making behaviour like politics, technology, economic, eco-technological and social planning, and also big science and big technology.

\(^2\) One has a U-shaped curve between the amount of damage and the probability of the onset: A relatively small damage with a relatively high probability may take the same amount of risk as a huge damage at a very minimum probability of the onset. One may very well ask whether a nuclear plant may make good for a comparable risk when the potential damage is huge and extreme, whether even the smallest of smallest probabilities may make good for that risk.
III
RISKS AND GOVERNANCE IN THE KNOWLEDGE SOCIETY

THESIS 1. Not only risk taking is dependent on social interaction and assessments as well as manipulation or changes, but also risk imposing, i.e. the bestowing or inflicting risks on another person, is also certainly depending on these social, human, psychic (in general, anthropogenic and sociogenic) factors.

The Texan philosopher Paul Thompson did already in 1985 consider that the bestowing or inflicting of risks on another person could and should be seen as an action oriented at the addressee that means that such an action would be a matter of responsibility of the agent bestowing the risk on the other one. If bestowing or inflicting risks on another person is an action for which the originator has to bear the responsibility relative to the addressee, the systematic interconnection between risk bestowing and responsibility for such an imposing of risk on other persons is certainly emphasised.

Indeed, neither ethics nor social philosophy, nor philosophical anthropology in general have so far (as far as I can see) systematically discussed the problems of risk-imposing from the viewpoint of responsibilities.

What I have thus far said is even true all the more for groups or institutions or corporations, in everyday situations and in particular in high-tech environments, would impose risks on other persons, although there is a wide discussion about how to assess formally and measure such risks in quantitative terms and how to decide politically and base respective decision processes on procedures of our representative democratic structures in society, including law. (All these have notably been discussed by experts and politicians with respect to nuclear risks: not only with attacks, be they in war or from the side of terrorists, but also in the problem of whether and where to locate nuclear plants in densely populated regions. Especially after the nuclear accidents of Harrisburg (Three Mile Island, 1979) and Chernobyl (1986, April 26) the international and respective national discussions were intensified (see e. g. [3])

3 The nuclear accident of major dimension at Kyschtym and Mayak in 1957 (and again in 1967) in the former Soviet Union had been the object of a cover-up by the Soviet officials, although the radioactive fallout was allegedly greater than at Chernobyl leaving a wide part of the contaminated land uninhabitable and leading to radioactive pollution of rivers and lakes in the Southern Ural Mountains. Only after the Perestroika and the end of the Soviet Union details and reports of that gave catastrophe became known to the international public, after the high flying US-aircraft which had apparently photographed the catastrophe was shot downed by the Soviets and the pilot only released after years. According to these reports the amount of radioactivity released was greater than in the vicinity of Chernobyl [4].
Regarding the planning of the actions to be taken after a risky engagement in case of a ‘normal’ [5] or an ‘extreme’ accident like, e.g., the one as of 1986 at the nuclear plant near Chernobyl or, rather, Pripyat, most politicians, administrators, and leading persons in responsible positions tend to go back to expertise and counselling by experts — who are as a rule specialised only in one discipline as, for instance, nuclear technology, frequently lacking the interdisciplinary intertwining of several disciplinary perspectives in the truly interdisciplinary object and situational setting usually even located between differing approaches like the ones from social sciences, natural sciences, and ethics. This also would relate to any dealing with risky decisions as alluded to before.

As came out only rather lately with many expertises in the fields of big science and big technologies interwoven with all-today life there is a so-called expert dilemma: Experts from special fields are not without personal interests in getting research money and being awarded a project. Thus, you seem to be able to somehow ‘buy’ the respective expertise. This is in particular true in fields where objective data are hardly available or the multidisciplinary interlacing and involvement are that great that the delimitation and potential changing of perspectives would affect the respective expertises.

Even with regard to such clearly extreme accidents like the nuclear blast at Chernobyl were very different expert views available, and five years after the accident there were quite different overall judgements in the offing about the triggering cause(s) and the assignment of responsibilities of the accidental malfunctions in the incident. The Soviet administration just named and sanctioned ‘human failure’ as the main and (almost) only cause, and consequently pilloried, and blamed, and even indicted some technicians and lower supervisors on duty at the plant as scapegoats or whipping boys, some of whom were even convicted in law cases. (One CEO even committed suicide.)

But this seems to have been an all too easy way-out of the problem. To be sure, there were ‘human failures’, e.g. to switch off the fast emer-

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4 However, a representative of the New German Atomic Forum as well as the engineers’ journal VDI-Nachrichten (April 26, 1991) judged that ‘not man, but technology’ would have ‘failed’ at Chernobyl. This is too general; indeed an overstatement, since also human failures were at hand. Therefore, not only man, but in quite a considerable perspective also technology was unsafe — due to the mentioned reasons and possibly other ones.
ergency shut-down at the wrong time, but then to try to re-activate it a minute later only to trigger the positive steam reactivity and consequently the explosion. The same is true for the removing of the graphite rods and later on the impossibility of trying to get them back after some cooling channels were already destroyed by the melt-down. In fact, the manual was not designed to cover for such a huge accident nor even good enough for other minor ‘normal’ malfunctions displaying errors in the decisive emergency manual. This already shows that not only individual human failures were influential, but (also) general regulations, e.g. in the manuals and in training the operators and, above all, in the construction of the plant. (Mainly, the lack of a containment hull and of an automatic shut-down system as well as the miss of double and triple check security procedures to be automatically released in case of emergency are to be mentioned here.) Therefore, the whole design for the plant was unsafe and has been blamed as one of the decisive combination of factors of all the unfavourable circumstances turning out to have been necessary and sufficient for this major accident. Also, the hierarchy of responsibilities under the supervision of the state and its apparatus seems to lead to a certain kind of red tape of distributing low-level responsibilities and ignoring adjacent ones.

The overall insight is that, depending on the status and affiliation as well as potential conflict of interests, the respective expertises and judgments are at times incompatible or even contrary to one another or at least differing to a wide margin. This is not an easy problem to be solved in view of the mentioned expert dilemma.

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5 In 1999, I myself had paid a visit to the nuclear plant Sosnowy Bor in the vicinity of St. Petersburg. That is also a reactor of the Chernobyl type – still without a containment hull, although many other safety automatisms had meanwhile been installed as the respective guide said to our official delegation of representatives of the German Ministry of Environmental Agenda (Umwelministerium).

6 As regards nuclear accidents, strict natural scientists would even tend to take on their strictly naturalistic point of view consciously taking into account the risk of having up to 400,000 deaths and/or casualties from radioactivity and additional 70,000 genetically severely harmed children per year (!) as the radiologist Wachsmann had uttered years before Chernobyl (after Frankfurter Allgemeine Zeitung [6]). Even famous physicists like von Laue apparently more or less explicitly judged after the atomic bombings in Japan 1945 that it would have been the ‘greatest fieldwork experiment’ which mankind had as yet undertaken. The influential physicist Häfele stated after Chernobyl at a public lecture in the University of Karlsruhe that Chernobyl would have been much more a sort of ‘semantic catastrophe’, i.e. that what the
ON RISKING AND RESPONSIBILITY IN THE 21st CENTURY

Kahneman and Tversky developed models and experimental setups to measure subjective disproportions in the assessments of probabilities with respect to luck and mischievous hazards [7]. People tend systematically to deviate from the monotonous growth of the respective risk curve (subjectively augmenting the chances of luck and decreasing the probabilities of misfortune or disadvantages, etc. [8]). Thus, there is a robust effect of risk avoiding (‘risk averse’) in the case of a sure win and a ‘risk seeking’ in the case of sure losses. Losses are usually even more than costs to be paid; and the ‘framing effects’ of the set-up of questions in terms of gains, losses or costs will unproportionally, even inconsistently, alter the respective answers to real decision makings: “…losses loom larger than gains” (and costs).

As has been confirmed already decades ago, the human subjective risk assessment by small groups is governed by social interaction and communication processes like amongst others the so-called risky shift effect [9]. This also includes the risky shift effect in scientific and engineering pioneer groups and pilot enterprises.

media had made of it, more than the real physical one. An appendix on the history of electrical engineering in the Introduction to Electrical Engineering later on just mentioned that April 26th, 1986 a ‘hazardous incident’ (Störfall) had occurred within the vicinity of Kiev. One can hardly more downplay the importance and impacts of the Chernobyl accident than by such an understatement which somehow seems to be typical for a hardcore naturalistic standpoint. In fact, there is a systematic effect on downplaying the grave consequences and even measurements in order not to disturb and stir up the public in an encompassing appeasement strategy or policy in connection with the Chernobyl case. The director of the plant first downplayed the burden of radioactivity unto one thousandth (!) of the really measured rems. The death toll of 31 officially notified later on (with the exception of the military so-called liquidators which were never counted since they were members of the Red Army) was unbelievable low with regard to the now current figures of 10,000 at the least through 30,000 and even up to 280,000 deads of cancer in the long run [6].

The same is true for an equally robust undervaluing ‘a reduction in the probability of a hazard’ in comparison to the ‘complete elimination’. In general, the over-weighting of very low probabilities reverses the comparison between risk avoidance and risk seeking.

The risky shift effect was experimentally analysed and corroborated by Emerson in mountaineering groups in an American Everest expedition already fifty years ago [10]. This effect states that in high performance or adventurous achievement and sensation motivated persons like those in mountaineering; the eventual result of risk taking would lead to a higher readiness to take over higher risks than if the individual members of the group would assess and have to take over the respective guessed risks and the whole of the responsibility by themselves. There is a shift to higher risk taking behaviour in adventure groups, high achievement groups of any kind and sometimes even in some quasi democratic group structures of small teams or decision groups. This is even true with regard to the fact that the individual lives of the members are at risk – as always in adventurous enterprises in high performance mountaineering and
All these show that risk analysis is not but a rather formal matter as provided by the multiplication formula of potential damage as assessed and the guessed probability, but a very intricate matter between the tendencies of manipulating the assessments, the social judgements and evaluations as well as the respective prejudices and biases. Even the specialised scientific community of a research field or a technological development would tend to defend its own interests and partial or even egotistic objectives. The public administrations as well as the corporations in charge also tend to play down or cover up accidents, at least minor incidents or technical malfunctions, etc. in order not to stir up the wide public which might, after being stirred up, develop a certain eigen-dynamics of spreading rumours and social as well as economic consequences.

As can easily be seen, all these insights also carry over to broader perspectives of risk assessment in general — and also in practical applied cases.

The connection between risk-taking, risk-imposing and responsibilities should be obvious by now. However, also the ‘concept of responsibility’ itself is not clear enough. It has to be analysed in a more detailed manner in order to be applicable to complex situations of interacting groups, decision makers, institutions, laws, etc., and it also does not seem to be enough for solving the occurring responsibility problems with risk imposing measures since just the appeal to responsibility. Categorising responsibility, even in analysed form of specified types, will not solve responsibility conflicts and the respective problems, because indeed the call just for responsibility and a responsible individual is not enough, since the assignment and also taking of responsibility would occasionally lead to paradoxical effects and responsibility conflicts between different types of responsibilities which can only be solved or mitigated by some other regulatory norms and rules of prioritisation (rules of preferences of priorities in responsibility conflicts) and by practical, e.g. political, measures.
and legislation. Indeed, philosophy as such and ethics have not yet taken these conflict problems into consideration in a satisfactory manner.

Of course there is no absolute safety anywhere, and that for sure is so also with regards to technical and technological systems. Generally speaking, there is no absolute safety in our lives, but instead of postulating such an absolute safety one should try indeed to guarantee a possibly of next-to-maximum checking and control of technical systems and safety management of the broader socio-technological systems and infrastructures. Only those technologies are amenable to responsibility which function relatively safely and can be managed and dominated with a high degree of safety. This is true in particular for those potentially dangerous technologies which carry with them a high amount of potential detrimental harm, even if the risk, understood as the quantitative amount of detriment times probability of occurrence, would be rather low. These latter technologies have certainly to obey much higher standards of safety requirements.

Regarding the overall safety situation with respect to such catastrophes as terrorist attacks or technological catastrophes or ‘accidents’, whether or not considered already ‘normal’ [5], I would like to forward some further theses relating to safety problems and the respective responsibility for these. Certainly, the following insights are only sketched out in a rather speculative and hypothetical manner and should be considered only preliminary or as tentative ones. Let me now summarise my insights about the societal dimension of responsibilities and some about risks assessment.

**THESIS 2.** Many politicians and managers as well as technologists tend to only look for purely technological measures and prearrangements or precautionary attempts in order to guarantee purely technological multiple safety measurements as the panacea against catastrophic events or developments leading to such ones like the terror attacks, nuclear power plants melting-downs, etc.\(^9\)

\(^9\) An example would be a rather topical one: the US American government has planned or even spent billions of dollars for an information systems-based rocketry defense system, but the Americans were not able to make their airports safe enough. There were experimental but nevertheless representative sample experiments to smuggle weapons into airplanes — and these experiments turned out to be successful at a rate of 68%! (Even after the terrorist attacks it was possible — as I read — to turn in a suitcase without actually personally flying on the pre-bought ticket.)
All that would mean that one did not take into account the social component to a sufficient degree, and didn’t enough consider social safety. Indeed, one thought and maybe thinks even today that the safety problems could and would be solved essentially by technology pure and only by technology. Certainly, technology is necessary for safety measures. Without technology clearly we could not discover hidden weapons, etc., but this certainly does not suffice by itself.

The same is by the way true for most of the greatest catastrophes in modern history of technology. One might think of Bhopal, Chernobyl and even the fatal accident of the space shuttle Challenger (see below). Generally speaking it has been stated that 80% of such catastrophes are due to what is called ‘human failure’ and not just purely technical malfunction. This social component is to be considered indeed and absolutely necessarily required as regards the partaking workers, the managerial officials, etc.

**THESIS 3.** Without taking into account these socio-technical and societal-technological components and prearrangements, there is no way of excluding potential catastrophic events in a highly connected plant of a dangerous technology. Indeed, today we have to deal rather with socio-technical and socio-technological systems of larger dimensions and not only with purely technical systems and the very technical management, technical safety, technological responsibility from a just technical perspective of an expert training, say, in engineering alone.

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10 For instance, in Bhopal the administrative workers, being not explicitly enough schooled in safety and catastrophe management, thought that they would have to take their tea before sounding the highest alarm. Apparently they were not able to assess the real danger of the situation. In fact, at the time MIC (Methyl isocyanate – MIC – is a toxic organic compound used in the production of carbamate pesticides. – Ed.) was not even well enough analysed regarding toxicity. Safety measurements and evacuation plans were not installed or not working. The population who had settled around the plant was not in any case prepared to deal with such an emergency situation. The workers themselves even did not know that it was absolutely forbidden to pour water in the respective MIC tank and even to try to extinguish the explosion or, rather, the deflagration, by later on pouring water on the tank only to really trigger the enhancement of the explosion! In addition, there was no infrastructure for emergency situations, no oxygen masks, no alarm siren was sounded at all, neither police nor population were informed, even the safety installations, absolutely required in West Virginia’s home base of the respective corporation (Union Carbide Corp. is one of the oldest chemical and polymers companies in the United States. – Ed.), were not in place nor functioning.
I would even like to add to the theory of socio-technical systems [11] also the ecological embedding and the respective perspectives by talking of ecological and socio-technological systems or eco-socio-technical systems, for short. The ecological problems are as important and occasionally amounting to dramatic consequences as the social problems by applying large-scale and big technologies.

**THESIS 4.** Responsibility and the problem of distributing and assigning responsibilities is, notably by the wider public and primarily also in law, usually defined and understood by what we can call the responsibility of guilt and whipping boys, to find any or the one and only scapegoat. Usually responsibility seems to just occur after the fact, i.e. after the accident.

As regards responsibility and accountability problems, the problem of distributing and assigning responsibilities is indeed normally understood by what is known as the responsibility of guilt assignment. (Responsibility here is as rather common exclusively understood as mere ‘blameworthy responsibility’ *ex post* being activated only after the fact.) It has just negative connotations of finding the respective originating person to pass the buck to. But instead, as the moral philosopher John Ladd had repeatedly stressed, we have to pay much more attention to the prospective, future-oriented safety and responsibility as a general disposition for acting in — and with regard to — the future. Notably ethical responsibility, but also expert responsibility has much more than hitherto to attend to and prepare for an ethical responsibility in a wider sense, namely to stress the obligation and future orientation at safety and any responsible role-fulfillment and execution of duty instead of only understanding responsibility just in the negative and *ex post* as assigning guilt in the case of failure, accidents, or even catastrophes. Philosophers like Edgar Bodenheimer [12] and John Ladd [13; 14] emphasise the necessity of a wider, future-oriented, inclusive (open to many responsible participants) responsibility which is indeed not just exclusively concentrating on one and only guilty person or agency. Also Hans Jonas in his well-received book *The Imperative of Responsibility* [15] as well as the present author [16] developed an approach to what Jonas called ‘wider or widened responsibility’ not just relying on actual deeds originated by the agent. Instead, the wider responsibility would
III
RISKS AND GOVERNANCE IN THE KNOWLEDGE SOCIETY

depend, according to the extent and potentially affected persons, on the dependencies of the potentially affected persons by future acts and on outlines of what is to be done. (However, Jonas erroneously thought that this wider kind of responsibility would more or less totally replace the traditional sort of guilt- and blame-responsibility.)

In fact, already in 1979 I myself stressed: “New possibilities”, capacities, opportunities, and “powers of actions would actualise extended and modified responsibilities” [16, p. 73] — explicitly mentioning the responsibility for safeguarding ecological equilibriums in and for nature and for creatures in a fast-growing technological world facing dangers of regional and global overpopulation. This runs parallel to Jonas’s emphasis on a wider or extended responsibility although he claimed that the traditional responsibility of the agent for past actions would be displaced or replaced by this widened version of responsibility (a thesis which he later on took back in our joint discussion). It was again John Ladd who in his some outstanding articles about the Bhopal catastrophe and about information technology showed that with respect to particular technological areas this kind of prospective and open-minded (non-exclusive) ethical responsibility has to gain relief and wider validity as well as expert schooling. This is true also for general education and in particular for the taking into consideration of values and ethical norms by engineers and practical technological managers, etc.

THESIS 5. Moral responsibility as a prospective (i.e. future-oriented) responsibility has to be seen as differentiated and differentiable. In general, responsibilities have to be seen and to be taken into account in a much more differentiated way. Responsibilities have to be made operative.

That is, it is not enough just to appeal to and preach them, or to conduct as ethicist new conceptual analyses and ideal visions, but we as ethicists and educationists have much more to involve ourselves in problems of practice, to study cases and the general forms and problems of responsibility types and similar questions like conflicts, interactions and even ‘social trap’ situations. This has by far not been achieved enough in traditional philosophical research. In some sense, jurisprudence and also practical jurisdiction are a bit better off in this respect, since they had ever much more been confronted with practical cases and affairs,
though again, they have to date been indeed also relying mostly on the traditional guilt assignment principle. Indeed, it seems to be very difficult to capture in a legal concept those phenomena and questions of the extended and wider responsibilities of this mentioned ethical sort.

Who was responsible for the Challenger accident?

Quite often managers sometimes tend to ignore the question and problems of safety. This might dramatically be highlighted by an analysis of the catastrophe of the US spacecraft Challenger in 1986, when 73 seconds after takeoff from Cape Canaveral the manned spaceship exploded and seven astronauts lost their lives. A direct cause was a brittle rubber sealing ring which, in accordance and with the expectations and warnings of the engineers from the rocket manufacturer Morton Thiokol, fractured under low temperature conditions. One day before takeoff the engineers, most notably Allen MacDonald, the project leader, and Roger Boisjoly, the expert on sealing rings in rocketry, had warned and protested against takeoff plans for the next day. They informed NASA about the danger that the sealing rings would break below freezing point. They were assisted by the Deputy Director of the engineering department of the rocketry firm, Robert Lund, who also informed Jerry Mason, a super-ordinate engineer within the same firm. Mason, however, silenced Lund and finished the debate by saying, ‘Take off your engineering hat and put on your management hat’. Lund gave in and gave his consent to the takeoff, which he notified to the project leader of NASA, who authorised the takeoff without mentioning any doubts. The catastrophic accident ensued. Later, the engineers who had launched the warnings, MacDonald and Boisjoly, were, even after the accident, transferred to another department, which they deemed a kind of quasi-punishment, after the fact.

Do indeed managers decide differently from engineers? Is this a case where apparently ethical aspects of decision-making and factual judgment diverge for the ethics of technology and economics? Regarding ethical decisions, does the management hat differ from the engineering one?

Indeed, one could perhaps argue that ethical problems in economy are further-reaching than moral problems in technology, because there are many problems in the economic management and distribution of jobs and so forth, not directly relevant to or influenced by technological factors. However, there is a large overlap between the two fields of technology
and economy where technology is involved and technological implementation at stake within economic decision making. The problems of ethical relevance of both fields are very similar or at least narrowly connected [17].

In any case, the example shows immediately how intriguing the problems of responsibility, its interpretation and its distribution are: Who was the responsible person or body in this case? Everybody who had been involved? Just NASA, not a person individually? Each to a certain degree? How much, then? However, first the questions of defining and delineating responsibility in general have to be addressed.

2. RESPONSIBILITY AS AN ESSENTIAL HUMAN TRAIT AND AS A RELATIONAL CONSTRUCT

Generally speaking, humans are responsible beings; one can even say that they are the (only) moral beings. To be responsible (to be attributed responsibility of some sort or other, to bear, acknowledge, consciously identify and accept or take over responsibility for the outcome of one’s own actions and role fulfilments) is certainly an essential characteristic mark of human beings. We are inevitably the morally responsible beings who may nowadays even be in the situation of having to bear also some responsibilities of caring for other beings, creatures, even ecological systems, etc. To the extent in which we are able to encroach onto and into the (eco)systems of nature and to influence the lives, limbs, and living conditions of these other beings, in particular other humans. Thus, such capabilities would oblige us – as political, technological and managerial powers would do also. Understood as agents, humans are the only moral beings capable of bearing real responsibility11.

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11 Yet, moral responsibility is but one sort of responsibility, which can be located within a rather complex realm, for example, those responsibilities engendered by contracts or other mutual agreements that not necessarily be moral in the narrower sense, that is, they might not affect the life, limbs, psyche, and well-being of other people or living beings in general. These, ethically speaking, non-morally relevant responsibilities might be called ethically neutral. But they are still normative and prima facie to be obeyed by the respective persons who have taken over these non-moral responsibilities. In addition, these ethically neutral responsibilities can come into conflict with moral duties and ethically relevant obligations, i.e. moral duties in the narrower sense.
Responsibility is not just a concept solely to be used descriptively — someone is responsible — but is above all an evaluative attributive concept — somebody is held (to be) responsible. This introduces the normative, even ethical dimension of action in a stricter sense. The concept of responsibility itself is a diverse concept of structure or relation that is linked to assignment, attribution and imputation, a scheme that needs to be analysed and interpreted with respect to the following elements:

someone: the subject or bearer of responsibility (a person or a corporation)
is responsible for: something (actions, consequences of actions, situations, tasks, etc.)
in view of: an addressee (object of responsibility)
under the supervision or judgment of: a judging or sanctioning instance
in relation to: a (prescriptive, normative) criterion of attribution of accountability
within: a specific realm of responsibility and action.

Responsibility is, first, a concept that figures within a relational attributive norm (controlled expectation of action and behaviour). Responsibility means that a person must justify actions, consequences of actions, situations, tasks, and so forth in front of an addressee and before an instance of justification in respect of which he (or she) has obligations or duties of rendering justification, in accordance with standards, criteria, norms. The responsible person is accountable for his (or her) own actions, or, under specific conditions, for actions performed by others for whom he (or she) is vicariously responsible. (Parents, for example, are liable for a certain wrong conduct by their young children, perhaps in the sense of the violation of their supervisory duty.)

The concept of responsibility gives a structure to the social reality (of norms and actions) and to social relations. One can differentiate between the typical bearers of responsibility in terms of active roles and observer roles. Specifically, one imputes or attributes a special responsibility to oneself as an actor or to others from the perspective of participant, observer, or scientist, in relation to rules and norms that apply beyond the individual. The attribution (in a particular case) activates, that is instantiates, the general pattern of responsibility in a specific
instance. Imputation of responsibility lies as much in self-interpretation as in the interpretation of the actions of others.

As one distinguishes between a general responsibility for the results of an action derived from a kind of role responsibility and task responsibility, and from the point of view of legal and moral responsibility, a second aspect of interpretation becomes clear: the responsibility for the result of an action is at first just seen as a superordinate, schematic or ‘formal’ pattern; it must be related, through the contextual specifications of tasks or roles or through (universal) moral or legal interpretation, to the appropriate realm of substantial values and norms. Only then can its content and sense be comprehensible.

3. DIFFERENT TYPES OF RESPONSIBILITY

The most obvious and general level at which to describe responsibilities is referring to one’s being responsible for the results and consequences of one’s own actions. We may call this prototype (causally oriented) action responsibility. An agent is to be held responsible for the outcomes of his (or her) actions in an instance for which he (or she) is accountable. An engineer, designing a bridge or a dam, is responsible to the supervisor, employer, client and/or the public for the design in terms of technical correctness, safety, cost, feasibility, etc. Frequently, accountability questions are raised in negative cases, by failing in one or some of these respects. The breaking of a dam may be the result of false computations in statics or of careless, negligent, or even criminal work, or poor craftsmanship, or using cheap material. Therefore, it is important to emphasise negative action responsibility. Professionals, e.g., have a responsibility to the public to ensure high standards in their work and to avoid risks of disasters as far as possible at a reasonable cost. The responsibility to avoid mistakes, failures, pure quality of work, etc. is part and parcel of action responsibility. Further subtypes of action responsibility are shown in Fig. 1.

Very often, institutions or corporations act collectively. Therefore, there is a responsibility of institutional or corporate actions: it may coincide, though not be identical, with the individual responsibility of a person being in a representative position (the representing person or
role holder). Leadership responsibility with respect to outside addressees and instances is but one example of this kind of responsibility. The most usual case of responsibility, dealt with so far, is individual action responsibility, but if a group is acting collectively or individuals participate in a joint group action, there is a co-responsibility of partaking members. The responsibility for group actions is sometimes called collective or group responsibility.

The second level is comprised of the types of role and task responsibility (Fig. 2). In taking over and fulfilling a role or a task (e.g. in a job), a role-holder usually bears a responsibility for normal acceptable or optimum role-fulfilment. These role duties might be assigned in a formal way or be more or less informal. They can even be legally ascribed or at least be legally relevant. If the role-taker is a representative in corporate or institutional role patterns his responsibility may be connected with the associated institutional role responsibilities (as in leadership).

**FIG. 1.** The fist level of responsibility (action responsibility)
In addition, there is the corporate responsibility of corporations or institutions, if these have a special task or obligation to perform with respect to clients, the public, or members of the corporation. This type of responsibility can be a legal, moral, or neutrally organisational character. There may again be a coincidence with a group responsibility (of a group being in charge of the institution or corporation).

The third level of responsibility consists of types of universal moral responsibility (Fig. 3). First, there is the direct moral responsibility for the agent’s acts and results of his or her activities in a given situation. This responsibility is directed toward persons or living beings whose well-being is affected by the agent’s activity. More remote consequences of the agent’s activity — possibly combined...
with the impacts of other people’s actions or omissions — might amount to an *indirect* moral (co-)responsibility. Neglecting a safety check or a wrong approval stamp on an aircraft can result in loss of lives — as actually occurred in the 1974 Paris crash of a Turkish *DC 10*. In 1972, three inspectors of the *DC Long Beach* plant had wrongly approved modifications of the fatally dangerous cargo door locking system without any work on the cargo doors actually having been done [18]. More complex problems of indirect co-responsibilities are raised with the problems of synergetic and cumulative threshold effects mentioned below within interacting systems, e.g., in pollution or depletion problems.

Beside legal responsibilities, corporations seem also to bear *moral responsibilities*, particularly, if they refuse to improve dangerous conditions — as for example the management of the *Air New Zealand* in the case of the crash on the *Antarctic Mount Erebus* [19, ch. xi]. This is certainly a type of moral responsibility different

**FIG. 3.** The third level of responsibility (universal moral responsibility)
III

RISKS AND GOVERNANCE IN THE KNOWLEDGE SOCIETY

from an individual’s moral accountability. Corporate moral responsibility frequently coincides, but need not to be identical, with the moral co-responsibility of members of a decision-making board. Corporate moral responsibility therefore is analytically not to be confounded with moral co-responsibility of group members partaking in a collective action or decision-making process.

Caring responsibility certainly is not only role-bound but also morally relevant. It is the responsibility to take care for the well-being of a dependent person or living being by specific acts, but in the context of a general permanent obligation.

In engineering ethics codes — as in many other codes of science associations — the responsibility for the safety, health, and welfare of the public is stressed, even considered to be of paramount importance (cf. e.g. that of the Institute of Electrical and Electronic Engineers). This responsibility, a combination of indirect moral responsibilities mentioned above and of the obligation to abide by the ethics code of the respective professional society, is, on a second level, certainly a moral obligation too. Therefore, besides immediate action or impact oriented responsibilities there is also a higher level moral responsibility to fulfil contractual or role duties and promises and to live up to ethics codes of professional societies, etc. This obligation is certainly a universal moral one, if the fulfilment of a task, contract, or role does not contradict another overriding moral norm.

In general, thus, there exists a rather differentiated interplay of levels and types of responsibilities — the moral obligations being but one spectrum. Moral responsibility may be activated by a special type of action and in connection with a special role, but it is universal. It is not peculiar to a specific person or role, but would apply to everyone being in the same situation and/or role. Morality and moral responsibility are universal. Moral responsibility is individualised in that sense that it cannot be delegated, substituted, displaced, or replaced or shoved off from the respective person (or corporation/institution). It cannot be diminished or divided, dissolved or vanished, by being borne by a number of people. It is irreplaceable and not to be diminished in that sense.
4. PROBLEMS OF DISTRIBUTING RESPONSIBILITY

Problems of distributing responsibility are to be found today, in particular, in highly developed industrial societies shaped by technology and advanced economies. Personal acting seems to disappear behind collective, institutional, and group actions. Group and collective action is, on the one hand, the acting of and the acting within organisations (corporate acting) and, on the other hand, the action of many actors under strategic and competitive conditions; sometimes the actors are rather independent of one another. With respect to collective actions there are at least two classes of distribution problems, or rather, distributability problems (which may however overlap): a) the problem of attributing responsibility in the case of non-corporate collective actions of many actors (be they corporations or individuals); and b) the problem of attributing and distributing responsibility within the organisation with respect to internal corporate segregation of work and role assignment as well as with respect to the corporate division of labour and production [20]. Today and in the near future these problems are becoming extremely relevant and pressing, if only because of the impact of new systems-technological phenomena and processes.

Cases in which somebody fully and exclusively must take the responsibility are, as a rule, examined in philosophy. Yet there are also other cases of cooperative responsibility, collective/cooperative decisions, and collective action in general, that are gaining much more importance today, in which someone carries full responsibility by sharing responsibility, according to the degree of the individual cooperation or accountability. In other words, does the extent of the distribution of responsibility generally reduce the degree of moral responsibility?

Are all the people partaking and/or contributing in the overall system of the respective project in big technology or big science co-responsible — maybe to the extent in which they have office and power of decision and representative action? This idea might even be analysed in a somewhat operational manner by using graph theoretic models refining the respective hierarchies and influential individual decisions and actions of the people actually involved. In practice though, it is difficult to assign workable comparative measures of responsibility to the respective role takers, be they individuals or groups or corporations, etc.
In addition, one has to take into account that many a responsibility is negative, i.e. the responsibility for omission of detrimental actions and consequences, etc. Moreover, different sorts and types of responsibilities come in as to be mentioned and sketched out in the following. Again, the problem of the distinction between blameworthiness responsibility (after Ladd) and participatory (inclusive) future-oriented responsibility-orientation comes in here, too. It is of high importance that the assignment and attribution of responsibilities should be made operational, checkable, institutionalised and governed by unequivocal rules and laws.

As a provisional thesis, the following conclusion should be emphasised in regard to this problem: central in the model of the distribution of responsibility is the question of the distribution of normative and descriptive responsibility — according to a theory of action — and the reference of the collective responsibility to individual actors, which is dependent on the form of collective actions and causes; the respective form of collective action is also decisive and should constitute a criterion for distinguishing the various ways of attributing responsibility. A further point of emphasis is the distribution in terms of the respective responsibility types. If one draws a distinction between a duty to compensate and moral responsibility, then a division as a solution is more likely in the former case than in the latter.

Basic problems of responsibility distribution do not only arise out of the non-corporate collective action of many actors, but also out of specific strategic conditions, particularly in division of labour processes, that is, in labour segregation in the market external to corporations. The effects, results and side-effects of such actions have — and always have had — an increasingly explosive nature. The difficulty can perhaps be clarified with the help of examples and models of social traps which have to date been discussed mostly within the realm of individual rationality vs. collective irrationality [21; 22].

Negative external synergetic and/or cumulative effects may occur if a large number of actors act along the lines of individual need calculations (each being directly responsible for their own interests and acts). Particular components, which, as such are relatively, that is subliminally, harmless, can lead as a whole to damages or even to the loss of
highly appreciated ‘commons’ or public property. It is characteristic of these damages that property rights, i.e. individual rights to use (e.g. public) resources, are poorly or not at all defined or that they are not obeyed. Externalities are characterised by an incongruity between that outcome for which one is actually responsible and that for which one is made responsible or liable. To avoid external social costs, these could, for instance, be internalised – incorporated into the ‘production functions’ of a business.

With regard to this problem of responsibility two sub-problems emerge: first, the question of the distribution of responsibility for or in view of cumulative and synergetic damages, and second, the question of the responsibility for unforeseen or even unforeseeable consequences. With regard to moral judgment, it follows from the sub-problems that a personal action responsibility in such a case cannot in general be attributed to an individual agent alone nor, under many a circumstance, can the cause be attributed to a single domain. In the sense of task and role responsibility, and also in the moral and legal sense, the concerned individuals take over a co-responsibility corresponding to their active, potential, or formal participation, to their constituting or influential shares (to be determined in each individual case). An extension of the operationally manageable models of the distribution of (co)responsibility is, considering the consequences of collective action, imperative. Appeals to avoid social traps alone are not very useful. It is necessary also to introduce operationally available and efficient measures such as legal sanctions (product liability, collective responsibility, etc.), financial incentives to change production, determination of property rights for public goods, and so forth. The following remarks could serve as a guideline: as many laws, regulations, and prohibitions as necessary; as many incentives, and individual initiatives, and as much individual responsibility as possible.

A second layer of problems, involving responsibility distribution, includes the external responsibility of corporations – the responsibility of corporations and some or all of its members – and the internal responsibility in differently structured corporations (hierarchies, etc.) in terms of individual responsibility and co-responsibility, the delegation of responsibility, and so forth. The respective moral responsibility thus
III
RISKS AND GOVERNANCE IN THE KNOWLEDGE SOCIETY

turns out to be differentiable, in regard to (at least ideal) corporate action: corporations as such, corporation members, or the corporation and its members. The attribution of individual moral responsibility must be separately justified in each case. In general, one should make a distinction between the external (moral, legal, role) responsibility of the corporations and the (corresponding) internal responsibility distribution.

In addition to the role or task specific, the legal, and the action responsibility, corporations and institutions have a moral responsibility or accountability analogous to moral responsibility. This moral responsibility can also be understood as a second level responsibility; it would exist in addition to and independent of the individual responsibilities of the individual corporation member. Individual responsibility and corporate responsibility do not have the same meaning; they cannot simply be mutually reduced to one another. One type of responsibility does not replace the other. The following 10 working hypotheses are formulated to address this point.

1. It is only possible to lay down general distribution rules.
2. These rules are (ideally) to be applied to each individual case with extra provisos regarding special conditions.
3. Responsibility distribution is codetermined by the structures of the organisation, decision-making structures (internal decision units) and principles (decision-making on an individual and collective basis, principles of unanimity or majority). (This applies to the social structure in general too.)
4. The external responsibility in view of third parties, society, and with regard to their relevant agents is dependent on the corporate structure, on the influence and control of individuals, on the contributions of (individual) agents and in general on the internal responsibility distribution (in the sense of competency and task distribution and role-structure).
5. The internal responsibility for the fulfilment of tasks and roles with respect to colleagues is also primarily determined by the structure of the organisation. It is primarily accountability to superiors and a special case of role and task responsibility. (The observation of these duties is generally legally required, usually in form of a contract; it can also be morally required.)
6. Tasks and competencies and the responsibility connected with them can be delegated. In this case the responsibility of the delegating person does not (necessarily) end with the act of delegation. In general, however, it is not possible to delegate moral responsibility.

7. The (normative) responsibility for the consequences of actions is primarily a result of the individual contributions of action and production. The individual director or the Chief Executive Officer, as well as the performer or executive, would act indeed. (The execution of an order or a command does not, however, generally exculpate the performer.) The distribution of such an external or internal responsibility, which for its part is at times a prerequisite for other responsibility distributions, results from the respective contribution to the action or production and from the involvement of the actor or contributor.

8. Role and task responsibility results from formal as well as informal roles and tasks; the responsibility and its (external or internal) distribution depend on corporate structure, hierarchy and position.

9. Moral responsibility (in a narrower sense) as simply directly and personally attributable responsibility in view of external or internal addressees is actualised by their own actions and possibilities of action. Moral responsibility is a function of power, influence and knowledge. The degree of co-responsibility depends upon the strategic position or the respective positioning of an individual in a corporation. Responsibility would increase with the higher position, centrality or level: the higher the formal authority of the bearer and his or her status within the hierarchy or corporate decision structure the greater their responsibility is. The moral responsibility of A can be greater than, less than or the same as the responsibility of B. However, it is more appropriate to express responsibility distributions with the help of comparative statements than in percentage or other quantitative figures. It indeed is qualitative or judge. As we already stated, moral responsibility is not really divisible; however, it is open to sharing. It can be borne solely (exclusively) or jointly (each person fully or partly). In the distribution model of moral responsibility, both the individuality of the attribution and the intuitively justified non-disappearance of the co-responsibility must be taken into account even in the case of an increasing number of participants (which might factually tend to minimise the personal share of the responsibility).
III
RISKS AND GOVERNANCE IN THE KNOWLEDGE SOCIETY

10. The legal distribution of responsibility is dealt with separately according to legal or natural persons, to the respective civil or criminal law, to legal aspects of administration or aspects of constitutional law. In this way, legally the person may, as a rule, be held liable to third parties for those who act on its behalf according to civil law. Internally speaking, the organisation or corporation may have claims against natural persons (e.g. members).

To avoid or counteract the effects of large committee irresponsibility there are several possibilities, e.g. institutional measures of audiatur et altera pars and the consultation of external experts, review boards, consultants, etc., or the official introduction of a role of advocatus diaboli for dissenting opinions within the firm, the development of a culture of fundamental debate, the establishment of an official monitoring and planning sub-organisation as well as an office of internal control [23, p. 20].

Making corporations responsible can also constitute a first step of attributing responsibility for corporate action; the internal distribution problem within the corporation can be dealt with in a second step. The latter is difficult to deal with according to responsibility types.

5. PRIORITY RULES

In considering different types of responsibility and the respective conflicts rather commonly obtaining between them, Matthias Maring and myself have tried to develop priority rules. We would like to propose the following rules of priority which are arranged in a successive order and valid under prima facie conditions (that is, they may be overruled by higher and more binding moral obligations)\textsuperscript{12}.

1. To weight moral rights of the respective individual; these moral rights are pre-distributive rights overriding utility considerations.

2. To seek a compromise taking into consideration interests of everyone on an equal basis.

3. After considering the moral rights of each party, one should vote for the solution that causes least damage or maximises utility for all involved parties.

\textsuperscript{12} The first four rules are adapted from P. Werhane [24, p. 72–74].

160
4. Only after application of rule 1, 2, and 3, utility considerations are to be weighted against potential harm. Thus, in general: non-alienable (pre-distributive) moral rights are prior to considerations of *avoiding harm and damage* and these latter are *prior to utility* considerations.

5. In practically unsolvable conflicts, one should look for *fair compromises* (that is for compromises which involve proximately equally distributed or proportionally justified distributions of disadvantages and utilities respectively).

6. *General* (higher level) *moral responsibility* is to obtain a preference over restricted non-moral *prima facie* obligations.

7. Universal moral responsibility generally takes preference also over role and task responsibility.

8. *Direct* or primary moral responsibility, is usually, but not always to be considered *prior to indirect* responsibility for remote consequences. (This is true because of urgency, but needs occasionally necessarily to be modified according to the importance and impact of consequences and long range effectiveness).

9. Primary and *personal moral responsibility surpasses* the second level *corporate* responsibility.

10. The *public weal* and the common good precede all other specific and particular interests.

11. Safety goes on top of technical-functional and economic considerations (as, for instance, DIN 31.000 (Standard developed by *Deutsches Institut für Normung* (DIN). — *Ed.*) would postulate).

12. Global or continental as well as regional and local environmental compatibility are to be differentiated and have to be taken into account: system relevant or decisive environmental compatibility, and usually the more comprehensive compatibility, remain paramount. Sustainable development of ecosystems is particularly urgent on each of these levels.

13. Urgency of eco-compatibility and sustainability (especially in a system decisive context) precede economic utility.

14. Social and human compatibility would in the case of conflict have to precede environmental and nature or species compatibilities, which are, however, still to be considered as means of reaching for meaningful compromises.
III
RISKS AND GOVERNANCE IN THE KNOWLEDGE SOCIETY

15. Human and social acceptability surpass functional efficiency and utility.
16. Concrete humanity and humaneness should go in front of abstract requirements and formal universal principles (for a more detailed discussion see: [25; 26]).
17. Anticipated acceptability of and compatibility with the requirements for the survival and quality of life of future human generations should take very high priority.
18. Social and political planning at large should take into account endeavours to achieve a relative maximum of liberty and freedom of decision-making (openness and flexibility of large-scope planning) and largely equal opportunities for future generations.
19. In the same vein, a relative (potential) multiplicity of options for the generations to come should have a high priority (multi-options society), e.g., no important options should be blocked for them (avoiding total resource depletion and environmental pollution by favouring sustainable development).

Such rules of priorities are conducive to tracing and solving conflicts between competing types of responsibilities and also of different forms of risks obtaining in a particular actual situation. Whereas differentiating between the levels and types of responsibilities is necessary for the discovery and identification of conflicts, the rules of priorities could helpfully be applied in solving or at least regulating and assessing the respective conflict situations and in tracing their special sources. Yet, in this realm, much work has still to be done in the future.

6. PROFESSIONAL CODES OF ETHICS AND RESPONSIBILITY CONFLICTS

Professional regulations and rules of behaviour such as the codes of ethics should not and can not merely represent the current professional ethos [27]; ethical considerations, general social values and goals have also to be recognised as somehow obligatory or effective guidelines; the orientation to the common good(s) should be strengthened, various institutional controls and possibilities of obtaining and furthering corporate discipline should be included; particular notice should be
given to the question of the structural interrelations with the market and in the job and workplace (in businesses and corporations), to institutional corporate responsibility and to moral ideals (as non-legally enforced virtues). If the codes can find stronger and increased entry into the positive law and gain a kind of legal status, chances of the realisation of the codes would be enhanced: mere appeals and the sensitisation of individuals — especially of dependent employees — appear to be insufficient, as necessary as they are indeed. Institutional support is also required. Again, it remains important to include ethical and moral basics in education and technological training and to provide for accompanying measures, such as discussion and publication of case studies, the establishment of ethics committees, the design and implementation of professional vows, e.g. a kind of Hippocratic oaths, etc., and the provision of legal support for particularly ethical employees under pressure, so that the ethics codes prove to be other than pretences or ineffective alibis that have nothing to do with real life.

In particular, the ethics codes should set priorities and decision criteria to help solving the conflicts. With regard to responsibility conflicts in practice no isolated solutions or suggestions are possible for such cases; instead, applicability rules or practical guidelines on an intermediate level should be developed. These rules should differentiate, for example, between moral ideals (virtues) and moral (obligatory) rules [28]. A combination of individual and institutional measures seems necessary: to further and strengthen individual ethical competence is a necessary, yet by no means sufficient, step for the efficient solution of responsibility problems and conflicts. Moreover, an implementation of ethical considerations in law and politics would render this step more effective.

Most engineers and scientists work as dependent employees in industry. This implies the respective company codes, principles of management, and guidelines for specific jobs are relevant for them. These norms are usually discussed under the heading of business ethics. In practical job situations, technology related and science oriented questions and problems are combined, so that a clear cut separation of both of these is neither beneficial nor meaningful. Responsibility for technology and science (research) is particularly concretised in corporate acting in and for businesses.
7. SOME CONCLUDING REMARKS ABOUT TRENDS, AUSPICES AND CHALLENGES FOR RESPONSIBILITIES

Nowadays, systems orientation, systems engineering, and the establishment and maintenance of socio-techno-systems lead to an inseparable or not solvable social systems syndrome provoked by ever-growing, ever-accelerating, ever more encompassing technological measures.

There is a tendency to conceive of the whole world as technology-dominated, manipulated, organised, and shaped by techno-systems. Ecosystems and social systems become artificially-encroached-upon eco-techno-systems or eco-socio-technical systems. The trend towards a mega-information-system or mega-world-machine is enhanced by the meta-functionality of technological and operational processing and by the multiple applicability of processes, machines, and programs.

Not only technology and economics but also society and the pervasively artificial environments, encroached on by technological measures and systems of a rather large scale, do interact, the phenomena and effects of which got more and more intermingled and interwoven. Therefore, it makes sense — as mentioned in the beginning of this paper — not only to speak of socio-technical systems but also of eco-socio-technical systems and the respective information and network technologies.

By way of an interdisciplinary, formally systematised, functional integration and interrelation of generalised operations in all walks of life, we are getting a weaving together of mutual dependencies among all the realms of life that are susceptible to systematic technological, informational, and operational manipulations (including economic manipulation).

As I predicted already twenty-five years ago, systems technocratic tendencies will gain in importance. This means that different political, cultural, and human problems of modern societies will tend to be conceived of and discussed, as well as attacked (and maybe even partially solved) by systems-technological means. Systems-technological administrations are gaining momentum everywhere. Systems-technocratic dangers seem to be intimately integrated with systems-technological approaches.
The encompassing intertwinement of systems components within all-comprehensive socio-technological systems in general implies a certain susceptibility or proneness to some specific risks.

Systems-technological and informational-technological multiplication of impacts, whether of technological success or technological failure which obtain and grow. With the nearly unimaginable explosion of human technological power in the vast extension of energy technologies and systems and information technologies and systems, direct and indirect consequences both of success (domination and manipulation) and of failure (catastrophes, ‘normal’ or otherwise) will pose extraordinary problems to deal with. Indeed, they seem to grow beyond any potential human grasp (in the literal as well as in the figurative sense).

Ever-extending systems-technological trends and the enlargement of the power of encroachment in multiply distributed technological systems – big technologies, even worldwide technological systems – pose tough ethical problems, including responsibilities for the still-human-made technological world and events therein [29]. These tough questions arise and seem to present insoluble tasks of how to deal with, divide up, distribute, or share responsibility. Technology appears to take on the characteristic of a fate or destiny. At the same time, the survival of humankind, essentially and cumulatively, appears to depend on increasing technological, social, political, and ecological progress. However, ever-accelerating technological progress, on a worldwide scale – including globalisation effects in organisations and the economy – seem to take on a vast expansion and momentum. Responsibilities for general systems phenomena, for detailed consequences of technological intertwinements, even for individual decision-making at strategic points, can hardly be borne by individual persons, given current legal and moral responsibilities. Large realms of socio-technical development seem to evade responsible decision-making and any willingness at all to accept responsibility, especially the one for risk imposing and risk distribution. In the future, we have much more than hitherto to take into account the social dimensions and differentiations as well as distribution problems with regard to risking and responsibility.
III
RISKS AND GOVERNANCE IN THE KNOWLEDGE SOCIETY

References

ON RISKING AND RESPONSIBILITY IN THE 21st CENTURY


Concerns about the societal consequences of an unfettered expansion of (natural but also social science) knowledge are today being raised more urgently and moving to the centre of disputes in society — and thus to the top of the political agenda. In the preamble to the Charter of Fundamental Rights in the draft of the treaty establishing a Constitution for Europe that was adopted by consensus by the European Convention in the summer of 2003, we find the following statement expressing anxieties about the impact of science and technology on individuals and society and affirming the need by the European Union to engage in the future in knowledge politics: “...it is necessary to strengthen the protection of fundamental rights in the light of changes in society, social progress and scientific and technological developments...”

It is of course a truism that anxieties and concerns about the social consequences of new scientific knowledge and novel technologies are not of recent origin. Nor are elusive promises of the clear blessings of science for humankind, and the mitigation of human suffering that scientific advances entail. But what is now at stake is more than merely the vague feeling that a slowdown or a consolidation in the volume of the fabrication of new knowledge is in order.

Present-day society may be described as a knowledge society because of the penetration of all its spheres by scientific and technical knowledge. Past theorists of society as well provided designations for the assembly of those attributes of social relations they regarded as constitutive of the specific nature of their particular society. They therefore spoke of capitalist or industrial society. It is for quite similar reasons that we label the now emerging form of society as a knowledge society, since it is increasingly clear that knowledge is the con-
stitutive identity-defining mechanism of modern society and the (re)source of its economic activities.

The historical emergence of ‘knowledge societies’ does not occur suddenly; it represents not a revolutionary development, but rather a gradual process during which the defining characteristics of society change and new traits emerge. Even today, the demise of societies is typically as gradual as was their beginning, even if some social transformations do occur in spectacular leaps. But most major social changes continue to evolve gradually, at an uneven pace, and they become clearly visible only after the transition is already over. The proximity of our time to significant social, economic and cultural changes, however, makes it highly likely that what is now beginning to come into view is of extraordinary present and future significance.

1. KNOWLEDGE AND INFORMATION SOCIETY

The starting point for the analysis of the knowledge and information society was the 1960s [1; 2]. Above all, the programmatic contribution by Daniel Bell caused a re-orientation. In his *Venture of Social Forecasting*, he describes the outline of a so-called post-industrial society in which it is not material possession and industrial production that are the ‘axial principle’ but knowledge [3]. Current contributions to this subject refer implicitly or explicitly to Daniel Bell [4]. At the same time they link with the information-technological revolution and accompanying forms of the diffusion of new information and communication technologies. The increasing penetration of all areas of society with modern information technologies thus even leads to a redefinition of the social functions of speed, time and space [5].

Despite these interpretations an economics of the information society dominates. Thus the use of new knowledge is regarded first and foremost as a competitive factor for technical innovations, and studies on technology transfer or on so-called national innovation systems examine the resulting institutional arrangements primarily from this point of view [6]. In this case the focus is done on more than the change in the production structure and the use of technological innovations. This becomes particularly clear in the concept of the knowledge society. According to Willke, one can speak of a knowledge society provided
that all functional areas of society are knowledge-dependent and dependent on the production of new knowledge [7].

The discovery of an increasing basis of knowledge beneath modern society moves the question about the function of knowledge, in particular of science, as a carrier of the transformation process to the centre of society-theoretical consideration. This perspective goes back basically to classics like Max Weber. At the centre of his considerations stood the systematisation, rationalisation and ‘scientification’ of economy and bureaucracy. In contrast, Schumpeter [8] underlined the innovation strength and in this way also the creative character of the destruction of modern societies. According to him, innovations are produced by exceptional entrepreneur personalities through the foundation of enterprises and the creation of new markets. Knowledge is essential for this to happen, scientific knowledge, on the other hand, is an important but not indispensable condition. In the further development of this approach, newer contributions underline the integrated inclusion of scientific research. On the one hand, the basis is the emergence of research and development departments in economic organisations, on the other hand, the networking of innovative enterprises with research institutions. The decisive element is accordingly the use of distributed knowledge in ‘post-schumpeterian networks of innovation’ [9]. These forms of super-individual use of scientific knowledge for practical purposes are also emphasised within the framework of the investigation of successful innovation locations, so-called milieux of innovation [5].

Never theories of the knowledge society assume that knowledge represents social action potential [10, p. 31]. It not only makes new connections accessible in nature and society, but it at the same time produces and constructs new social realities and action options. Other authors stress that – basically – all orientations, norms, and values for action which were formerly unquestionably passed on become accessible to reflection [11]. At the same time the knowledge base leads to risk production, because the foundations are insecure and enable risky applications by the feasibility of recombining new knowledge. Information and knowledge societies are accordingly highly susceptible to new risks.
2. KNOWLEDGE ABOUT KNOWLEDGE

Among the reasons for the deficit in our knowledge about knowledge is that scientific discourse developed a kind of natural attitude toward its own knowledge. Over the centuries scientific discourse has generated a self-understanding of its knowledge that is both widely accepted among the public and that tends to systematically overestimate not only the objectivity of its claims but also the immediate and unmediated societal relevance of scientific knowledge or, the power of knowledge.

For the purpose of a better comprehension of the social (and economic) role of knowledge, one has first of all to arrive at a sociological concept of knowledge. This requires that one distinguishes between what is known, the content of knowledge, and knowing. Knowing is a relation to things, persons and facts, but also to rules, laws and programmes. Some sort of participation is therefore constitutive for knowing; knowing things, rules, programmes, and facts is ‘appropriating’ them in some sense, by including them into our field of orientation and competence. Rather than suggesting that knowledge is something that people have in their possession or are able to obtain with relative ease — a notion that is more appropriate for the term information — knowing is better seen as an activity, as something that individuals do. Therefore, knowing is *grosso modo* participation in the cultural resources of society.

Knowledge, ideas and information are most peculiar entities with attributes unlike those of commodities, secrets or money, for example. If exchanged, knowledge, ideas or information do enter other domains and yet remain within the domain of their producer. Knowledge is not destroyed in the process of consumption. Knowledge does not have zero-sum qualities. Knowledge is widely available. Unlike secrets, knowledge does not lose its influence when revealed. The apparently unrestricted potential of its availability does not diminish its significance but makes it resistant to private ownership in peculiar and unusual ways.

While it has been understood for some time that the ‘creation’ or production of knowledge is fraught with uncertainties and is difficult to predict and plan, the parallel conviction that its application is with-
out substantial risks and that its acquisition reduces uncertainty has only recently been debunked. Only lately have we learned that knowledge is not merely, as once widely thought, the key and the solution to the mysteries and miseries of the world, but is the becoming of a world. And, despite its reputation, knowledge rarely is uncontested. In science, its contestability is seen as one of its foremost virtues. In practical circumstances, the contentious character of knowledge is often repressed and/or conflicts with the exigencies of social action. The introduction of knowledge into a particular situation (by specific actors) does not necessarily mean that it will have definitive consequences, as often thought. Finally, while it is very reasonable indeed, and in some sense even urgent to speak of the limits to growth in many spheres and resources of life, the same does not appear to hold for knowledge. Knowledge has virtually no limits to its growth.

I would like to define knowledge as a capacity for social action. In this sense, knowledge is a universal phenomenon, or an anthropological constant. Our choice of terms derives from Francis Bacon’s famous observation *scientia est potentia* or as it has often been translated in a somewhat misleading fashion: *Knowledge is power*. Bacon suggests that knowledge derives its utility from its capacity to set something in motion. The term *potentia* or capacity is employed to describe the power of knowing. Knowledge, as a generalised capacity for action, acquires an active role in the course of social action only under circumstances where such action does not follow purely stereotypical patterns or is strictly regulated in some other fashion [12]. In knowledge societies, the volume and range of situations that require decisions multiplies immensely.

Whatever the particular importance of scientific knowledge in modern society generally and in the economic system in particular [13–15], its significance cannot be derived from the fact that it constitutes a capacity for action. In that respect, scientific knowledge does not differ from everyday knowledge or religious ‘knowledge’. As a matter of fact, scientific knowledge should not be seen, as a resource that lacks contestability, as everyday knowledge does, or is not subject to interpretation and can be reproduced at will. Science is incapable to offer cognitive certainty. This is to say that scientific discourse has been
depragmatised. It cannot offer definitive or even true statements (in the sense of proven causal chains) for practical purposes but only more or less plausible and often contested assumptions, scenarios and probabilities. Instead of being the source of reliable trustworthy knowledge, in this way science becomes a source of uncertainty. And contrary to what rational scientific theories suggest, this problem cannot be comprehended or remedied by differentiating between ‘good’ or ‘bad’ science (or between pseudo-science and correct, i.e. proper science). After all, who would be capable of doing this under conditions of uncertainty? If these observations about the systemic limits of the power of knowledge are correct, one must transform, as it is attempted here, ontological and epistemological questions about knowledge into sociological ones.

The extraordinary importance of scientific and technical knowledge does not primarily derive from its peculiar cultural image that represents it as an essentially uncontested (or objective, that is, as reality-congruent) body of knowledge claims. The tremendous importance of scientific and technical knowledge in developed societies is related to one unique attribute of such knowledge, namely that it represents **incremental** capacities for social and economic action or an increase in the ability of **how-to-do-it** that may be **privately appropriated**, if only temporarily.

It seems to me that the notion of knowledge as a capacity for social action has the advantage that it enables one to stress not merely one-sided but multifaceted consequences of knowledge for action. For example, the term ‘capacity for action’ signals that knowledge may be left unused or, may be employed for irrational ends. The thesis that knowledge is invariably pushed to its limits, or realised and implemented almost without regard for its consequences, constitutes a view, which is quite common among some observers, e.g. those concerned with the nature of technological development or better, technological determinism. However, by assuming such automaticity in the realisation of technical and scientific knowledge, the notion that science and technology inherently and inevitably force their own realisation in practice fails to give proper recognition to the context of implementation and the extent to which the utilisation of knowledge is dependent
III
RISKS AND GOVERNANCE IN THE KNOWLEDGE SOCIETY

on situation-specific conditions. In other words, the realisation of knowledge in economic or business contexts is embedded in a web of social, legal, economic, and political circumstances. That is, the definition of knowledge as a capacity for action indicates strongly that the material realisation and implementation of knowledge is generally dependent on specific social and intellectual contexts.

Inasmuch as the realisation of knowledge is dependent on the active elaboration of knowledge as a capacity for action within specific social conditions, a first direct and important link between knowledge and power becomes evident: The control of the relevant conditions within which knowledge is utilised requires social power. I will now move to the question the emergence of knowledge politics.

3. KNOWLEDGE POLITICS AS A NEW FORM OF GOVERNANCE

I will first describe and delineate the notion of knowledge politics as a new field of political activity. Knowledge politics as conceived here is a new field of political activity for a number of reasons recognising of course that given efforts of various sorts in the past designed to promote or restrict novel knowledge claims, political, commercial and diplomatic activities designed to control knowledge is hardly a new activity. To render information or knowledge as private, as secrets of the state or a corporation is of course an age-old activity designed to restrict the use of knowledge.

Thus to briefly enumerate a number of reasons why knowledge politics is a new field of political activity is of importance. The main reasons I would like to adduce have to do with major societal transformations that set knowledge politics apart from often successful attempts to control knowledge in the past. Among the societal transformations I have in mind is, on the political place, (1) the shift from centralised, often authoritarian or elitist societies to much more broadly based participatory societies, on the cultural and distributive plane, there is (2) the shift from a monopoly control (for example, by the Church and the university) to a market-based control of knowledge (which does not mean that judgments about new knowledge exclu-
sively rely on utilitarian considerations but on a broad range of cultural values that find their way into the market place), and there is (3) the institutional shift from a largely materially-based economy to a knowledge-based economy.

Taken together the societal transformation alters the social role of knowledge in fundamental ways. The up-shot of these transformations in society is that the regulation of the relation between science and society today is filtered through processes that are more democratic (scientists alone should not make the decisions about the social implications of their work) than was the case in any past conflicts between science and society and that there were far fewer rationales (for instance, values that are demanded to be taken into account) and complicated opportunities for the regulation of novel scientific knowledge (the latter also applies to a rapid extension in regulations and rationales such as informed consent that pertain to science and research policies, that is, as I will define it, the production of scientific knowledge and technologies).

When it comes to the utilisation of new capacities for action (that is, knowledge), knowledge politics does not have to be restrictive a priori; my focus, however, will be on efforts to anticipate the effects of new knowledge on social relations, and attempts to control its impact.

4. THE EMERGENCE OF KNOWLEDGE POLITICS

On the origins of modern knowledge politics. Why are knowledge politics emerging? Why are there growing efforts to exert power over knowledge? Why are we, perhaps in growing numbers, not prepared simply to accept the apparently ‘natural’ progression; to take for granted the relentless, exponential development of scientific knowledge, of technical artefacts and their application, as a key to unlocking the mysteries of the world, as a release from pain and freedom from suffering, as the basis for a better and more just society, as a means to greater prosperity; or to believe that more knowledge represents the master key to an emancipation from all kinds of troubling ills and harsh constraints? The straightforward, or at least traditional, assumption that specialised knowledge ought to command respect in general, and that any increase
in knowledge automatically brings with it an increase in benefits to humankind in particular, is becoming vulnerable and fragile.

The idea that the *uselessness* of science is a virtue and that the uses that humans “have drawn from science have contributed to their misery” [16, p. 21] is still only a marginal voice. But the optimistic faith that science whatever its specific function gives satisfaction and expansion of ‘knowledge’ might even prompt a displacement of politics and ideology uttered with some confidence in the 1950s and 1960s, during an era of unprecedented economic growth, has been thoroughly demystified.

Thus, if one no longer regards the fabrication and use of additional scientific knowledge as a humanitarian project, as in harmony with the aspirations of different publics and “as an unquestioned ultimate good, one is willing to consider its disciplined direction” [17, p. 23]).

The fear that we know too much and that we are about to assume the role of God (or are about to commence a “self-transformation of the species” [18, p. 42]) increasingly replaces the concern that we do not know enough and that we are to a large degree poorly informed. Apprehension and alarm replace the rhetoric of hope and the conviction that new knowledge enlarges our sense of human dignity and autonomy that, until recently, dominated societal discourse about new developments in science and technology in modern societies.

Moreover, the social relations between the scientific communities, scientists as experts, society and the public have changed. Scientists no longer almost automatically inspire trust. On the contrary, we believe less and less in experts, although we employ them more and more. The growing policy field of setting limits to the presence of certain ingredients in foodstuffs, of safety regulations, risk management and hazard control, has often had the unanticipated effect of ruining the reputation of experts and the notion of certainty once closely allied with knowledge. The work required to transform a contested matter into an uncontested issue is linked to the ability of experts to mobilise social and cultural resources in *relevant* contexts. The boundaries of science are less definite and the channels of influence on science, or as some might see it, the economic and political levers of intervention in scientific affairs have become more evident but also more legitimate.
All of this signals the end of the golden age of science and technology in which it served as a symbol of secular progress and civilization advance and enjoyed enormous freedom and autonomy of inquiry. The golden age of science and technology ended in the early part of the last century. But its demise became more visible only since the end of the Second World War.

The emergence of knowledge politics occurs with some delay in response to the exceptional growth and speed with which knowledge and technical capacities are added in modern societies. Appropriating Adolph Lowe’s [19, p. 563] astute insights, it is a change from social realities in which things simply happened (at least from the point of view of most people) to a social world in which more and more things are made to happen. Advanced society may be described as a knowledge society because of the penetration of all its spheres by scientific and technical knowledge.

The boundaries of what at one time appeared to be solidly beyond the ability of all of us to change are rapidly moved and penetrated. This applies, for example, to the possibility that we may come to review the validity of the Lamarckian idea that deliberately induced genetic transformations in one individual may in fact be passed to one’s offspring in the future. The result is that new knowledge and new technological abilities as capacities to act are also perceived as a peril posed to every woman, man and child; not merely as a threat and a burden to privacy, the status quo, the course of life and the understanding of what life is, but also as a danger to the very nature of creation.

The concern we know too much is no longer as was the case in the seventies and eighties that we are amassing a large store of trivial and practically irrelevant knowledge at a high price that promises no useful gains. This fear has been replaced by concerns about the accumulation of novel knowledge that appears to have questionable social consequences. In that sense, at least, current concerns about science represent a return to conflicts that science has experienced in the past.

But in contrast to past disputes, when discussions about the societal consequences of science were driven by complaints about its lack of social and economic utility in tackling major social problems of the day, today concern is focused on a surplus of effects — especially with
III

RISKS AND GOVERNANCE IN THE KNOWLEDGE SOCIETY

respect to traditional world views, the established life-worlds and the limits to what can be manipulated in nature and society.

It would be a mistake to conclude, however, given the prominence assigned to developments in molecular biology that the issue of knowledge politics is either confined to these fields of science or is a wholly civilian matter. Knowledge politics extends to military use and knowledge politics in its military version extends to fields other than biotechnology and information warfare; it could include, for example, the field of meteorology (weather as a weapon). In addition, other fields of science and technology will likely generate new knowledge that will be subject to regulation and control, for example in the field of medical science, pharmacology, demography or criminology.

How is knowledge politics emerging? The economic, political, legal, and societal importance of knowledge policy in this century escalates because of the following:

1. We are faced with new forms of knowledge. The route from basic research to applied research and to commercial application is in some fields of science, such as molecular biology, particularly short and direct one. The difference between basic and applied research diminishes.

2. The identification of a gene constitutes the test for a particular gene. The transformation of knowledge is co-determined by an increasing specialisation in science and a massive infusion of private and public funds in support of particular research fields. The limits of what is feasible in practice are decisively displaced. Knowledge itself is transformed. Knowledge now emerging is more powerful in shifting or destroying the boundaries of the possible; for example, the techniques of genetic engineering make DNA subject to direct human access and control. The bio-utopian future, as it is promised, amounts to a control of the biological destiny of mankind.

3. The rapid increase of knowledge multiplies, by definition, our capacities to act, for knowledge represents capacities of action or models for reality that considerably enlarge our options for changing social realities. The economic, political, and social centrality of knowledge grows. For the political system, constantly on the lookout for political
topics, new scientific knowledge constitutes problems that have to be dealt with politically. The enlarged capacities to act bring about an increase in concerns about the various effects of as well as access to control, distribution, benefits and costs of new knowledge. Nothing appears to be impossible anymore. The prevailing public sentiments about the benefits and costs associated with our enlarged ability to alter the environment and society are changing.

4. Although every past technical invention and scientific breakthrough has produced responses of exhilaration as well as deep concern and dire predictions about its social or psychological impact, there is a tendency to shift, when it comes to the assessment of the role of science and technology in society, from a willingness to engage in a posterior cleanup towards efforts to reduce or even prevent harmful effects. The rapidity with which incremental knowledge is produced has not only increased the awareness that knowledge becomes the motor of social change, but has also heightened the sense of alarm, risk and uncertainty that are seen to be associated with the transformative capacity of knowledge.

5. Similarly, even an element of outright hostility may be one of the visible responses from the general public — for example, with respect to the heightened tempo of scientific and technological ‘progress’ and its anticipated effects. During periods of accelerated social change, demands for planning, regulating and policing the forces of change always grow as well. Rapid social change generated by knowledge is no exception.

6. Efforts to regulate and control incremental knowledge cannot be uncoupled from time and place. As a matter of fact, the importance of the context and the boundaries of the context within which efforts may be launched to control knowledge immediately point to one of the dilemmas knowledge policy inevitably faces, even in a world that is supposedly shrinking as the result of the forces of globalisation: namely the limits of control, legitimacy and authority to police knowledge across contingent boundaries and borders.

Moreover, one can ask, would knowledge permitting an extension of the average human life expectancy not be applied almost instantly after it had been discovered as a capacity for action? Once medical
intervention is possible prior to the onset of a disorder, why wait until someone falls ill?

But should we not fear, on the other hand, a much improved predictability of individual life expectancy or therapy preceding an illness? Might such predictability of the life span of the individual not eliminate much of the spontaneity of action or lead to horrible mistakes?

The politics of regulating new knowledge and novel technical devices is bound to upset the established line of political conflicts, and in many instances may well create 'strange political bedfellows' in the form of novel and quickly changing political coalitions.

Central emotionally and politically charged debates in modem society about the authority of science, medicine or experts, but also about politics and the control of the body, the desirable relations between nature and society, the meaning of technology and human agency, the linkages between ethics and knowledge will not only be symbolically recast and heavily strained but also re-invented.

5. KNOWLEDGE POLITICS IN ACTION

Modern knowledge politics or governance of knowledge is about:
– attempts to systematically channel the social role of knowledge;
– the generation of rules and enforcement of sanctions pertaining to relevant actors and organisations;
– affixing certain attributes (such as property restrictions or legal prohibitions) to knowledge; and
– generally, restricting the application of new knowledge and technical artefacts – this likely being the most controversial strategy.

Knowledge politics do not in principle exclude policies to promote the use of scientific knowledge or technology.

A pertinent, recent example as well as a signifier of the complex nature of contemporary knowledge politics is the restriction in at least some European countries to employ the technique of pre-implantation genetic diagnostics.

Another example refers to the establishment of ethic councils to monitor such developments. Among others, the UN is currently negotiating a Treaty to outlaw reproductive cloning.
Yet another example is the introduction of restrictions in the Deliberate Release Directive (of genetically-modified organisms in the environment) following a moratorium period.

Knowledge politics is clearly not confined to a particular brand of science, e.g. the field of molecular biology.

Other fields of science and technology which are likely to generate new knowledge that will be subject to regulation and control include the fields of nanotechnology and cognitive science.

Furthermore knowledge politics are not merely circumscribed by ethical convictions. Information advantages are the key to economic interests and equally sought after for strengthening military supremacy. Governments at multiple levels will have to engage in new political activity and will be held accountable to new standards.

But the state clearly will not be the only relevant actor in the context of knowledge politics. Economic interests and actors will play a significant role as social movements and NGOs.

Public conflicts, frictions and disputes over the implementation of knowledge, which are seen by at least some as attacks on science and the deliberate creation of excessive fear among the public, will no longer take place mainly \textit{a posteriori}.

It will also have to contest with globalisation processes, the loss of sovereignty of the nation-state, and conflicts that are bound to arise between national and transnational policies.

6. THE REGULATION OF KNOWLEDGE

I will try to offer some tentative answers to questions about the regulation of knowledge in modern societies such as the possibilities, foundations, prospects and effectiveness of modern knowledge politics in an increasingly globalised world. My answer will be a sceptical one when it comes to the effectiveness of such policy designs or the practical resistance organised in civil society.

So, is a form of restrictive knowledge politics even imaginable and will it work? For example, would knowledge permitting an extension of the average human life expectancy not be applied almost instantly after it had been discovered as a capacity for action? Once medical
intervention is possible prior to the onset of a disorder, why wait until someone falls ill? Do we want to live in a world in which control of all conquerable genetic defects is possible? In what ways will the state or other corporate actors intervene between prospective parents and their ability to decide the genetic makeup of their children? Should the prerogative of individual autonomy prevail in these cases or should collective prerogatives govern decision-making about how to approach the potential utilization of new knowledge?

All of these issues become even more perplexing in light of the observation that we are in fact living in an age of deregulation; or that those who advocate the withdrawal of the state by pushing a neoliberal policy agenda have won the day. At least within the developed world, there appears to be no exception to the strong support for neoliberal policies that promote deregulation efforts, be it by freeing labour markets, by lowering taxes, by withdrawing from strong welfare-state policies and possibly advancing but small, reluctant doses of knowledge politics.

In an unambiguous observation about the function of the societal regulation of power, John Kenneth Galbraith offers the following proposition: “The precision and effectiveness of the regulation of the use of condign power are, perhaps, the clearest index of the level of civilization in a community, and they are extensively so regarded in practice” [20, p. 83]. If this is the case and, as can be asserted, among the growing sources of power in modern society is new or additional knowledge, then the regulation of the use of such knowledge becomes an indicator of the civility of social relations in modern society.

Nonetheless, knowledge politics will be a strongly contested form of regulative politics. But that there will be knowledge politics is a certainty. A certainty is also that there will be winners and losers. There will be winners and losers as a result of the social changes brought about by new knowledge and technical artefacts that are introduced into society and winners and losers as a result of successful efforts to prevent the realisation of new technical artefacts and knowledge. Efforts to regulate knowledge will hardly ever be consensual. The changes brought about by new knowledge and technical artefacts will threaten established social patterns, trends and meanings.
We should not have any excessive hopes, however, that our ability to anticipate (in any robust sense) the social impact of the use of novel capacities to act (knowledge) will be very impressive. Similarly, knowledge politics will be enacted even though the ability to forecast the consequences of intervention in systems other than the political system is likely quite limited. Knowledge politics will have to contest and reckon with globalisation processes, the loss of sovereignty of the nation-state, and conflicts that are bound to arise between national and transnational policies.

7. PROSPECTS

The massive difference in and additions to human capacities to act within just a century may well be represented by two bookmarks. In 1945 humans had produced the capacity to destroy life on earth on a grand scale, while by 2045 it might be possible to create life on a grand as well as a minute scale.

Thus, it seems, the speed with which new capacities to act are generated forces us to alter our conceptions of who we are and, even more consequentially, may in fact change who we are.

The promises and anxieties raised by these prospects are the motor of knowledge politics in modern societies.

The political landscape is changing as a result of new scientific discoveries and new technological innovations. The kind of regulative knowledge politics now in demand is new. Present mechanisms and institutions are unprepared to cope.

But governments will be forced to face up to new problems and novel standards. They will have to develop new rules and they will be judged as to whether they are successful in meeting new goals. The nation-state will continue to be of consequence, but less so as an autonomous corporate actor that shapes knowledge politics.

The knowledge politics of the nation-state will frequently have to or desire to enact policies of wider global institutions, international treaties and social movements.

However, and this can also already be detected, the tempo with which solutions to the new problems are found will be far outdistanced by the accentuation of new political challenges.
III
RISKS AND GOVERNANCE IN THE KNOWLEDGE SOCIETY

With the advent and the ascent of knowledge politics on the political ladder of importance, one can expect that the general lack of attention the scientific community has paid to what is done with their discoveries in society will also change.

The scientific detachment and autonomy that began as a useful barrier against threats to the unencumbered, single-minded pursuit of knowledge will increasingly be seen as an isolating boundary and challenged by the consequences of knowledge politics for scientific work.

The atomic bomb, of course, shattered the isolation of science first. But the new capacities of knowledge, and their apprehended impact on individual and society and enlargement of what is possible, will be an equally powerful force that should transform the relations between science and society and the social engagement of scientists.

Current public debates already demonstrate that in increasing members, scientists are leaving their laboratories and studies in order to take part in political debates about the future of science and the social consequences of scientific developments.

Past legal and regulatory practices will probably prove to be of limited value as a guide and precedent for future practices. The disputes, debates and dilemmas over what discourse (e.g., political, normative, military or economic considerations) should be decisive in decisions that draft and enact knowledge policies are bound to escalate.

8. CONCLUSIONS

The growth of knowledge and technological capacities is not merely prompted by sheer curiosity to penetrate the secrets of nature and society, but also driven by economic and military interests.

In deploying novel knowledge and technical artefacts for economic growth and military purposes, the social costs and environmental burdens produced are treated as exogenous and ex post developments. As the term ‘exogenous costs’ signals, perceived burdens and costs are mitigated as far as possible only after the realisation of new knowledge.

Knowledge politics as defined here is not about adaptation to, a ‘cleaning up’ or a dismantling of undesirable consequences of polluting
products for example by the state or corporations using technological innovations. Knowledge politics therefore is unlike policy debates and scientific disputes concerning mitigating climate change where conflicts centre on the need to respond to damages already in evidence, however contentious such evidence might be. Knowledge politics is about the desirability of anticipated consequences of new scientific knowledge or innovative technical artefacts attempting to move into society. The products of the so-called converging technologies would be an importance case in point [21].

Thus, a growing gap between perceived benefits and burdens will of course enhance calls for the proactive regulation of new knowledge and technological capacities. Vanderburg, for example, refers to the existence of a ‘labyrinth of technology’ in modern societies; that is, the extent to which these civilizations are trapped within the dilemma of first creating burdens of various kind as the result of making use of science and technology and then mitigating these costs. The labyrinth of technology calls for the “creation of an approach for the engineering, management, and regulation of modern technology that proactively prevents social and environmental burdens” [22, ch. xi].

Knowledge has also become an intensively debated political issue because of its role as an immediately productive force in the knowledge-based economy and because of the highly contested issue centred on the question whether knowledge should be treated as a commodity or a public good.

The by now constant and controversial public debates about the consequences of new scientific knowledge and technical artefacts and calls for their regulation and administration are expanding the public sphere in modern societies. The organisation of the public sphere is changing, participatory demands and contribution to the regulation of knowledge are bound to become more routine and, more generally, we will see significant transformations of the political culture and the realignment of the major institutions of modern society as the result of the emergence of knowledge politics as a new field of political activity. Whether a new “social contract for science” [23, p. 284–300] is possible or desirable the future will have to decide.
III
RISKS AND GOVERNANCE IN THE KNOWLEDGE SOCIETY

References

GOTTHARD BECHMANN

THE EMERGING OF A NEW GOVERNANCE OF KNOWLEDGE


Nowadays nanotechnology is viewed in all developed countries as the technology of the future that can save the world. There now is even talk of a nanotechnology revolution. Indeed, nanotechnology has changed the way the wider public sees the world in one go and scientists, too, have suddenly discovered the intermediate sphere of nanophenomena that lies between the world of quantum mechanics and the macroworld. That does not mean that scientists had no idea about this sphere before, but the essence of this scientific revolution is that it does not only rapidly change scientific notions, but involves many different spheres of our everyday life. Nanotechnologies are now taught at schools, teachers encourage their students to continue education in this promising field of science and technology. Aged people are promised a chance to recover from diseases that were deemed incurable before, and even an opportunity to prolong life. Entrepreneurs dream of huge profits from introducing nanotechnology innovations into industry; politicians hope for progress in the defence sector and to find solutions to many social problems; scientists anticipate that this will lead to an enhancement in the prestige of science in modern society and increased financing of applied and long-term basic research; and all of them dream of achieving social well-being for everybody. Finally, it should be mentioned that nanotechnology possesses a huge, Jules-Verne-like futuristic potential (Fig. 1).

These expectations are however clouded by insights about unforeseen negative consequences and risks associated with the introduction of new technologies. Anyhow, both become the subject of major natural science, engineering, social and humane research, at least in the Western countries. More and more often we are hearing and reading about the development of special nanoethics (see, for example: [2–5]).

So what is new that nanotechnology has brought to our world and that requires the development of special ethics?
Scientists believe that since nanoontology* enables us to model a process, we shall necessarily be able to receive it and actually make it a reality. However, together with optimistic prospects of a bright future for humanity the scientists are beginning to pay more and more attention to the possible negative consequences of such interferences in delicate natural nanostructures (for example, in neuron processes that take place in the human brain) [6]. Expert research, conducted by the Bureau of Social Evaluation of Technology at the German Bundestag, analysed scientific, technical, social and ethical aspects of nanotechnology, and, in particular, what dangers we face from the penetration of practically non-registrable nanoparticles into the human lungs and even through cell membranes. Nanoparticles may accumulate in different parts of the human body: in the nasal cavity, trachea, bronchi, lungs and so on. Nanoparticles and nanomaterials produced with the help of nanotechnology and its real and potential applications enter the human body (the bodies of people, working at nanoenterprises, and their consumers, i.e. the population) through drinking water, fall-out, air and food products [7; 8, p. 354]. All of the above places nanoethics at the

**FIG. 1. Nanotechnologies**

* Nanoontology represents an integration of different theories on the base of the unified picture of the world which is ensured by nanotechnologies.
forefront of ethical discussions and many other debates, including specialised scientific discussions in the sphere of nanotechnoscience.

First of all, it should be noted that such an approach (discussion and research of social and ethical issues within the framework of science and technology or, as often termed now, technoscience) is a peculiarity of the postneoclassical science. “The postneoclassical type of scientific rationality enlarges the area of reflection over actions. It considers the way knowledge, received about an object, correlates with the peculiarities of tools and operations of actions, as well as value-purpose structures. At that, a connection is elucidated between intra-scientific goals and social values and targets that are not within the scope of any science” [9, p. 327]. Technoscience is a new sphere of scientific and technological activity that is distinguished by a new way of thinking and practice. This is an important step forward on the way to changing science from a cognition tool and knowledge storage into a transformative type of activity that enables us not only to imitate nature, but to create objects, phenomena and processes that have no natural analogues. The power of modern technoscience and many dangers, as well as essential and unforeseen consequences are concealed in this. Therefore, its development is organically connected with increased social responsibility and the inclusion of a whole range of ethical problems in the very ‘body’ of the new science, while earlier it was only used in the context of the implementation of scientific achievements. This is well demonstrated by nanotechnology: even specialised reference books include chapters on social and ethical problems. For instance, The Handbook of Nanotechnology [10] includes a special chapter called “Social and Ethical Implications of Nanotechnology” with a subchapter “Sources of Ethical Behaviour” (38.4).

Thus, ethical problems of technology have been coming more and more to the forefront lately in connection with the enhancement of the social responsibility of the scientist, engineer and designer in modern society since the ultimate goal of technology is serving people without damaging other people and nature. In this connection the issue of ecological, computer, economic and other types of ethics is actively discussed today. We can also class nanoethics in this category, as it is distinguished by uniting scientific, technological, and economic ethics. This
is because very often it is impossible to differentiate experimental research, engineering design, and nanosystems fabrication in time and space. Today, when nobody knows for sure, even from a special scientific point of view, what impact nanotubes may have on our lives and what results may be achieved by introducing different nanoimplants into the human body and even the brain, the number of newly-founded companies that offer nanoproducts is growing tremendously. "At present special attention is paid to public discussion of risks inherent in artificial nanoparticles. This sphere opens a huge potential market for the exchange of nanoproducts. New products based on new properties of nanomaterials may be created by admixing nanoparticles or covering the surface with a special nanoparticle layer, for example, in cosmetic products or in sunblock creams" [11]. As of the end of July 2007 about 300 consumer products including sunblock creams, toothpastes and shampoos were produced based on nanotechnologies in the USA. At present FDA (Food and Drug Administration) allows their sale without a special label “Contains nanoparticles”. At the same time many researchers claim that such nanoparticles may cause inflammatory and immune response reactions by penetrating into the human body [12–14]. There were no such issues with professional ethics before nanotechnoscience appeared, since scientific, technological and economic ethics could be easily differentiated and referred to different professional communities.

What is the environment in which professional ethics is realised? We think, this environment is distinguished, primarily, by the presence of a well-established scientific and engineering society that ensures moral responsibility of its members in their professional activity; second, by the development of engineering consciousness (engineering self-consciousness) formed by a system of scientific and engineering education; third, by the existence of social structures that create conditions for relevant and moral orientation of scientists and engineers. However, these are requirements that are not satisfied within nanotechnoscience. There is no well-established professional community in this field yet and this is explained by its interdisciplinary nature; but the system of special education, in this country (Russia. – Ed.) at least, does not pay enough attention to ethical issues. There are no spe-
The same responsibility problem arises in the event of absolute unpredictability or unforeseeability of the side effects of a new technique and technology introduction. How can we ascribe responsibility for something that was not known? “When proposing a thesis of insufficient predictability, we shall not forget that many aspects of technical development may be predicted or rationally foreseen. <…> Activity in the environment where risk can not be excluded, poses stricter requirements upon activity in relatively safe conditions” [15; 16]. Moreover, scientific and technological ethics is not limited to the professional ethics of a scientist, engineer or designer, it also presupposes an ethical attitude towards the use of technology that is relevant to all of society and all its members individually. Careless use of complex technology by its users can lead to catastrophic consequences in our highly technicalised world. Besides, technology may be used for other purposes than for which it was invented, for example, by terrorists. This poses additional risk, connected with the functioning of technology in the modern society that becomes dependent upon it. At the same time it increases the responsibility of the person who “takes a specially dedicated position in the course of nature, since only he is able to cognise ‘nature’, which is to successfully produce explanations and predictions.
on the basis of his own theories and successfully manipulate parts and objects of nature with the help of his own knowledge, as well as to adapt it to his purposes and exploit it. This power — even if it is a negative destructive technological power over natural subsystems — is still an expression of his special position. However, power and knowledge induce responsibility, the special responsibility of the knowledgeable and the powerful. This responsibility spreads not only over other human beings and their future, but over the whole living world” [17, p. 61].

The most vivid example of an increase of such responsibility is the development of nuclear science and technology. One of the first prominent German technology philosophers, Friedrich Dessauer, a radio-logist by trade, devoted one of his books Atomic Energy and the Atomic Bomb to this issue. At the end of his book he writes, “Reliability and safety in the sphere of natural-science research and technical construction are the factor that shapes the current generation and the new layer of society that grows in the sphere of natural-science research and technology — the layer of society that will seize public power. <…> Natural-science research and technology form world history”. He notes, though, that natural scientists and engineers often lack interest in the preservation of any historical or humanistic traditions. “The range of public issues, connected with discovery and technological acquirement of the break-up energy, is not a national range of issues anymore; these are the problems of the whole world community” [18, p. 284, 286, 292]. This fact significantly changes the way the problems of nuclear power engineering safety and the responsibility borne by scientists, engineers and politicians for that safety, are discussed. No references to the public, economic or technological expedience and higher scientific interests can justify the moral and material damage that can be done to human beings and the environment. The same is true for nanotechnology.

Many schemes in nanotechnology do not provide for separation between research, technology development, and design. With that, engineering techniques, purpose orientation and methods penetrate into the sphere of science and transform the traditional norms and ideals of research, which on the one hand enables us to fill the gap between
III

RISKS AND GOVERNANCE IN THE KNOWLEDGE SOCIETY

research and design and on the other hand enhances the level of social responsibility of nanotechnoscience. It demonstrates its similarity with systems engineering aimed at research and design of large engineering systems; the only difference is that nanosystems engineering deals with micro- and nanosystems that are ‘invisible’ or ‘imperceptible’ for a normal human being (non-expert) and are difficult to register for an expert scientist. “Nanosystems engineering is a set of methods used in modelling, designing and construction of objects of different functionality, including nanomaterials, micro- and nanosystems, characterised by wide use of quantum-dimensional, cooperative, synergy, giant effects and other phenomena and processes that display in the sphere of material objects consisting of elements of characteristic nanometric dimensions” [19, p. 32]. Nanosystems engineering, just like macrosystems engineering, includes both systems engineering and complex research. Purpose orientation, characteristic of nanotechnology, influences the priorities of complex research by shaping the attitude towards scientific knowledge not only as knowledge about something, but as a tool of activity: “...a major vision of nanotechnology has always been the purposeful manipulation of the substance on the atomic level” [7, p. 27].

Systems engineering does not only include the person (subject) as a vital element into the system being researched and engineered, but examines the object of engineering as one included in human activity. The object of engineering and research is being made subjective. It possesses its own will and independent behaviour. With that we allow for active behaviour of the engineering object, and its ability and opportunity to respond. It can even resist engineering pressure by responding to it; the object possesses ‘consciousness’ and may ‘disagree’ with certain types of engineering pressure. Here, as an example, we can mention major projects on the reconstruction and development of residential areas that change the lifestyle of people living in these areas. This problem develops further in connection with the ambitious desire of nanosystems engineering to project the human beings themselves, which is expressed in the programme of human ‘improvement’, where the human being acts as the ‘soldier of the system’. The development of nanotechnology provides new opportunities for pointed changes of structures on molecular and atomic levels, for implanting new micro-
devices into the human body; these devices enhance and increase the potential of human perception and human senses. This causes new ethical problems, for example, connected with the creation of an ‘ideal soldier’ with unique abilities of human senses and even the installation of new senses, e.g. infra-red vision. While the world public discusses these potential dangers, a special institute (Institute of Soldier Nanotechnologies in MIT that received $50 million for research from the US army and some sponsorship funds from other companies) is being founded in the USA. Moreover, purpose-oriented work and experiments are being carried out in this sphere. The scientists do not only work at equipping ‘the ideal soldier’ with nanoequipment that will enhance his senses and a uniform produced of nanomaterials (supposedly, it would be lighter and will possess unique properties, e.g. the ability to adapt to the colouring of the environment), but at implanting biologic, electromagnetic and chemical nanosensors in his body. Researchers from the University of New York have developed a special ‘molecular dagger’ that kills harmful microorganisms that penetrate the soldier’s uniform [7, p. 110–111].

This means forced interference with the human body’s ‘interior’. Even if the human being does not mind such interference in his body, he is not able to evaluate those unforeseeable negative consequences that can lead to the destruction of his body and, moreover, his personality (when neurophysiological processes of the human brain are interfered with). This, indeed, can not be foreknown by the scientists themselves. Here we are talking about a kind of violence and coercion, veiled by formal agreement and scientific substantiation “at the achieved level of scientific development”, and “the damage that is done against the will of that or those against whom this violence and this coercion are targeted” [20]. That means that human will is neutralised by impractical promises that are, however, supported by convincing arguments. With that, just as with an ‘impeccable judge’, we should still determine who deserves to become ‘the creator’ who will take the responsibility for their creations.

This puts the new understanding of separation between the natural and the artificial, the living being and the mechanism inside the nanomechanism at the center of attention of multiple discussions. As early
as in 1997 the conference *Biomolecular Motors and Nanomechanisms* was held in the USA. By the year 2002 researchers had managed to develop an electronic circuit on the basis of a live bacterium that was “smaller than microcircuits on the basis of genetically modified proteins extracted from high temperature-resistant bacteria acting as a matrix for hexagonal (six-sided) structures to which nanoparticles of gold were added. The metaphor of mechanism is, however, insufficient support for the explanation of this ‘hybrid artifact’ produced by convergence of nanotechnology and molecular biology in one of the laboratories of the North American Satellite Agency” [21]. This leads to the fact that even scientists can not draw a distinction between natural components of the human body and artificial components implanted into the body by nanosystems engineers. “Nanotechnology includes both manipulation with natural molecules and creation of molecules that do not exist in our world yet. <...> At that, some nanotechnology objects can be easily distinguished from natural components, while others are identical to them. Therefore, nanotechnology does not only create an artificial world, separated from nature, it is connected with natural processes and materials created with the help of new methods, and this makes it difficult to separate them from nature. <...> Nature is something that has not been produced by humans. This notion is the basis for the distinction between natural and artificial objects. <...> The object is considered natural if we cannot prove with the help of all scientific methods available at present that it was created in the course of human activity. <...> The artificial object would belong to nature if it was impossible to distinguish it from identical natural objects with the help of all scientific methods available to date” [22]. Consequently, the synthesis of artificial objects identical to natural objects leads to the fact that natural and artificial objects become indiscernible at the present level of scientific development which on the one hand impedes their identification and the ‘repairs’ of these artificial structures, should such necessity arise, and on the other hand it impedes the potential opportunity to differentiate such objects on the new level of scientific development and then determine, for example, the incompatibility of these artificial formations with the body into which they were implanted. This presents another ethical problem, though from a legal point of
view the scientist that has done everything possible at the given stage of scientific development does not bear any responsibility.

All this presupposes a moral responsibility of individual persons, making decisions on development of certain technological directions or projects, for the decisions made that can damage human beings or the environment regardless of the momentary benefits they would bring to the society and state. Moreover, these persons bear specific moral responsibility for their actions before both present and future generations. “The human Prometheus’ spirit is not able to grasp the technology it creates, to manage the uninhibited unseen energies. <…> Technology replaces the organically irrational with the organised and rational; however, it brings new irrational consequences for our social life. …The human being has not yet quite adapted to the new reality that manifests itself through technology and mechanisms; he does not know if he will be able to breathe in the new electric and radioactive environment, in the new cold metallic reality without vital heat. We have no idea about how destructive the atmosphere created by his own technical discoveries and developments may be for him” [23, p. 150–151].

Technology is acquiring cosmogonic meaning in the 20th century: it possesses a huge force of realisation and makes the human being the king and master of the universe, the ‘cosmiurge’, for the first time in history. This also conceals the dangers of the technology for the human being and for the environment around him, since mass technological organisation destroys the individuality of both outer and inner emotional life; moreover, nanotechnology is particularly dangerous since it can destroy the inner life of a human being, when implants that are incompatible with his body are implanted, and when ‘mistakes’ in his natural development are corrected, especially considering the fact that such correction can hypothetically be performed in a forced way. “The word ‘violence’ in the natural language means coercion to do something by force, against somebody’s will. That expresses the very essence of this notion. Violence means blocking the free will of individuals and forcing them to perform activities (or holding them back from them), prescribed by those committing violence. It can in short be defined as usurpation over free will. Violence is the supremacy of certain beings
over others, based on external coercion. This is the extreme, special
case of relationships between the predominance and subordination, of
an authoritative relationship. <…> However, public and common con-
sciousness, as well as certain social and philosophical concepts, do not
only see violence as evil, but sometimes tolerate its morally justified
use. It is considered that violence can sometimes be used for good.
Thereby, it is in a way ethically sanctioned” [24]. In this case, doesn’t
nanotechnology present the opportunity to justify violence over the
human personality and body for the sake of national defence and secu-

rity? No one can foresee what the artificially improved version of a cer-
tain person will become after improvement. “It is necessary to consider
unintended side effects... On the one hand, introduction of convergent
technologies into the process of improving human abilities is aimed at
a promising increase in the human potential, and technical improve-
ment of a human being, on the other hand, many pitfalls that make
such convergence dangerous for the humanity are possible. Therefore,
scientific research of these issues requires that all the pros and cons are
weighed up, not only from the point of view of the natural science and
technology, but also from the point of view of the social and humani-
tarian sciences” [25; 26].

In nanotechnology, conferring the status of integrity to the object of
engineering and at the same time understanding the integrity of its being
(where every partial change may cause irrecoverable destruction of the
whole) inevitably lead to the need to conduct comprehensive research of
the object using many different sciences. This is especially evident when
nanotechnologies and genetically engineered developments combine
together, although this is also true about socio-technical systems where
the understanding of cohesion between the objective reality of humanity,
human culture as a whole and the universal whole and each single
creature is formed. Examination of the object of engineering and the
engineering itself as one that is developing, and the understanding of the
fact that one can not recreate an engineered object (since it would beco-
me another object), but could gradually change and transform into a
new condition chosen from the multitude of possible variations, compels
the researcher to study its history, preserve and keep the ‘traditions’ of
its existence in combination with structural changes.
The impression of irreversibility of engineering activities arouses a sense of danger in the results of technological activity (and the activity itself), not only for the person who works with a certain technology system (for example, operates it), but for people who have nothing to do with it. For example, hazardous chemical enterprises do harm not only to their employees (who at least know of the potential dangers and consciously agree to work there, take protective measures and, finally, receive certain benefits for hazardous work conditions), but to people living nearby who breathe the poisonous air and consume their waste products through water, food, etc. Therefore, the role of modelling, that imitates as yet unrealised activities with a view to forecast possible consequences, is increasing. At the same time the researchers realise the limitations of this modelling and forecasting activity, i.e. the impossibility to forecast everything beforehand by means of scientific analysis, the fundamental inexhaustibility, problematic nature, and incompleteness of the object of research and engineering, as well as of the research and engineering themselves.

The realisation of the fact that there is not and cannot be a single perfect project or plan that can help recreate the world once and for all, leads to the awareness of many alternatives of engineering activity, the equality and even complementarity of alternatives, the need to correct constantly the influence of engineering, come back again and again to the point of start (therefore, we should provide for the opportunity of such return), timely acknowledgement and correction of mistakes, and reengineering. The destruction of a feeling of ‘infallibility’ of an engineer before the passive object, that is being engineered, encourages the engineer to develop a feeling of empathy and involvement, and form not only a technological, but also an ethical attitude towards the object of research and engineering.

In the 1990s nanotechnology went beyond the scope of the narrow circle of expert scientists; many governmental nanoresearch programmes were launched; the programmes attracted the attention of a number of private investors, the wider public, and the mass media to nano-issues. All these gave rise to different futuristic scenarios of nanotechnology development and its influence on society and human beings, both positive and negative. It became necessary to present these visions.
of the future in a ‘popular’ form, with a view to evaluate potential prospects and risks and decide on priority financing of certain spheres of nanoscience. The problem of evaluating scientific and technological development is complicated by the fact that the scientific community in this sphere has not been formed yet. Therefore, there are no universally recognised experts in nanotechnology. “But who is an expert in nanotechnology? ...We should distinguish between the commonplace meaning of the word ‘expert’, which means any person who knows a lot about the subject, and the more specific meaning of this term that is used when we discuss the social role that this expert should play. There are four characteristics of expertise that are important to describe the social role of an expert: 1) an expert possesses specialised knowledge and skills that are difficult to acquire for a non-expert; 2) this knowledge is usually of a technical nature (this means knowledge about specific methods of cognition and creation of certain things); 3) an expert is acknowledged as such by the corresponding professional community; 4) this professional community is acknowledged as being legitimate within a wider social structure. While the first and the second points present no problems for nanotechnology, the third and the fourth points cause some difficulties. ...It is very difficult to become an expert acknowledged by the professional community, if this professional community is only being formed” [27, p. 261–262].

In view of fundamental interdisciplinarity of nanotechnology, every expert participating in its development, even if he is a Nobel Prize Winner, acts only as a partial expert. Moreover, nanotechnology touches upon many social, humanitarian and ethical questions that lie beyond the competence of natural scientists and engineers and are discussed primarily within the scope of social and humanitarian disciplines. State leaders and managers of scientific organisations, parliamentarians, investors and taxpayers are not able to range priority of different scientific and technological spheres, so they have to rely on the often far reaching, but insufficiently grounded expert evaluations of science and technology lobbyists interested in obtaining new funds; or on precedent decisions made in other countries. That is why expert groups and decision-makers as well as the wider public and the scientific community have to rely on visualisation based on the computer imita-
vision of nanotechnology processes and results. However, we should not forget that such visualisation, i.e. simplifying communication, is of dual character: interdisciplinary and transdisciplinary. In the first case it is aimed at ensuring mutual understanding in the course of research and matching the results of scientific and technological research conducted by different experts who participate in the development of nanoscience. In the second case it enables communication between the scientific and technological society and non-scientific spheres, i.e. is aimed at arousing interest and explanation of potential advantages and risks associated with the introduction of specific nanotechnologies to the governmental officials and members of parliamentary commissions who decide on funding of scientific and technological research and development; to investors and managers of industrial enterprises who can ensure the production, introduction and distribution of nanotechnology products; to colleagues from other spheres of science and technology who can impact the scientific acknowledgement or non-recognition of this new sphere; to the wider public with a view to encourage people by promising them to find solutions to many social and other topical human problems (for example, cure for diseases, the provision of cheap and high-quality food products, extending life span and so on) and to respond to the often well-grounded doubts in the safety of the new technologies. That is why, in the second case, the process that helps receive such visualisation with the help of, for example, transmission electronic microscopy (a complex algorithm of transformations of images of ‘raw’ data received that is necessarily followed in the specialised papers) is omitted.

Such data and the initial image, built with their help, do not mean anything for non-experts; they require further computer processing and interpretation even for scientific experts. The end-products of such presentations, offered to the general public, do not contain information about intermediary steps*. It makes the ‘invisible’ visible and clearly tangible. This presents a whole new sphere of social responsibility of scientists for visual representations, provided as substantiations, to the general public and decision-makers.

* See, for example, image representation of nanostructures, obtained by powerful Scanning Probe Microscopes, at Veeco Instruments website: http://www.veeco.com/library/nanotheater
The ethics of science and technology is an important tool that helps society to formalise, structure and influence the course of technological development in the direction, necessary for society. However, the purpose of ethical reflection is not to prevent conflict situations, but to create boundary social conditions of their “rational overcoming that shall be realised discursively, with orientation to understanding and without the use of force” [15, p. 59]. Therefore, the development of nanotechnology makes the ethics of non-violence the main regulatory tool of nanotechnology research and engineering, since it does not only possess huge potential for creative activity, but at least the same potential of destructive activity, whose impact on the future development of humanity and the biosphere can not be predicted and foreseen. “Non-violence is a universal, domain-specific and even technological behavioural paradigm. Substantiation of reality, of practical feasibility of a non-violent alternative is the main theoretic task of ethics, while real-life experiences of non-violent activity are its basic arguments. Ethics of non-violence is theorising with the help of real-life terms, which is theory and practice at the same time” [28]. As early as in 1933 Berdyaev in his paper The Human and the Mechanism warns that technology can give a human or a small group of humans huge destructive power: “Very soon peaceful scientists will be able to cause convulsions of an historic and cosmic nature.” This allows the concentration of power in the hands of those who have insight into technological secrets. Therefore, modern technology can not be neutral in spiritual issues. It impacts the destiny of all humanity. Berdyaev supposes that the ‘technology époque’, the époque when technology governs the human soul will inevitably end with the victory of the human spirit and spiritual values of life. “However, technical civilisation, technicalised and automated society want to make the person their part, their tool and weapon, they do everything to destroy the human identity and integrity, they want the human to stop being a personality. A terrible fight between the personality and technical civilisation and technicalised society lies ahead... Technology has never shown any mercy to the living and the existing. Compassion for the living and the existing shall limit the power of technology in life” [23, p. 159].
References


III
RISKS AND GOVERNANCE IN THE KNOWLEDGE SOCIETY

IV

TRENDS
IN THE KNOWLEDGE-BASED
SOCIETY
Innovation, creativity and design are among the most frequently used words in business and society today. In most situation innovation studies are focusing on markets and technological road-mapping of future innovations. Less attention is paid to non-economic and non-technical innovations.

Contrary to common trends, this article is focusing on non-technical and non-economic innovations. Furthermore, in this article we discuss briefly key models of non-economic and non-technical innovation. This paper is not a fully comprehensive survey, but just focused on four important models of modern innovation studies, which should be a part of research agenda in the field of research of non-technical and non-economic innovations.

In this paper my aim is to add to traditional innovation models non-economic element. In this way I try to build up new theory framework of non-market innovations (NMI).

1. KEY TRAJECTORIES OF SCIENCE AND TECHNOLOGY

In this section I shall shortly describe key trajectories of science and technology. The analysis is based on the studies performed in the USA (TechCast, 2008), Japan (NISTEP, 2007) and Germany (FUTUR, 2002).

TechCast technology foresight. The TechCast method consists of five phases [1]. Phase I is Scanning. We first do extensive scanning of the scientific literature, media, Internet, interviews, and other sources to accumulate background data. Phase II is Breakthrough Analysis. Next we organise the scanning data into a ‘breakthrough analysis’ consisting
IV
TRENDS IN THE KNOWLEDGE-BASED SOCIETY

of the event to be forecasted, data points, and trends opposing and driving each technology. The ‘events’ or ‘milestones’ are precisely defined adoption levels to be forecast for each technology. We usually use the 30% adoption level, but other adoption levels are used where they seem appropriate. The 30% level is of particular interest because emerging technologies are usually entering the economic mainstream at this point. The breakthrough analyses are considered especially useful because they summarise the available knowledge on any technology in a succinct and convenient format, and we estimate they tend to reduce uncertainty by 20–50%. Phase III is an Expert Survey. The experts work online to integrate all this information using their judgment to provide accurate estimates. We strive to enlist the most competent authorities with advanced degrees, extensive publications, relevant experience, and breadth of knowledge. Experts are drawn from nations around the globe, male and female, young and old. They include authorities working in research, business, government, academia, and other fields. Experts are asked to focus on areas they feel most knowledgeable about, so not all respond to all technologies. Phase IV includes Results. The system automatically aggregate estimates to calculate means for the ‘Most Likely Year’ each technology will reach its adoption level in industrialised nations, the ‘Experts’ Confidence’ in this forecast, and the likely ‘Market Size’. Because figures for market size of the global economy are not available, these data are valid for the USA. Delphi studies are considered reliable if they include a dozen or more experts, and these results surpass that criterion considerably, usually running about 50 or more data sets [2]. Phase V includes Iterations. Experts’ comments and new background information are incorporated in an updated breakthrough analysis, and this process is repeated every year or so to ‘track’ the forecast over time, allowing us to extrapolate better forecasts. ’Arrival’ dates are also noted to evaluate the accuracy of forecasts. TechCast analyses include 7 larger trajectories: (1) energy and environment, (2) information technology, (3) E-commerce, (4) manufacturing and robotics, (5) medicine and biogenetics, (6) transportation, and (7) space.

1 For more details, see the TechCast website: http://www.techcast.org
The major conclusion of this work is that breakthroughs are appearing in all fields that will transform industries, the way organisations work, and society itself. Most probably short run breakthroughs are happening in wireless technologies, B2B, utility computing and in the field of hybrid cars. Medium level probabilities are having telemedicine, nanotech, alternative energy and smart robots. Timing is expected to after 2015. Quantum computing is expected to be our reality after 2020.

**The NISTEP socially oriented technology foresight study.** The second trajectory analysis is based on NISTEP study presented in 2007 [3]. The NISTEP study is focusing more on social and cultural aspects of technological development*.

According this NISTEP study, in the ultra-gray society of 2025, a paradigm shift in thinking on healthcare is occurring, we move towards the era of lifelong health. The meaningful point is that in the arrival of the era of self-care people will actively contribute to their own healthcare to maintain their health rather than having doctors manage their healthcare. Self care is personal health maintenance. It is any activity of an individual, family or community, with the intention of improving or restoring health, or treating or preventing disease. Meanwhile, medical technology is developing and provides many possibilities for self-care. Most intractable and chronic diseases will have been conquered till the year 2025. Along with living fulfilling home lives, people will enjoy healthy, meaningful lives in society, without regard to age or gender. The shape of ‘the era of lifelong health’ is seen in the following two areas. (1) Long, healthy lives: people are enjoying long, active lives without serious illness; and (2) In their daily lives, people are constantly acting voluntarily to maintain health and prevent disease. When a problem does arise, they can receive advanced treatment by professionals at a hospital. Along with treatment of disease (at medical facilities), people are very interested in health main-

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* NISTEP (The National Institute of Science and Technology Policy, Japan) summary of the foresight scenarios “Social vision toward 2025 – Scenario Discussion based on S&T Foresight” can be found at: http://www.nistep.go.jp/achiev/sum/eng/rep101e/rep101se.html
IV
TRENDS IN THE KNOWLEDGE-BASED SOCIETY

tenance and promotion (in their daily lives) to stay healthy and prevent disease. This is individually appropriate (shift to tailor-made healthcare), on the same level (equalisation of healthcare), and available to everyone (shift to ubiquitous healthcare) [3, p. 10].

The second important future trajectory is information environment as life infrastructure. The rise of the Internet was not only an enormous innovation by itself, but it also provided infrastructure for many other innovations. The speed of change will increase in the future. No government or organisation will be able to do anything without collaborating with others. Policy weight will shift to environmental upgrades. Many innovations will be seen in people’s lives through the information infrastructure below [3, p. 11]:

(1) Digital value infrastructure: Economic activity will shift completely to an electronic network basis. In addition to secure electronic money, value information related to economic activity, such as currency and stocks, will circulate securely as standardised digital data. Copyrights and other property rights can be confirmed as digital data and can circulate on networks in accordance with designated standards.

(2) Digitized system infrastructure: Basic social systems such as laws, contracts, and rules will be recorded electronically, and negotiation among them will be automated as much as possible. In a mature ubiquitous-connection society, social rules will be digitized, much machine control will be automatically optimised, and social systems will operate more efficiently.

(3) Ubiquitous identification infrastructure: The real world and network worlds will be linked in an integrated fashion. The idea of ubiquitous computing environments presents important issues to the development of several areas of computer science, including distributing computing, computer networking, software engineering, human-machine interaction, and artificial intelligence. Places and things will be assigned unique identifiers, enabling open identification that transcends organisations and applications. Communication with places and things is possible, and they can be electronically identified and linked with relevant information. Personal authentication, individual recognition, and location/time authentication mechanisms are improved, with guaranteed accuracy.
(4) **Universal operability infrastructure**: Everyone will be guaranteed the use of various services in a ubiquitous-connection environment. Public operation interfaces will be unified, easing the burden on people involved with the operation of devices.

The third important trajectory according to NISTEP analysis is **support for people’s activities through advances in brain science**. By 2025, brain science in the broad sense — integrating neuroscience, cognitive science, healthcare, and engineering (robotics, etc.) — will have advanced in a progressive way. Along with advances in human understanding, technology applications in social activities will progress rapidly. Many of them are connected to new applications of social media [4]. As a result, the ways ordinary people work, learn, live and interact with each other will change in the following ways [3, p. 12]:

1. **Improved health, medicine, and care**: Early detection, prevention and treatment of diseases related to cerebral nerves, the motor system, and cognitive function will be possible. The spread of robots and other machines to care for the elderly people and people with disabilities will advance systemic improvements that enable them to live as independently as possible. The number of healthy elderly people who want to work will increase, and the burden on caregivers will decline. Social systems that allow people from various generations to respect and help each other as they live together will improve.

2. **Advanced education, learning, and daily life**: Learning can be tailored to children’s abilities, individuality and environments. Desire for learning with clear goals will increase. Support for healthy development of social skills and emotions will be available. Opportunities for lifelong learning and improvement in response to individual suitability and history will be provided. The will of the people will be better reflected in society through support systems for social decision making.

3. **Changes in labour, safety, and security systems**: Labour systems including machinery will make up for difficult to avoid human characteristics such as carelessness and fatigue, expanding the environments in which humans and machines cooperate. The transfer of knowledge and skills among diverse people and organisations will become simpler, and efficient and people-friendly production systems will be utilised. Decision making systems for dealing with disasters, accidents, climate change, dis-
ease, and so on will improve. Ordinary people will deepen their understanding of disasters and their management, responding on their own to the extent possible. Disaster relief systems will also improve. Mutual aid with countries in Asia and elsewhere will be achieved, and Japan’s international contributions will be respected worldwide.

The fourth important trajectory will be a need to develop safe and sustainable cities. Because social problems exist in advanced and intensified form in the cities where human activity is concentrated, large cities face deepening environmental and traffic problems, while regional cities must deal with the blight of advancing depopulation. For the living environment in 2025 to be sustainable, it must be energy conserving, with low environmental impact, highly durable and safe. At the same time, cities must be beautiful and urban life must be vital even in the face of declining population. Much urban infrastructure will need replacing around the year 2025. It will be a turning point for urban renewal that will determine the shape of social infrastructure for a hundred years [3, p. 13]:

(1) Compact cities: Urban planning that sets size goals in light of 100-year estimates for population decline will achieve compact cities that use land and energy efficiently. Housing and jobs will be close together, and beautiful cityscapes will raise the value of cities and sustain them. Prosperity will return to life in every part of Japan. Beautiful regional cities that harmonise natural environments and urban convenience will attract people from all over the world, creating virtuous circles that concentrate knowledge and production.

(2) Environmentally-friendly urban transportation: Advanced integration of public transportation with low environmental impact cars and road infrastructure will create new urban transportation systems. This will ease traffic jams, decrease accidents caused by elderly drivers and other human errors, achieving safe, environmentally friendly movement.

(3) Distributed energy systems: Network energy systems will be adopted, integrating small distributed energy systems and large intensive energy systems in appropriate mixes. Effective use of waste heat and recycling of waste products will advance, decreasing the amount of resources and energy invested in cities. In regional cities, new businesses offering local production for local consumption will appear.
(4) Cities with few disasters: Various information networks will become more advanced. Pre-assessment of potential disasters and quick and accurate understanding of conditions when they occur will enable full physical and mental preparation for earthquakes. Complete insurance menus for protection by region or block will become available, enabling economic preparation as well. Local residents will seek measures rooted in their communities, creating a virtuous circle that advances effective policies.

The fifth important trajectory will be openhearted living, which includes such issues like diversification of career choices, childrearing and senior lifestyles. In 2025, with the population declining and globalisation advancing, all kinds of people, including parents, seniors, people with disabilities, and foreign nationals will be all working happily together. The following lifestyle has been achieved till the year 2025 [3, p. 14]:

(1) Career choices appropriate to life stages: Diversification of employment types and portability of corporate pensions have made job changing easier. An improved lifelong education system enables career planning and job selection appropriate to each stage of life. Barrier-free, universal design, housing closer to employment, automated translation, and so on enable people with disabilities, seniors, and people raising children to continue working, and it will be easy for all, including foreign nationals, to work together.

(2) Society will accommodate families with children in various ways: The life course of people raising children will be fulfilling. Communities will support the healthy growth of children. Childbirth will be safe in every community and childrearing anxieties will be relieved. Improved safety systems will make people feel that they live in a safe society. Information systems will enable immediate receipt of shared information and advice on childrearing. Travel will become easier because of barrier-free design. To make it easy for people raising children to work outside the home, career resumption guarantee systems and remote lifelong education systems will be in place. Automation of housework will enable people raising children to have more time for them.

(3) Seniors can choose among diverse lifestyles: such as transferring to new types of businesses, pursuing volunteer work or hobbies,
moving so they can enjoy retirement, and so on. The necessary education systems will be in place. Seniors can collaborate with other generations or pass on their knowledge through the community, making the most of their wisdom and experience and communication skills. Those who require care will access cooperative care through collaboration between their families and caregivers.

The sixth important and very critical trajectory from global perspective will be solving global environmental problems and coexistence with the world. In order to avoid or mitigate global crises such as global warming, issues related to water, food, energy, and so on must be understood as interrelated world problems rather than as individual issues. Improvement as integrated decentralised systems by region is necessary. The shape for which Japan should aim through 2025 is as follows [3, p. 15]:

1. **A sustainable society leading the world**: With some of the world’s best environmental conservation technology, the Japanese government, businesses, and the public working together will achieve a drastically reduction of CO₂ emissions and will contribute to improving global environmental problems such as waste disposal and water issues. The public will care about the environment, actively engaging in volunteer work, supported by corporations as well.

2. **A recycling-oriented society that serves as a world example**: Green purchasing and socially responsible investing will be increasing. Advances in recycling technology will secure a transition towards a recycling-oriented society that reuses waste heat, water and garbage. Distributed energy will spread, making regions independent. Problems related to water resources and disaster response will be overcome, and a sustainable, recycling-oriented society will be achieved.

3. **Coexistence with the world**: Foreign trainees will come to Japan to learn about its world-leading environmental cleaning technology and energy conservation technology. When they return to their home countries, they will improve the environmental economics there. Japanese personnel who have received outstanding environmental educations domestically will be active around the world, expanding Japanese environmental businesses and enhancing the competitiveness of Japanese corporations.
The German technology foresight project “FUTUR”. Third technology and science related trajectory analysis, I would like to discuss in this paper, is the German and European FUTUR [5; 6]. This analysis was more social science oriented analysis focusing much on the most challenging information/knowledge society issues. The FUTUR project, which is the most recent project under the ‘foresight banner’ in Germany, is described as the German Research Dialogue. Its starting point was a series of 9 workshops, which produced a collection of about 10,000 topics that were classified by a list of 21 subject bundles comprising a total of 63 topics. The outcomes were a series of ‘guiding visions’ designed to provide input for the development of R&D support programmes by the German Federal Ministry of Education and Research. Until summer 2002, four of the six themes, revealed at the fifth stage, were developed into guiding visions (also called ‘lead visions’, or Leitvisionen). The four guiding visions are:

1) Understanding Thought Processes;
2) Creating Open Access to Tomorrow’s World of Learning;
3) Healthy and Vital throughout Life by Prevention;

These visions contain aspects related to Information Society Technologies (IST), with two of them strongly IST-oriented, but none of these themes are in a classical sense IST themes. This is a result of the demand driven approach of the formulation of research themes. Most of all, the vision of Networks involves more or less classical IST themes and the vision Understanding Thought Processes is on the innovative side of IST research.

The vision on Understanding Thought Processes is oriented strongly towards learning, with a stress on research rather than such things as ‘learning services’ or IST applications in learning. Among the technologies mentioned in the context were artificial intelligence, new computer architectures and algorithms, autonomous robots, artificial retina, inner ears and muscle control, and organic computing (Organic

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2 For more details see the website of German Federal Ministry of Education and Research: http://www.bmbf.de/de/6502.php
IV
TRENDS IN THE KNOWLEDGE-BASED SOCIETY

Computing System is a technical system which adapts dynamically to the current conditions of its environment. — Ed.)

The vision Creating Open Access to Tomorrow’s World of Learning is even less technologically oriented than the first one, although there is a section on ‘e-learning’ which does not have high priority in the overall vision. The question raised in this context is about suitable strategies for the application and evaluation of e-learning. There is a scenario for the year 2010 which makes little or only vague mention of technology (virtual laboratories, distance learning, education management tools, networks). Skills are an important factor in this vision as they help to prevent social exclusion.

The Health vision is driven mainly by the concern of ‘social cohesion’ and access to preventive medicine for all. The only technologies specifically mentioned are patient chip cards and mini laboratories for home use. Obviously data protection and security are mentioned in this vision, but they do not play any major role.

The fourth vision Living in a networked world does address certain key technologies and cross-cutting issues related to IST, such as man-machine interfaces and ambient intelligence, described here as ‘ubiquitous and invisible infrastructure’. Mobile communication, broadband, electronic services, embedded systems and nanotechnology are also mentioned. A major vision for IST is that these should be personal, individual and adaptable. Confidence, trust and vulnerability are major cross-cutting concerns as is social cohesion which is treated in the shape of preventing the digital divide.

The man-machine interface is described at greater length with such aspects highlighted as intuitive support by the communications interface, artificial intelligence, cognitive science, microsystems, voice control, visualisation and displays including electronic or intelligent paper, sensors and the semantic web. In connection with mobile communication, a need to address the issue of energy supply is pointed out. Socionics is mentioned as a new direction of research in the area of autonomous software agents, including robot systems. Another area of research covered by this vision is labelled ‘networks and the structure of services’, which makes vague reference to ubiquitous and mobile terminal devices, personal networks, greater bandwidth and innovative services. Technologies
### TABLE. 1. Main GRIN-technology trajectories

<table>
<thead>
<tr>
<th>Technology class</th>
<th>Main trajectories</th>
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</table>
| **Genomics**     | 1. *Biomedical materials*. Implants and human spare parts made of biomedical materials will be used in skin and organ transplantation and other surgical operations.  
2. *Biomimetics*. By imitating and adapting natural methods, for example, in paper production it is possible to prevent environmental hazards.  
3. *Gene manipulation*. Hereditary diseases can be prevented and cured with gene manipulation.  
4. *Targeted medicines*. In health care, there will be more effective medicines well targeted to cure, for example, certain parts of the body affected by cancer.  
5. *Cell technology*. Cloning possibly can be used to treat infertility.  
6. *Bioproducts*. Bioproducts are used to clean soil and water. |
| **Robotics**     | *Sensors*. Sensors that measure movement, transition, and change of form, will be used to observe, for example, hazardous changes in the environment. |
| **Informatics**  | 1. *Photonic materials*. Materials that produce, perceive, and handle light will replace conductors made of copper in many devices, which affects, for example, information transference.  
2. *Integrated technology*. Homes, offices, and other built environments will merge through information and communication technology and enable fast communication between people.  
3. *Virtual reality*. Virtual reality enables distance working, distance healthcare, and other distance services, making public services cheaper and more easily available for people.  
4. *3-G Technologies*. Opportunity to transfer text and picture fast increases a variety of different public services.  
5. *IT-technology*. Highly developed IT-technology will replace paper in offices. |
| **Nanotechnology** | 1. *Intelligent materials*. Materials that monitor and repair their own condition relieve humans of observation tasks.  
2. *Unbreakable materials*. Useful life of devices increases when certain parts of consumer goods can be replaced with flawless materials.  
3. *New polymers*. New polymers are used in industry to conduct and store electricity, which makes production more effective.  
4. *Nanotechnology process*. Hard and elastic nanotubes are used in objects that get easily damaged, for example, in electronic utility goods to prevent damage and made them last longer.  
5. *Diagnostics*. In health care, it is possible to install nanosized machines in human beings to diagnose diseases, dose medicines and monitor vital functions. |

Source: [7, p. 73].
mentioned in connection with security include quantum cryptography and DNA cryptography based on molecular biology [5; 6].

One very general conclusion concerning science and technology trajectories is that there are typically four important fields of technology, which are discussed almost in all relevant science and research studies. All my three trajectory studies from the USA, Japan and Germany (Europe) indicate this kind of technology and science trajectory logic. These four key trajectories can be called as GRIN-trajectories: (1) Genomics, (2) Robotics, (3) Informatics and (4) Nanotechnology. Many remarkable novel innovations are so called cross-border innovations, innovations combining fresh ideas from different science and technology trajectories. One key character of this process is convergence between different GRIN-technologies.

There is also some plausibility of technological theses related to these GRIN-trajectories [7]. Partly these science and technology developments can be interconnected to bigger trajectories. The relevant technology theses according to Ahqvist are presented in Table 1.

2. INTEGRATION OF INNOVATION AND FORESIGHT RESEARCH

According to Kaivo-oja [8], we can connect foresight systems and innovation systems in the following alternative ways which are non-linear rather than conventionally linear [9]. The seven theoretical alternative interaction models are possible in modern firms and corporations. Foresight systems often play an important role within innovation systems. The models demonstrating the interaction between foresight systems and innovation processes are presented in Fig. 1.

The innovation models I–VII include an economic element as well as production and marketing elements. One way to extend these models of non-economic innovation is to substitute a social system for production and marketing, which leads to seven novel interaction models regarding innovation processes. These models are non-economic social systems models (Fig. 2).

One important research question concerning non-economic and non-technological innovations is how foresight systems handle such innova-
FIG. 1. Models of interaction between foresight systems and innovation processes

Model I

Innovation process → Foresight system → Other processes: production and marketing

Model II

Foresight system → Innovation process → Other processes: production and marketing

Model III

Other processes: production and marketing → Foresight system → Innovation process

Model IV

Other processes: production and marketing → Innovation process → Foresight system

Model V

Foresight system → Other processes: production and marketing → Innovation process

Model VI

Innovation process → Other processes: production and marketing → Foresight system

Model VII (interactive and simulative)

Foresight system ↔ Other processes: production and marketing ↔ Innovation process
IV
TRENDS IN THE KNOWLEDGE-BASED SOCIETY

FIG. 2. Non-economic social systems models

Model VIII

Innovation process → Foresight system → Social systems

Model IX

Foresight system → Innovation process → Social systems

Model X

Social systems → Foresight system → Innovation process

Model XI

Social systems → Innovation process → Foresight system

Model XII

Foresight system → Social systems → Innovation process

Model XIII

Innovation process → Social systems → Foresight system

Model XIV (interactive and socio-simulative)

Foresight system ←→ Social systems ←→ Innovation process
tions. Currently, there is increasing complexity in the innovation development and research field. In particular, there are many interesting trade-offs between non-economic and economic innovations. Thus, it is to be expected that the nature of trade-offs between non-economic and economic innovations depends on the nature of the economic innovations.

3. KEY INNOVATION MODELS

In this section four different innovation models/theories and their relevance to non-economic innovations are discussed as well as some important aspects of non-technological innovations.

The open innovation model. Increasing attention has been recently devoted to the concept of open innovation, both in academia and in practice. Chesbrough, who coined the term ‘open innovation’ in his book *Open Innovation: The New Imperative for Creating and Profiting from Technology* [10], describes how organisations have shifted from so-called closed innovation processes towards a more open method of innovation [10–14].

Traditionally, new business development processes and the marketing of new products have taken place within a firm. In contrast, the open innovation model is a relevant concept for non-economic innovations. This new, gradually developing research tradition is relevant to non-technological and non-economic innovation research.

Several factors have led to the erosion of closed innovation. First of all, the mobility and availability of highly educated people has increased over the years. As a result, large amounts of knowledge exist outside the research laboratories of big organisations. In addition to that, when employees change jobs, they take their knowledge with them, resulting in increasing knowledge flows between firms. Secondly, the availability of venture capital has increased significantly, which makes it possible for good and promising ideas and technologies to be further developed outside the business organisation. Such development can be seen in the form of spin-offs or in licensing agreements. Finally, other organisations in the supply chain, e.g. suppliers, play an increasingly important role in the innovation process.
Consequently, organisations have started to look for other ways to increase the efficiency and effectiveness of their innovation processes. For instance, through the active search for new technologies and ideas outside of the firm, but also through cooperation with suppliers and competitors, in order to create customer value. Another important aspect is the further development or out-licensing of ideas and technologies that do not fit the strategy of an organisation. Ideas can also be distributed for non-economic purposes. Open innovation can thus be described as combining internal and external ideas as well as internal and external paths to market and advancing the development of new technologies.

One interesting aspect of open innovation developed by Chesbrough is that it does not take non-economic innovations into consideration, although new markets are described as a potential place where innovations can be outsourced. This issue is analysed here in the context of the innovation category model. Accordingly we can conclude that the open innovation model could be developed in order to also take non-economic innovations into consideration.

The existence of an open innovation model implies that, in the first place, the shift described above means that organisations have to become aware of the increasing importance of open innovation. Not all good ideas are developed within business organisations, and not all ideas should necessarily be further developed within a business organisation’s boundaries. Table 2 illustrates this.

The Table 2 shows that within a business organisation a shift should take place in the way people look at companies and their environment. Involving other parties when developing new products and technologies can be of great added value. This can be seen with respect to cooperation with other organisations in a business sector, or cooperation with suppliers, universities and, of course, end-users. The essential aspect of this is that in open innovation operations experts are found and they constitute the key operators. An open innovation strategy can also be connected to the Blue Ocean strategy [15] and the actor-network theory [16], which are approaches that are relevant mostly to European companies.
Closed and open innovation principles

<table>
<thead>
<tr>
<th>Closed innovation</th>
<th>Open innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The smart people in the field work for us.</td>
<td>Not all the smart people in the field work for us. We need to work with smart</td>
</tr>
<tr>
<td></td>
<td>people inside and outside the company.</td>
</tr>
<tr>
<td>To profit from R&amp;D, we must discover it, develop it, and ship it ourselves.</td>
<td>External R&amp;D can create significant value. Internal R&amp;D is needed to claim some</td>
</tr>
<tr>
<td></td>
<td>portion of that value.</td>
</tr>
<tr>
<td>If we discover it ourselves, we will get it to the market first.</td>
<td>We don’t have to originate the research to profit from it.</td>
</tr>
<tr>
<td>The company that gets an innovation to the market first will win.</td>
<td>Building a better business model is better than getting to the market first.</td>
</tr>
<tr>
<td>If we create the most and the best ideas in the industry, we will win.</td>
<td>If we make the best use of internal and external ideas, we will win.</td>
</tr>
<tr>
<td>We should control our IP, so that our competitors don’t profit from our ideas.</td>
<td>We should profit from others’ use of our IP, and we should buy others’ IP</td>
</tr>
<tr>
<td></td>
<td>whenever it advances our business model.</td>
</tr>
</tbody>
</table>

Source: [10, ch. xxvi].

Innovation category model. The following innovation models are inspired by the innovation category model developed by von Stamm [17, p. 49]. Her model divides innovations into incremental and radical innovations and to existing market and new market innovations. To understand the new role of non-economic innovation we can add non-economic innovations to her model. In this reshaped innovation category model there six innovation categories A, B, C, D, E, and F). In Fig. 3, A conventional trends in markets and society are presented. According to this approach innovations tend to develop incrementally, in the long run, in the direction of an existing market system. These conventional trends are linked to the closed innovation model, not to the open innovation model. In Fig. 3, A non-market boxes have been added to von Stamm’s conventional innovation category model.
In Fig. 3, B non-conventional, countervailing trends in markets and society are presented. According to this alternative, non-conventional approach innovations can also be developed, in the long run, in the direction of new markets, radical innovation models and non-economic systems. These non-conventional trends are linked to the open innovation model, not to the closed conventional innovation model where innovations tend to be incremental and placed in established markets.

*The Schumpeterian tradition of innovation research.* A theoretical framework for dynamic competition and firm dynamics can be found in the notion of ‘creative destruction’ by Schumpeter. Dynamic competition is a process in which innovators with a new technology enter a market and compete with incumbents who have conventional technology. If the innovation is successful, the entrants will be able replace the incumbents. If not, they will fail to survive. Indeed, such dynamic competition “from the new commodity, the new technology, the new source of supply, the new type of organisations” strikes “not at the margins of the profits and the outputs of the existing firms but at their foundations and their very lives” [18].

In the Schumpeterian tradition, many empirical studies focus on the relationship between *firm size and innovation*. Some arguments for the positive effect of firm size on innovation are as follows [19; 20]:

- The returns from R&D are higher where the innovator has a large volume of sales over which to spread the fixed costs of innovation (economies of scale in R&D);
- Large diversified firms can benefit from positive spill-over between the various research programmes (economies of scope in R&D);
- Large firms can undertake many projects at one time and hence diversify the risks of R&D;
- Large firms with market power have an advantage in securing finance for risky R&D, because size and market power can increase the availability and stability of external and internal funds.

But, one can also find counter-arguments in the spirit of Schumpeter [18], namely, the bureaucratisation of inventive activity [19]:

**IV**

**TRENDS IN THE KNOWLEDGE-BASED SOCIETY**
**FIG. 3. Innovation category models**

**A. Innovation category model: typical innovation processes**

- Non-economic systems
  - A
  - B

- New markets
  - C
  - D

- Existing markets
  - E
  - F

Incremental innovations
Radical innovations

**B. Innovation category model: countervailing open innovation processes**

- Non-economic systems
  - A
  - B

- New markets
  - C
  - D

- Existing markets
  - E
  - F

Incremental innovations
Radical innovations
TRENDS IN THE KNOWLEDGE-BASED SOCIETY

— As firms grow large, efficiency in R&D is undermined through loss of managerial control; and
— As firms grow large, the incentives for individual scientists and entrepreneurs become attenuated as their ability to capture the benefits from their efforts diminishes.

In Schumpeterian research tradition less attention is paid to large social systems which potentially have large innovation potential. For example, educational and university systems create new innovation potential, but they are not necessarily monopolies in existing or new markets.

In many empirical studies, Schumpeter’s claim that large firms in concentrated markets have an advantage in innovation was interpreted as a proposition that innovative activity increases at the same proportion as firm size [21]. Alternatively, some other studies have examined the relationship between market concentration* and innovative activities as measured by innovative inputs (R&D expenditures, R&D employment, etc.) or by innovative outputs (patent counts, etc.). However, it was also pointed out that Schumpeter had never claimed a continuous relationship between R&D and firm size. What Schumpeter focused on is said to be the qualitative differences between small entrepreneurial enterprises and large modern corporations in their innovative activities.

Innovation is a concept in which there is considerable variance in individual observers’ definitions; both between common sense — or lay thinking — understanding and analytical approaches, and between different analytical or theoretical approaches. One element common to all these approaches is that market introduction is a crucial aspect of innovation. This is what distinguishes innovation from invention. In fact, the concepts are incomparable in the sense that invention is a technical concept and innovation is an economic concept. However, they are not wholly unrelated; technical feasibility is a necessary, but not sufficient condition for economic feasibility. For service innovations, social or cultural feasibility is also a very necessary condition for economic feasibility.

Since the concept of innovation involves at least novelty for a firm, the change in a market’s characteristics is related to a change in some firm characteristics. Already Joseph Schumpeter pointed out that the

* Market concentration is a function of the number of firms and their respective shares of the total production (alternatively, total capacity or total reserves) in a market.
simplified picture of profit-maximising price-competing firms, with price as the main information carrier between the actors on the market, was too simple picture to explain the development of market systems [18; 22; 23]. In addition to price competition, there is an even more important technological competition; with firms competing on the qualitative characteristics of products and processes. Schumpeter identified five classes of innovation that were important determinants of economic outcomes. The first two, technological product and process innovation, have almost exclusively been focused on in innovation literature and research. In a way, non-technological and non-economic innovations have been neglected because Schumpeter’s first two innovation categories have attracted so much research attention and activity. As Schumpeter’s focus was primarily on the industry level and not on the firm level, an innovation was something that was new to the world and therefore was new to the industry, not new to society. Hence, he also regarded his third category of organisational innovations as the appearance of new general organisational modes transferable to and applicable in a wide variety of firms, as well as restructuring on the industry level. The industry perspective excludes the adjustment and imitation processes of the original industry-level innovation, as well as other local, ‘new to the firm’ innovations. Thus, local re-organisations of business firms, which are highly specific to an individual firm, are excluded from his perspective. His two last categories of innovation were the conquering of a new source of input or raw material which we would probably not consider an innovation today, and the opening of new markets. Generally, we can note that Schumpeter did not pay great attention to service innovations and business models.

To sum up, Schumpeter introduced 5 categories of innovation: (1) the introduction of a new good (with which consumers are not yet familiar) or of a new quality of a good; (2) the introduction of a new method of production which need not be founded upon a new scientific discovery; (3) the opening of a new market, that is a market into which the particular branch of manufacture of the country in question has not previously entered, whether or not this market has existed before; (4) the conquest of a new source of supply of raw materials or half-manufactured goods; and finally (5) the carrying out of the new
organisation of any industry, such as the creation of a monopoly position or the breaking up of a monopoly position.

Nevertheless, the ultimate effects of innovations as economic phenomena are related to the commercial effects on the markets that the innovator is supplying. This makes it correct to state that innovation is a supply-side phenomenon, but this is different from characterising driving mechanisms of innovation processes, whether they are pushed by suppliers or pulled by customers. Market introduction presupposes the existence of a market. The process of introducing innovations into the economy may however in several instances be considered as the creation or opening of new markets. For services it is claimed that it is necessary to include a new class of innovation within this spectrum — delivery innovations [24]. Delivery innovations are described as innovations in the delivery system or medium of the service provider, such as ICT-based service provision.

The current focus on innovation processes differs somewhat from the original perspective of Joseph Schumpeter [22; 23]. First of all, the OECD Oslo Manual on innovation surveys [25] as well as the many innovation studies based on it focus on firm-level innovation. A firm-level approach makes innovation and diffusion complementary, rather than dichotomous, concepts. The intra-industrial diffusion process is considered an integrated part of innovation processes. The level of innovative activity differs considerably according to whether the analysis is restricted to ‘new to the industry’ innovations or includes ‘new to the firm’ innovations. The critical ratios between them can distinguish industry-specific patterns. There are no immediate reasons to believe that this picture differs qualitatively between manufacturing and services industries. It is often claimed however that an innovator’s appropriation of benefits from an innovation is more difficult in services as service innovations are easy to copy.

Schumpeter’s focus on innovation is reflected in neo-Schumpeterian economics which has been developed by researchers such as Christopher Freeman [26] and Giovanni Dosi [27].

**Triple helix model and non-technological and non-economic innovations.** The active role of universities in relation to society has been gaining emphasis in conjunction with, for instance, defining of the so-
called third task of the universities. Besides their roles as information node, transmitter, and networker, the concrete tasks of universities can also be seen in including the production of new openings based on foresight research and information as well as in catalysing various innovations that cross borders. The functional tasks of universities in relation to society can, in principle, be classified into two basic categories: the classical model and the interactive model. The first one describes the universities’ traditional tasks in transmitting information and producing new ideas and innovations. The idea that research results can be directly applicable faces many practical challenges.

Typical examples of the classical model are training of experts for the needs of businesses, contracted research, theses, and students’ practical training periods. This is much of what is desired from higher education institutions. These operations are quite important and significant from the point of the region and the individuals. From the development perspective, different operators and operations of the interactive model indicate the dynamic and intimate role of universities in the development of, for instance, a region. A successful, innovative network is often a community where the operators of academia, the cultural sector, and businesses meet one another in a fruitful way.

There are many kinds of models for describing collaborations between universities and other actors. The triple helix is the result of Henry Etzkowitz’ analysis of the change in scientific information production and universities in the information society [28–30]. According to Etzkowitz, information production has moved from universities to ‘university – government – industry’ interaction. For this combined activity he has created the name triple helix, which has become a popular concept in the field of higher education research and some other fields such as innovation research.

The triple helix is a model for understanding and guiding interactions in ‘university – industry – government’ relations. Each actor within a triple helix has its own task. Universities produce research, industries – manufacture, and a government secures stability for the maintenance of exchange and interaction. According to Etzkowitz, “The triple helix regime operates on these complex dynamics of innovation as a recursive overlay of interactions and negotiations among the three
IV
TRENDS IN THE KNOWLEDGE-BASED SOCIETY

FIG. 4. Models of ‘University – Industry – Government’ Relations

A. An Etatistic Model of ‘University – Industry – Government’ Relations

B. A ‘Laissez-Faire’ Model of ‘University – Industry – Government’ Relations

C. The Triple Helix Model of ‘University – Industry – Government’ Relations

institutional spheres. The different partners engage in collaborations and competitions as they calibrate their strategic direction and niche positions. The ‘triple helix’ denotes that this social world is more complex than the natural one”. The three alternative models are shown in
Fig. 4, A, B, and C of the triple helix model. These models can also be seen as future option frameworks for the European innovation policy.

The unique feature of the idea of the triple helix model is that it, in a specific way, emphasises the role of non-economic factors in an innovation policy. However, on the other hand, one important logical aspect of the triple helix model is that industry (wealth generation) and economic factors are always in some way involved in innovation processes. In this way the triple helix model does not take non-economic factors into consideration very seriously. The triple helix model includes policy institutions and academia as special factors. When two environments operate upon each other, mutual shaping and producing co-evolution along a particular trajectory is one possible outcome. When three environments are involved, more complex dynamics can be expected as a result of interactions involving bi-lateral and tri-lateral relations. The three environments are specified in the triple helix model: (1) wealth generation (industry); (2) the production of novelty (academia); and (3) public control (government). Furthermore, the triple helix model somewhat reduces complexity by using ‘university – industry – government’ relations for the specification of the historical conditions of the non-linear dynamics.

We can add non-economic aspects to the triple helix model when the system dynamics of an innovation process can be seen to be more complex (Fig. 5). However, it should be noted that in order to consider non-economic factors more deeply, a new triple helix model, which actually goes beyond the triple helix, has to be developed.

4. CONCLUSIONS AND SOME THOUGHTS ON NON-TECHNOLOGICAL INNOVATIONS

One way to analyse non-economic innovation is to present new versions of traditional innovation theories and models. This paper has focused on four relevant innovation models: (1) the open innovation model; (2) the innovation category model; (3) Schumpeter’s classical innovation theory; and (4) the triple helix model. Firstly, in this article I added the non-market sector to the open innovation model. In this way it is possible to understand that the innovation in process and the innovation out process
can also be connected to non-economic systems and non-market organisations. Therefore it is concluded that this additional element provides a new perspective on the open innovation model and associated open innovation processes. Without non-market and non-technological aspects the open innovation model is not comprehensive.

Secondly, in this article a new extension to the traditional innovation category model developed by von Stamm is added [17]. Specifically, non-economic or non-market sectors, from which incremental and radical innovations can also emerge have been added. The conventional trade-offs between different innovation types and also countervailing trade-offs have also been discussed, which should provide a new aspect to the innovation category model.

Thirdly, Schumpeter’s classical definitions of alternative innovations were discussed. It was noted that Schumpeter’s model did not pay very much attention to the non-economic elements of innovation, although he paid them some minor attention. Schumpeter’s focus was on the basic characteristics and organisations of the capitalist society.

Fourthly, three alternative triple helix models were presented, and there was a fourth new triple helix model included non-economic systems as a new element of the triple helix model. The non-economic systems make the triple helix model even more complex to understand and probably change our conventional view at the innovation dynamics associated with the triple helix model.
One general conclusion is that all these models do not include the framework of non-economic innovation (NEI). They are based on the fundamental economic ideas of market organisations, industries, clusters, and markets. In this paper a non-economic element has been added to these conventional models. This is the main scientific contribution of this article. In this way an attempt has been made to build up the new theory frameworks of NEI. Less attention in this paper has been paid to non-technological innovations (NTI) which are often social and service innovations.

If we analyse the spheres of NEI and NTI, we can outline four new innovation research field categories (Fig. 6). This kind of innovation categorisation helps in the identification of four critical research topics for modern innovation studies. It can be said that NEI and NTI analyses inspire us to build up four innovation research programmes, with specific background aspects. In this way NEI and NTI analyses and discussions can shift the paradigm of innovation research in new and interesting directions.

In this paper I have outlined new broader innovation theories for boxes B and D. Box B is explained mostly by conventional innovation theories. A new dynamic research field is service innovation studies. It is important to understand that there are many service innovations which are outside markets. It can also be said that limits between different innovation types are not very clear. Often there is a trade-off between economic and non-economic innovations, and social and technological innovations.

From Fig. 7 one can see that this clarification between technological and non-technological innovations is very important. It makes the hidden dimensions of NMI and NTI more visible. For example, it is possible to have both incremental and radical social innovations which are non-economic innovations.

To sum up, this article includes new forms and dimensions of NTI and NEI. New dimensions and forms can be presented in the contexts of traditional innovation theories and models. These findings and new theoretical concepts will probably have an impact on current theorising about innovation. Understanding that it is impossible to develop open innovation theory without comprehending the role of non-market and non-technological innovations seems to be one important impact.
Another impact of this article’s analyses is probably better understanding as regards conventional and countervailing innovation process dynamics.

**FIG. 6. Four new innovation categories inspired by NTI and NEI analyses**

- **Economic innovations**
  - A. Social innovations (NTI) in markets (EI)
  - C. Technological market (TI) innovations (EI)
  - B. Social innovations (NTI) in NEI social systems and environments
  - D. Technological innovations in NEI social systems and environments

**FIG. 7. Four new innovation categories inspired by NTI and conventional incremental/radical innovation analyses**

- **Incremental innovations**
  - A. Incremental social innovations (NTI)
  - C. Incremental technological market (TI) innovations (EI)
  - B. Radical social innovations (NTI)
  - D. Radical technological innovations

- **Radical innovations**
References


IV
TRENDS IN THE KNOWLEDGE-BASED SOCIETY


NADEZHDA GAPONENKO

TOWARDS A BALANCED AND ADAPTIVE SECTORAL INNOVATION SYSTEM IN NANOTECHNOLOGY

METHODOLOGICAL PROBLEMS, GLOBAL TRENDS AND REGIONAL STRATEGIES

The sectoral innovation system (SIS) in nanotechnology (SISn) is at the embryonic stage, marked by the setting up new institutions, new networks, and patterns of relations between different actors; the emergence of a learning regime; consolidation of technologies and the emergence of a new technological regime, as well as its embedding into the national innovation system (NIS), the global and national economy. It is still fragmented and marked by institutional gaps, but there are no doubts already, that it will have a significant impact on the NIS, the structural shifts in the economy, the competitiveness of countries on the world market and national security.

This paper seeks to contribute to our understanding of innovation system dynamics pointing to the need to look how SISn is emerging, what is its path creation dynamics which makes SISn different from other sectoral innovation systems. We argue that this knowledge plays a specific role in policy making and action plan development for building a balanced and adaptive SISn. Neither methodological nor analytical research has been completed in this area yet, so the discussion is based on the evolutionary theory, the chaos and complexity theory, as well as on the concept of sectoral innovation system developed by Franco Malerba [1–3]. This theoretical base underpins the analysis of the formed global and regional trends and policy mechanisms.

1. KEY FEATURES IN THE DEVELOPMENT OF SISn

The knowledge base, basic technologies and technological regime, agents and mechanisms of interaction between them, and sectoral institutions form the backbone blocks of the SISn, since it is they that condition the specific features of the SISn and its trajectory.
IV
TRENDS IN THE KNOWLEDGE-BASED SOCIETY

Scientific knowledge is not only the basis, but also the motive power of SIS development, so the specifics of the system of knowledge that lies at the foundation of the SIS have a significant impact on all other SISn blocks, the system as a whole and its trajectory. What are the peculiarities of the SISn knowledge base? What distinguishes it from other sectoral innovation systems? First, we should mention that the SISn knowledge base is formed at the intersection of different fundamental knowledge areas and applied disciplines; it is a multidisciplinary base characterised by the diverse scientific disciplines that encourage technological development. This base is not coherent, at least as of today, and is characterised by a rather high level of complexity. Research carried out by German academics shows that over the period of 1994–2003 there was an increase in the percentage of SISn articles devoted to problems of chemistry, polymer chemistry and material science and a decrease in the percentage of articles that deal with physics and biology issues. This means we may talk about structural shifts in the knowledge base per se.

The boundaries between basic and applied research seems diffused; to our mind, this also proves the complexity of the SISn knowledge base and this is what differentiates it from many other areas of knowledge. In 1997 Donald Stocks formulated the ‘use-inspired research’ concept to describe research that is not purely basic and not purely applied [4]. This concept was used in biotechnology research, classed as a science-based technology [5]. Nanotechnologies are also technologies of this type, since the research of fundamental phenomena on the nanolevel includes technological aspects and vice versa.

Some blocks of the knowledge base are codified; others are tacit and may be transmitted only by humans. It should be noted that in this respect SIS in nanotechnology repeats the trajectory of sectoral innovation system based on biotechnology. Being one of the key characteristics, the level of codified knowledge in the knowledge base predefined the formation of networks in the SISn for both the production and commercialisation of innovations.

We would like to note that the basic characteristics that have been used to describe the innovation systems knowledge base over the last two decades — stand-alone knowledge, generic or specific knowledge,
and codified knowledge – can not fully characterise the SISn knowledge base. The SISn knowledge base relies on generic knowledge that is specific to a significant degree, i.e. it may only be used in a certain sphere of science and technology; it is partly codified and partly tacit; it is stand-alone, but at the same time it depends on the generic knowledge. These basic characteristics of the knowledge base, introduced by Sidney Winter in 1987 and then advanced by many experts in the theory of innovations [6], do not provide in-depth view of the nanotechnology knowledge base. We argue that the key characteristic of the nanotechnology knowledge base is its multidisciplinarity. This feature predefines knowledge production, its propagation and the building of networks, systems and R&D mechanisms, the role and strategy of the corporate sector, as well as other important processes in the SISn.

SISn is at the stage when its technological regime is emerging. Nano- and biotechnologies, as well as ICT underpin the SISn technological base. The technological regime is mostly predefined by these technologies and their knowledge base and is influenced by the fact that nanotechnology is at the initial stage and is considered as revolutionary, breakthrough technologies that will change all other technological areas, sectoral innovation systems, and sectors of the economy, just like information technologies did in their time.

Since nanotechnology is at the initial stage, it is characterised by both high levels of opportunities and risks. In most fields of nanotechnology, basic technologies are not revealed yet, and for this reason there is a rich variety of technological solutions. According to Malerba, the high level of opportunity conditions is accompanied by powerful motivations for innovation activity. In SISn such motivations are the desire to be the first to enter the world market and expectations that this market will experience fast growth, which, in turn, will ensure high profitability. We suppose, though, that not only motivation (as Malerba and a number of other authors assert), but the existing R&D system, the model of interaction between science, industry, and the innovation governance, entrepreneurial and innovation culture and the formed financial infrastructure, i.e. the dominant NIS model influence the opportunities even at the early stage of sectoral innovation system. A powerful influx of financial resources to the nanosphere from the
government and corporate sector increases the level of opportunities, whereas a lack of qualified personnel in a number of countries provides a controversial impact. On the other hand, globalisation of the R&D system presents additional opportunities to those countries that could benefit from the globalisation processes.

Technological knowledge cumulativeness can be formally defined as degree of correlations among innovations and, more broadly, innovation activities. It represents the probability of innovating at the time $t+1$, conditional on innovations at the time $t$, or on innovations in the previous period. Malerba distinguishes the cumulativeness of technological knowledge on the level of companies, sectors and geographical areas, and links the level of cumulativeness with the existing low level of protection for innovations. What can we say about the cumulative nature of technological knowledge in the SISn at present and in the nearest future? This question has not been fully analysed yet, but we can already see that, since nanotechnology is built on basic research, and the research of fundamental phenomena on the nanolevel includes technological aspects and vice versa, this ensures a relatively fast pervasiveness of some technological knowledge between the companies of this sector. In the other words, the cumulative nature of technological knowledge on a sectoral level is relatively high, and this should be explained not by the low level of protection for innovations, but by the fact that nanotechnology emerges and develops from basic research. Furthermore, most knowledge is produced in the public sector (not the corporate one), and this also supports the high degree of knowledge cumulativeness on a sectoral level.

Finally, to our mind, not only and not so much the companies’ interconnections on the sectoral level, as cross-sectoral interactions will become the main source of technological knowledge cumulativeness in the nearest future. The thing is that the present stage of scientific and technological development is distinguished by the formation of a cluster of knowledge economy basic innovations, and this means that the basic technologies of the knowledge economy are now interweaving, which accelerates technological change. We will probably not be mistaken in asserting that the cumulativeness of technological knowledge will increase, since nanotechnology will include more and more other
fields, biotechnology and ICT, in the first instance. Interaction between these technologies becomes more and more complex; on the one hand, nanotechnology today encourages the development of biotechnology and ICT while, on the other hand, the growing demand for ICT and biotechnology urge the development of nanotechnology. The knowledge base and technological knowledge interpenetrate between the sectoral innovation systems in nanotechnology, biotechnology, and ICT. Such interaction is reflected in the cumulative nature of technological knowledge. We may expect the acceleration of such interpenetration in the nearest future, and the emergence of qualitatively new technologies that are called nano-bio-information-cognitive technologies (NBIC) by 2040. This is an example of how an increase in the scale of multidisciplinary research, i.e. the growing qualitative changes in the knowledge base, may lead to qualitative changes in the technological base and technological regime. The arguments described above allow us to conclude that we may expect a high and increasing level of cumulativeness on a sectoral level in SISn as a result of cross-sectoral interactions; this changes our notions of the source of knowledge cumulativeness that were founded by the fathers of the theory of innovations.

Any SIS is characterised by the *sectoral products* and the market segment it is oriented to, as well as the consumers whose demand stirs the market. Nanotechnologies are deemed to be breakthrough technologies that revolutionise all sectors of the economy, form the basis of the new Kondratiev cycle and provide solutions to many social and economic problems that could not be solved by the basic technologies of the former Kondratiev cycle, change the consumption model and form the basis of new needs. Experts have recently distinguished two key stages of nanotechnology development from the viewpoint of sectoral products: the evolutionary and revolutionary stages. *Evolutionary* nanotechnologies are aimed at improvements in the materials that are already used in different sectors of the economy, technological processes, and consumer properties of the manufactured products as well as lowering the cost of production. Evolutionary nanotechnologies are based on the unique properties of a substance at nanolevel. At this stage the SISn products are integrated into the production programme that
has already been realised by different branches and sectors of the economy; they transform the consumer properties of the products. The evolutionary stage of nanotechnology mostly represents a top down approach to nanotechnology. On the contrary, revolutionary nanotechnologies perform bottom up approach to nanotechnology and provide production basis to launch atomic assembly of a product.

These features of nanotechnology predefine the peculiarities of the SISn products presented on the market today. In a strict sense, as regards the market, the indicators of sales and market dynamics point out the sales of nano-enable products, not the sales of nanoproducts. For example, a nano-enable medicine may cost about 500 roubles per pack, while the cost of the nanocomponent embedded in the medicine may not exceed 20 roubles.

Though SISn are at the initial stage, SISn products are already used in all sectors of the economy. Many of today’s consumer goods already include nanocomponents, and the quantity of such goods is increasing dramatically: it doubled over a period of 14 months and constituted 475 consumer goods by May 2007. Clothes and cosmetics head the list of nanoproducts: 77 and 75 items of each of these product groups presented at the world market in 2007 were nano-enabled products. Silver nanoparticles are the most often used ‘nanoadditives’ in consumer goods; about 20% of the consumer goods that were sold at the market in 2007, contained silver nanoparticles. Carbon (including carbon nanotubes and fullerenes) is the second most widely used component (after silver nanoparticles) in the production of consumer goods.

Therefore, even at the initial stage of SISn, products are used in all sectors of the economy, they transform them at an evolutionary level, form a new circle of consumers and the ‘field’ for revolutionary nanotechnology development.

What can be said about the agents, actors, and emerging interactions between them and the networks being formed at the initial stage of SISn? Even at the embryonic stage, SISn is distinguished by a large number of agents included into the innovation process. Universities, research organisations of the public and private R&D sectors are the main producers of innovations. The R&D sectoral system constantly sees the advent of new agents and structures in the form of transdisci-
plinary research institutes and centres, as well as organisations in research infrastructure such as multiple-access centres. The multidisciplinary nature of nanotechnology requires the formation of multidisciplinary networks for knowledge production. Such networks are also formed in the course of self-organisation of different agents and as a result of the science and innovation policy pursued by the state, and also under the influence of corporations that shape the demand and provide financing for the public R&D sector.

Financial institutions, mostly venture funds and business angels, as well as pension funds and specialised state and corporate foundations enter the already existing networks and sometimes initiate new ones. Risk capital structures establish connections with research organisations, spin-off companies, but very often in order to distribute and lower the risks they form alliances with other venture funds, state structures, and innovation infrastructure institutions such as business incubators.

New information and consulting companies, foresight centres, incubators, founded with the support of the authorities or by private initiative, emerge in the SISn and form new channels of interaction between nanoscience and the SISn manufacturing sector; they are integrated into the existing networks or lay the foundations for new networks and interconnections.

Manufacturing companies establish linkages with research organisations, authorities, financial institutions, as well as consumers and suppliers. The SISn manufacturing sector grows mainly due to the foundation of new, start-up companies. This is what makes SISn different from other sectoral innovation systems.

The SISn includes a diverse range of agents, since all of them have different experience, motivations and play different roles in the SISn. The networks are formed not due to the interaction of agents by competence, but due to their ability to integrate mutually complementary structures that have different potential and different specialisation. SISn allows for a quick growth of different networks both because small businesses play a fundamental role in SISn development (in order to survive and gain experience, small businesses have to work in a network; networks play a qualitatively different role for small businesses
and large companies) and because this sphere is multidisciplinary and cross-sectoral in nature.

It should be noted that the mechanisms of interaction between the agents and the new networks are mostly emerged in the course of self-organisation; the ability to self-organise plays a critical role at the embryonic stage of SISn.

At the initial stage, SISn is characterised by the emergency of new sectoral institutions and the integration of the sector into the already formed national institutions. For example, a number of countries have already begun discussing the laws important for SISn regulation. The SISn legislation started with the ratification of laws aimed at sectoral product safety at the consumer markets. The problem of nanoprodut standardisation and the development of sectoral standards are also being discussed.

It should be noticed that the SISn already effects the institutions within the national innovation system. For example, many countries have begun to create specialised business incubators to support the start-ups. Nanocompanies need specific services and have to work in close cooperation with research organisations and venture capital, and all these define a new layer of requirements for the institution of incubators and calls for changes in the incubator model itself. On the one hand, such changes ensure the diversity of the incubator model while, on the other hand, in the nearest future, we may expect that under the impact of nano- bio- and information technologies these changes will influence the institution of business incubators at large.

Another example is the developing new structure of multidisciplinary research and expert evaluation of such research during grant allocation. The thing is that experts in different spheres talk a different scientific language, so such research encourages the establishment of a ‘common language’. We assume these changes will have a significant impact on other SISs and the national innovation system as a whole in the nearest perspective, since the importance of multidisciplinary research is growing; nanotechnology tracks the way for other SISs, being multidisciplinary in nature. The same may be said about the developing system of expert evaluation in multidisciplinary research.

Therefore, by way of a short summary, we should note that the emerging of SISn backbone blocks — the knowledge base and the learn-
ing regime, basic technologies and technological regime, interaction among actors and/or agents, and different institutions — takes place at the embryonic stage and is in the course of their self-organisation. The existing NIS model and national institutions have a significant impact upon the SISn trajectory at this stage.

2. SISn AS AN OPEN NATIONAL INNOVATION SYSTEM

There is another series of questions, important to gain understanding of the SISn at the initial stage: What shapes the SISn as a system? What place does the SISn take in the innovation and economic systems hierarchy? How are the system’s trajectory and dynamics formed?

SISn is an open system that should be analysed as part of the system of a higher level and as a system with its own characteristics at the same time. But what shapes this system? First of all, these are the emerging mechanisms of interaction between different agents, developing networks, learning and technological regimes, and sectoral institutions. Today it may be said that institutional boundaries of the SISn are being delineated, though it mostly concerns the R&D system and innovation infrastructure, and to a lesser extent — the production sector. Institutional boundaries of the production sector in nanotechnology are still rather washed out, since the evolutionary nanotechnologies, integrated into the existing production structure, occupy dominant positions today.

Would it be legitimate to assert that a national sectoral innovation system in nanotechnology has been established? The assertion seems reasonable: First, the system of SISn governance already comes into sight. Second, the state authorities work on rules and regulations in order that a balanced and adaptive SISn to be formed. Third, sectoral institutions emerge and the trajectory and nationally specific model of SISn, which includes entrepreneurial and innovation culture, business and research ethics, and consumption mode and culture, are taking a shape.

At the same time, the national SISn should be considered as part of the emerging global SISn. Undoubtedly, the SISn of different countries will influence each other through the patenting institutions and standards, mechanisms of national market protection adopted on a nation-
al level, nanoresearch confidentiality regimes, the globalising labour market, and through mechanisms of global problem solutions. At the present day, no domination pole has been formed yet, though, for example in biomedicine, some scholars argue that the USA occupies a leading position [7]. For example, the ‘old leaders’ such as the USA, Japan, and the EU countries are gradually pressed by countries of the Asian-Pacific regions (e.g., China, Korea), Israel, and the developing pool of nanotechnology in Russia based on the huge basic research potential and the traditionally strong performance in the Russian academic sector.

SISn should also be considered as part of the national innovation system and the national economy, and it is very important to understand their mutual influence on each other. At the first stage of SISn, the considerable influence of the national innovation system on the trajectory of the SISn being formed is evident. At subsequent stages we may expect quite the contrary: an increase in the influence of SISn on the national innovation system. At present the national innovation system influences the SISn through the existing institutions, knowledge structure, innovation infrastructure (venture capital as part of innovation infrastructure is paramount at the current stage; its model, and what institutions dominate in the venture capital structure — pension funds, banks, or corporate sector — should also be taken into consideration), through innovation and entrepreneurial culture, the existing model of cooperation between science, industry, and the government, as well as through the operating model of those companies that work on the market (their experience, learning regime, flexibility, and business ethics). The existing model of interaction between universities and public research organisations on the one hand and industrial companies on the other is of great importance for the SISn, since the public R&D sector is the source of innovations and changes in the SISn. This also predefines the importance of the adopted legislation for intellectual property rights.

The national economy pattern also influences the SISn trajectory through the peculiarities of demand for nanoproducts and nanoservices. National institutions, such as banks, the stock market and the educational system, are already exerting their influence on the SISn trajec-
tory. For example, Russia has strong traditions of training highly skilled specialists in the physics, chemistry and materials science, i.e. the areas that form the ground of this R&D sector. Therefore, the emerging educational system for the new SISn has something to rely on; this gives Russia a competitive advantage over, say, the countries of the Asian-Pacific region. However, Russia has the underdeveloped stock market: This influences decisions taken by venture capitalists since they analyse the strategies of exiting venture funds at the stage of their creation. This also affects the dynamics of venture capital that in its turn influences the dynamics of spin-off companies. This is a significant disadvantage for Russia, if we compare it, for example, with the USA or EU countries. Such a factor as the integration scale of national institutions and companies into the global economy and global innovation system may become critical for the SISn at the early stage because national markets often are too narrow for nanocompanies.

3. SISn DYNAMICS AT NATIONAL LEVEL

The SISn dynamics and trajectory are formed, to our mind, in the course of interaction of several processes that take place in different layers of the SIS, i.e. it is formed from a number of local dynamics and trajectories. One such layer is the innovation cycle itself: from knowledge production to market entry. As of today, this cycle is of a linear type, i.e. most innovations are produced at the universities and public research organisations and then they are either brought to market by the start-ups or commercialised by companies in different sectors of the economy.

The second layer is the interaction dynamics between research organisations, industrial structures, different kinds of governmental structures and financial institutions; these interactions form the SISn model, lay its foundations, moreover, in the course of such interactions the SISn knowledge base and technological base are developing, and the learning and technological regimes are being established.

Despite the fact that the SISn is at the embryonic stage, global problems and institutions already influence the national trajectories. First of all, we should note here that nanotechnology is linked with such global problems as a growing deficiency of fresh water, the
increasing gap between the rich and poor countries, and global climate change. Therefore, the decisions taken in this sphere by the global institutions have an impact on national structures and priorities, while the latter, in their turn, affect the national SISn trajectory and the emerging global and regional networks. Besides, the need to introduce standards, a unified patenting system, and mechanisms of control over the consumer and environmental safety of nanoproducts are already recognised and, therefore, we may expect these problems to appear on the agenda of international institutions in the nearest future and decisions taken to influence national trajectories. In order to analyse these problems, research and expert networks are already being formed. And, finally, national institutions are aware of the lack of qualified personnel; they understand the importance of nanotechnology for ensuring national security and try to reorient academics and experts from other countries for their own national interests. On the one hand, this helps to establish multinational networks while, on the other hand, it may cause unnecessary tension in the international relationships and increase the secrecy in nanoresearch. We should add to this that severe competition already exists between the major world regions, fighting for leadership and thereby influencing the national SISn trajectories through governmental and corporate decisions, and accelerating the establishment of partner relations between the public and the private sector, as well as the formation of networks and sectoral institutions.

The local (regional) layer of nanotechnology starts to exert influence on the SISn models and trajectories at the national scale. Regional authorities try to employ nanotechnology to solve respective regional problems. This is also assisted by the fact that nanotechnology can contribute significantly to the improvement of environment, the rehabilitation of water systems and the betterment of drinking water quality. These are the issues to be regulated by the regional authorities. That is why, on the one hand, regional authorities have begun to invest in nanoscience (in some countries the percentage of such investments in total budgetary appropriations on nanoscience is already significant, e.g. it is about 25% in the USA), and on the other hand, they shape the demand and provide preferences to the industrial companies that manufacture products for regional needs.
If we compare the SISn of different countries of the world, we may observe that the economic pattern influences the SISn trajectory. For example, in regions where microelectronics shapes regional competitive advantages (the Asian-Pacific region), nanoscience is oriented towards that sector and the large companies establish venture funds and play as consumers of the new knowledge. In countries where pharmaceuticals are competitive at the international market (e.g., Switzerland), nanomedicine is given priority. This means that the SISn trajectory, even at the embryonic stage, is already dependent on the economic pattern, the innovation and R&D system, and the NIS trajectory formed before. Our observations show that the SISn trajectory is also influenced by socioeconomic problems accumulated in the region. For example, fresh water deficiency in Africa predetermined the accents of the national nanotechnology programmes implemented by the countries in this region, i.e. they employ nanotechnology to find the solution or reduce this problem. It is understandable, though, that in the future the SISn is able to change the economic structure and the national innovation system, should there be any competitive advantages in the nanoscience and should they be worked in practice.

Thus, the SISn dynamics on a national level is shaped under the influence of diverse processes occurring at different levels of the SISn, where the global and local levels increase their influence on its model, dynamics and trajectory at a national scale.

4. GLOBAL TRENDS AND MECHANISMS OF ESTABLISHING A BALANCED SISn

Despite the fact that nanotechnology is at the starting stage and the SISn is still embryonic, we can already observe global trends and a change of leaders in there; we can also distinguish the general measures of SISn regulation, predetermined by the specific features of nanotechnology and the SISn, and the specific measures taken by different countries that grow, we believe, from the national model of an innovation system and the existing economic structure.

In order to accumulate resources and intellectual potential in the priority areas and to implement coordinated measures in nanotechnolo-
TRENDS IN THE KNOWLEDGE-BASED SOCIETY

With technological support, more than 35 countries have developed national programmes in nanotechnology, which represent the first essential move towards a balanced SISn [8].

Since one of the peculiarities of nanotechnology is its cross-sectoral nature, a substantially new way of coordinating the activities of different ministries and bodies is needed. To coordinate the activity of different authorities in SISn, interdepartmental commissions and councils are being established; businessmen and representatives of scientific community and non-governmental organisations are being invited in these bodies. All countries of the world are acting in the similar way.

Another feature of all national programmes in nanotechnology is the fact that the development of research infrastructure is distinguished as a separate system block, which is explained by high prices on the first-class research equipment.

The third feature of these programmes is that the problem of human capital accumulation is also distinguished as an important set of activity. It should be noted that both technologically developed and developing countries take almost identical measures. They accumulate human resources for launching transdisciplinary research, raise the status of nanoscience\(^1\); they create specialised transdisciplinary courses, hold conferences and organise summer schools, as well as attract ‘talents’ from other countries.

The fourth feature of the national programmes is developing private-public partnership, though the role of corporations differs from country to country. In the USA and Japan the private sector is very influential and often acts as the initiator of such programmes. In China, on the contrary, the state is the main national ‘ideologist’. Private-public partnership is explained first of all by the necessity of quick R&D commercialisation and R&D orientation towards the needs of a real sector of the economy. Besides, many countries encourage non-governmental organisations to participate in the development of national nanotechnology programmes.

\(^1\) China and Russia plan to detach nanotechnology as a single discipline and to grant scientific degrees in this field; the EU plans to introduce a special award in nanotechnology.
The fifth feature of the national programmes is that they set as a detached task issues of the consequences of use of nanoproducts and nanoservices, the possible negative influence of these products and services on human health and ecology, and the fostering consumers’ positive attitude to nanotechnology.

All national initiatives in nanotechnology are oriented towards filling the institutional gaps in the SISn, i.e. the foundation of:
- multidisciplinary centres, centres of excellence, and multiple-access centres in the sectoral system of R&D;
- university departments that will train specialists in nanotechnology and will establish teaching and professional courses for SISn;
- special structures at national and regional levels with a view to govern SISn;
- entities of financial, innovation and information infrastructure, such as incubators, libraries and databases, as well as adaptive and self-learning networks.

At the first stage of SISn, all countries have applied special efforts to support the nanoscience, sectoral system of R&D, taking into account that science is a major source and motivating power of nanotechnology advancement. All countries of the world provide unprecedented financing and develop measures aimed at mapping the nanotechnology scientific potential.

We may now outline specific measures that distinguish national initiatives in nanotechnology in different countries and regions of the world. For example, the USA spends about 50% of the national programme budget on the needs of the US Department of Defence; in 2008 the USA was the first country in the world that allocated funds to advance molecular nanotechnologies, after numerous discussions and the expressed discontent of the scientific community. The EU developed measures aimed at the formation of a pan-European unified ‘nanospace’ and the creation of technological platforms in nanoelectronics, nanobiology and nanoenergetics. Since R&D commercialisation is a bottleneck in all EU countries, a package of measures to support small businesses and spin-off companies was formed. China was the first country that claimed the need to create a balanced SISn in the official governmental documents and put into agenda standardisation ini-
TRENDS IN THE KNOWLEDGE-BASED SOCIETY

Taiwan marked out R&D commercialisation as its priority, Latin American countries, possessing a rather limited potential, orientate themselves towards cooperation with other countries. Finally, Russia has established a state nanocorporation, and most government investments in nanotechnology (especially those aimed at R&D commercialisation) will be distributed through this nanocorporation.

Today, we can already outline global and regional trends, structural shifts and problems that became evident after implementation of different nanotechnology measures in different countries; these trends, transformations and problems reflect, in a way, the specificity of the initial stage of nanotechnology.

Since the fight for leadership in this sphere has increased over the last few years, we naturally observe a constant growth of investments in nanotechnology. According to Científica* data, total investments in nanotechnology on a world scale have increased by 3.6 times during 2003–2007, government investments increased twice and corporate expenditures on nanoscience increased by 6 times (Fig. 1). Government investment growth rates in nanotechnology exceed the government R&D financing growth rates in all countries of the world; in some countries (the USA, Japan, Russia, Ireland and Taiwan) government

**FIG. 1. Global investments in nanotechnology**

![Graph showing global investments in nanotechnology from 2003 to 2010](image)

* Científica Ltd. is a company that provides a suite of consulting services on nanotechnology to a diverse group of clients (for further details, see: http://cientifica.eu).
spending on nanotechnology exceeds the government spending on other R&D fields, i.e. nanotechnology has the absolute priority. Fig. 2 illustrates the share of nanotechnology in total government funding on R&D in different countries. Corporate spending on nanoscience increases faster than government spending in all major world regions (North America, Asia, EU). This is a nanotechnology phenomenon, especially considering the fact that, for instance, in the EU, corporate R&D spending at large has tended to decrease or stagnate. The comparison of these two trends enables us to conclude that corporations actively finance the public R&D sector.

Analysis of government investments in nanotechnology by world region shows that the three competing poles have already been established: they are the USA, Japan and the EU. These world regions have been the leaders for a long time, but over the last few years their leadership has come to be contested by China and Korea. Therefore, we observe the establishment of the Asian and Pacific pole of leadership (Fig. 3). After the Presidential initiatives in nanotechnology were adopted in Russia, this country has begun to develop and implement measures that would allow it to score an advantage in basic research.

**FIG. 2. Share of nanotechnology in total government funding on R&D in 2005**

![Graph showing the share of nanotechnology in total government funding on R&D in 2005 for various countries.](image)

Source: [8, p. 125].

Data for Russia refer to 2006.
If we evaluate government investments in nanotechnology by the purchasing-power parity (PPP), we would see that in 2008 the leading positions here are taken by the EU (Fig. 4). After the Presidential initiatives, Russia rise to occupy the second place. The third place belongs to China, the fourth – to the USA. Therefore, the leaders are changing, but it should be noted that the new leaders orient their budget towards infrastructure development and the purchase of scientific equipment, but not towards nanoresearch per se. Many EU countries, the USA, and Japan have already gone through this stage.

As mentioned above, corporate sector spending on nanoresearch is increasing. In 2003 corporate spending on nanoresearch almost reached the level of government investments in nanotechnology; in 2005 the former exceeded the latter by 1.5 times and, in 2008, by 2.2 times. According to Cientifica, over 80% of all investments in nanoscience will come from the corporate sector in 2010. One of the peculiar features of the nanosphere is that corporations increase their spending on nanoscience at the embryonic stage of the market, when most basic and applied research is performed by the public sector. It should be noted that at the same time the ‘weight’ of different regions of the world in...
global corporate sector spending on the nanoscience is also changing; the weight of the Asian-Pacific countries is increasing. Russian corporations have showed no interest in nanotechnology. However, in 2007 the situation began to change. The ONEXIM group suggested to establishing a foundation aimed at investments into hydrogen energetics and nanotechnology. This step by ONEXIM group, taken under the influence of the Presidential initiatives, to our mind, may positively affect

**FIG. 4. Government investments in nanotechnology in 2008: lead countries**

Source: Cientifica.
IV

TRENDS IN THE KNOWLEDGE-BASED SOCIETY

the behaviour and motivation of other private companies and change the trajectory of corporate investments in nanotechnology in Russia. Therefore, the leaders are expected to change as regards spending on nanoresearch in this country as well.

One of the leadership indicators in nanoresearch is the publication of articles in peer-reviewed journals. In this connection it is worth to note that the total number of publications over the period of 1990–2006 increased by more than 28 times (Fig. 5). This proves that the nanosphere is now being formed and that nanoresearch is coming to the fore of science and technology.

The USA, Japan, China and Germany have been the leaders in nanopublications over this period. Before 2001, China published fewer articles than the USA, Japan and Germany, but then managed to out-run Germany in 2002, and Japan in 2003.

The quantitative analysis of publications during 2000–2005, conducted by Evaluametrics*, showed that the number of published articles doubled over that period [9]. Use of a fractional calculation method demonstrated that the USA published about 22% of those articles, the share of the EU-27 decreased from 32 to 25%, while the share

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* Evaluametrics Ltd. provides evaluation of research through publication metrics (for details, see: http://www.evaluametrics.co.uk).
of China, on the contrary, increased from 11 to 20% over that period. Most Americans published in biology and medicine, the Chinese – in chemistry and mechanical engineering, and researchers from the EU paid special attention to biology and medicine, as well as chemistry and physics. Since the early 1990s Russia has constantly ranked the sixth in the world nanopublications.

Another indicator of global leadership in nanotechnology is the citation index. Evaluametrics data show that articles by American experts are cited a lot more often than articles by the Chinese or the Europeans. About 56% of American articles published in 2003 had a citation index more than 10 (over the period of 2003–2006), only 38% of the European articles and 30% of the Chinese had the same citation index; Germany and the Netherlands are the European leaders in this sphere: 45% of articles from these countries were cited.

It should be noted that the number of joint publications by scientists from different countries increases, confirming the emergence of global networks where the American researchers have already taken the leading positions.

In general, the trend is that the three leaders in publication activity are being contested by China; also Russia may improve its position after the Presidential initiatives have come into force and the importance of nanotechnology has been acknowledged in the governmental and business circles, as well as in the academic community.

Patent statistics is another important leadership indicator in nanotechnology. Patent indicators also help to monitor the SISn trajectory, the structural shifts between the world regions, and inside the SISn between the different nanofields. Over the period of 1990–2006 the number of patents in nanotechnology increased by almost 25 times (Fig. 6); the patent and publication dynamics allows to say that the nanotechnology as a scientific field is being formed. It should be noticed that the publication and patent growth rates almost always coincide.

Analysis of the US Patent and Trademark Office (USPTO) data from 1976 to 2002 shows that the USA has been the leader in this sphere (67% of all patents), followed by Japan, Germany, Canada and France, South Korea and the Netherlands. This group of seven main-


IV

TRENDS IN THE KNOWLEDGE-BASED SOCIETY

tained its leadership in 2003, while China and Ireland entered the first twenty countries in nanotechnology. In 2005 the USA maintained its leading position, but reduced its share to 32%, China took the third position and Korea completed the group of five leaders (Fig. 7). Therefore, we are also observing a shift to the Asian-Pacific countries in the nanopatent activity.

The market dynamics and competitive positions of different countries at the nanomarket are aggregates to benchmark the SISn and leadership of different countries and regions in nanotechnology. The nanoproducts and nanoservices market is at the initial stage as well, but it is expected that in 2009 it will experience significant growth and become the most rapidly developing segment of the world high technology market.

In 2000 the US National Science Foundation (NSF) published a forecast, according to which in 2015 the world nanomarket would be valued at 1 trillion US dollars, about 15% of all manufactured products will be nano-enabled, 200 million new jobs will supposedly be created. In 2007 Cientifica and Lux Research published new estimations of nanomarket prospects: they suppose that the market will reach the 3 trillion dollars marked by 2015.

At regional level, over 40% of the market was occupied by the USA in 2007, 34% — by the EU countries and 23% — by Asia (Fig. 8); how-

**FIG. 6. Number of patents in nanotechnology**

Source: Georgia Tech TPAC / CNS-ASU patent analysis.
ever, the Asian market is the most dynamic among them and its share is bound to increase.

In all world regions, markets develop due to emergence of new small enterprises and spin-off companies; they account for up to 70% of the world market (Fig. 9). Practically, nanotechnology repeats the trajectory of biotechnology where spin-off companies were the main market driving force as well. According to Lux Research*, 1480 companies worked on the world market in 2005; more than 50% of those companies were from the USA. American companies have managed to keep their significant advantage over the last decade.

A number of large transnational companies invest considerable funds into nanoresearch and establish venture funds. However, they are usually presented on the market by their affiliate companies since this market is still too small for large companies. It is interesting to note that since a considerable nanomarket growth is expected in 2009, this may

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**FIG. 7. Lead countries in nanotechnology patents granted in 2005**

![Bar chart showing the percentage of nanotechnology patents granted in 2005 by different countries.]

Source: Lux Research.

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* For more details on Lux Research, see: http://www.luxresearchinc.com
IV
TRENDS IN THE KNOWLEDGE-BASED SOCIETY

cause significant changes in weight and position of different nanomarket players. For example, in the nanomaterials, where growth began earlier than in other segments of nanomarket, the number of manufacturing companies is already on the decrease and the transnational chemical companies are starting to dominate.

What encourages corporations to accelerate investments into nanotechnology when the market is at the embryonic stage, demand for nanoproducts and nanoservices has not been shaped yet, and most basic and applied research is concentrated in the public R&D

FIG. 8. Nanotechnology market structure by world region in 2007

Source: Cientifica.

FIG. 9. Key actors at nanotechnology world market in 2005

Source: Cientifica.
sector? Our analysis has enabled us to highlight the following basic factors:

— market expectations, expectations that the nanomarket will experience significant growth in the nearest future and, therefore, those who are the first on the market will receive their technology rent;

— increasing competition at the microelectronics and semi-conductors market, where one can not be competitive without ‘nano’ any more;

— aggravation of energy problems (high prices for energy resources);

— hopes laid upon nanotechnology in connection with a number of serious social and medical problems (cancer, diabetes, targeted medicine delivery, principally new diagnostic techniques that allow to detect diseases at a very early stage) encourage both authorities and corporations to invest in nanoresearch;

— finally, a deficiency in ‘non-nano’ innovations that would promise profits of the same scale as nanotechnology. Lux Research informs that nanoproducts supplied to the market today cost about 10% more than their traditional analogues.

Our research has also shown that the following major barriers to nanomarket may be marked out:

— lack of information about regional markets, their specific features and the problems that condition regional markets at their initial stage;

— uncertainty about the future trajectories of regional markets conditioned by both the peculiarities of governmental market regulation and the influence of social and cultural factors, i.e. whether consumers from different world regions are ready to accept nanotechnology, considering their religious beliefs and cultural traditions;

— risks related to the possible negative effects of nanotechnology on the environment and human health;

— perils arisen from so-called destructive consumers of nanotechnology, i.e. the appearance of nanoterrorism that will definitely require new regulatory mechanisms on national and even global levels;

— lack of information on R&D results and opportunities in different economic sectors caused by high technologies;

— limitedness of venture capital in all regions of the world since the venture investments play a major role in providing initial impetus for start-up companies that move on the nanomarket today.
The interest of venture capital in nanotechnology is growing all over the world. Over the period of 2002–2007, global venture capital investments in nanotechnology increased, by 1.82 times (Fig. 10). However, Lux Research data show that only 2% of all venture investments were spent on nanotechnology in 2005; the number of transactions decreased, but the average value per transaction increased and reached 10.9 million US dollars. Nanoelectronics was the leader in venture investments, with about 40% of all venture investments in nanotechnology spent on nanoelectronics in 2004 and 2005; life science came second, with nanomaterials and nanoinstruments sharing third place. Over the period of 1998–2005, only 143 nanostart-ups received venture capital investment and considering the fact that about 1500 nanostart-ups functioned at the world market in 2005, we may say that each tenth company was financed by venture capitalists. At the same time, all analysts note that there is an incredible lack of venture investments into nanoproducts and nanoservices.

The USA is the most advanced country as regards venture investments in nanotechnology; according to Lux Research, in 2007 the USA shared about 90% in the total venture capital investments. Two factors seem to be crucial for the US leadership: the developed model of venture capital, where major venture investors are pension and insurance
funds with a more long-term investment horizon (banks dominate in the EU and Asia), as well as a well-developed entrepreneurial culture (the Americans tend to risk and distribute their risks in case they are high). Therefore, the already formed venture capital model influences the SISn trajectory.

5. CONCLUSIONS

The SISn is at the embryonic stage and is characterised by rapid changes and structural shifts. It has emerged in the course of self-organisation of different agents and regulatory measures, while the peculiarities of nanotechnology and the initial stage of SISn predetermine the essence of these measures. Potentially, the SISn may significantly impact the knowledge base, basic technologies, and trajectories of the NIS and economy; however, at the initial stage, the already formed NIS model and economic pattern effects SISn to a high degree.

In order to understand the processes that occur in the SISn, we need to reconsider the theory of innovations and the SIS concepts, since their major postulates do not allow us to succeed in understanding and evaluating these processes. At the initial stage of SISn these processes are conditioned by the multidisciplinary and cross-sectoral nature of nanotechnology and the importance of cross-sectoral connections between the SISn and other innovation systems. To our mind, the SISn revolutionises both practically and theoretically not only the national innovation system and the economy, but also the theory of innovations and the concept of innovation systems and the importance of the SISn agenda increase for all innovation systems with the lapse of time.

Even at the initial stage, the SISn is shaped as the national and part of the global innovation system, and the mutual influence of global trends and processes is considerable. Therefore, the SISn should be viewed as an open, co-evolutionising system, integrated into a hierarchy of innovation and socioeconomic systems. This system is not equal to the sum of its elements, it is characterised by intricate non-linear reverse connections, and the self-organisation ability of its agents plays a critical role in the initial stage of the SISn. That is why in order to study how SISn is emerging and developing, we should use not only
the theoretical instruments provided by both the evolution and innovations theories, and the concept of SIS, but the chaos and complexity theory as well. To our way of thinking, studies on changes, that take place SISn, will encourage interpenetration of these concepts, contributing to the theoretical and methodological basis for studies in development, transformation and governance of innovation systems in the 21st century.

References


Today the Russian economy is going through several simultaneous transformational processes, some of which are local (for instance, market transformations), while others are worldwide tendencies, the most prominent of which is the transition to a knowledge economy. Basically, the transition to a knowledge society should probably not be considered an independent process, but an element of social transformation that was first described by the academician Vernadsky who predicted that future human progress will be confined to the sphere of knowledge and mind that he called the noosphere: “For the first time in history scientific thought emerges as a power that creates the noosphere in the course of a spontaneous process” [1, p. 64].

It is possible to suppose and even claim that the prospects of transition to a knowledge society are in line with this tendency, as described by Vernadsky. With that, the desire to ensure the leading position of a domestic economy in the future is only natural. This requires development of an adequate strategy that will enable us to reach compliance with future transformations, which, in turn, means that we should try to understand the underlying nature of these transformations. Let us analyse the economic basis of a knowledge economy in terms of the above assumptions without claiming to present a comprehensive assessment of its specifics.

RAS Academician V. L. Makarov was one of the first researchers in this country to define a knowledge economy:

“A knowledge economy is a special type of economy when the knowledge sector is considered of primary importance, and the production of knowledge is the main source of economic growth...

This notion is closely related to the following concepts:

– innovation economy,
– high-technology civilisation,
IV
TRENDS IN THE KNOWLEDGE-BASED SOCIETY

— knowledge society,
— information society...

Initially, the economy based on physical labour and agriculture was developed. Later, it transformed into an industrial economy based on the exploitation of natural resources. We are now observing how the latter is being substituted by an economy based on knowledge” [2].

To our mind, the given definitions do not quite correspond to the depth of transformations that accompany the transition of the economy and society as a whole to a new development stage. Moreover, the above features of the production method may be described from the point of view of Kondratiev as ‘long waves’ (it should be noted that until recently the economy was proceeding through an upward wave of the Kondratiev cycle). Indeed, the upward wave of the Kondratiev cycle is characterised by the avalanche-like introduction of a whole package of innovations that begins to subside in the upper point of the wave. That is the essence of an innovation economy. With that, the last upward wave of the Kondratiev cycle was caused by the avalanche-like introduction of ICT, which implies an information society and high-technology civilisation. In other words, all of the above trends comply with the characteristics of an upward wave of the Kondratiev cycle.

On the other hand, if we take into consideration the peculiarities of the Kondratiev cycles, then now, when we are going through or entering the downward wave, there are two alternatives for further global economic development: if the economic tendencies, mentioned above, are caused by the transition to a knowledge economy, they will take place in the next decade as well; if they are connected with long innovative cycles, though, this tendency is bound to recede and then change to the opposite in the nearest future.

Therefore, modern economic transformations, the transition to a knowledge economy can not be explained only by quantitative changes in the technological process and an increase in the importance of expert knowledge and skills that are characteristic of the upward trend of any innovation cycle. In this case we shall come to the opposite conclusion: the avalanche-like innovation process shall subside and change to the opposite tendency.
However, it should be noted that acceleration of scientific and technological change, acknowledged as being unequivocal since the middle of the previous century, is definitely not the most evident feature of the modern stage of economic development. In-depth structural changes in the modern production method are a lot more important: the role and the place of different factors of this method have undergone qualitative changes.

The material bases of production play a primary role in an industrial society, as they do not only determine the level of social production, but also the level of production of each and every enterprise. The volume and the type of fixed production assets and the level of technology used were the crucial features of such a society. The capabilities of the equipment used were shaped and determined not only by the level and quality of products, but also by personnel skills. Besides everything else, this shaped the approaches of the classical management theory that was developed practically simultaneously with the formation of modern industrial society; the main principle of this theory is separation of labour force from means of production and desire to encourage it to work for the achievement of the management tasks.

Toward the end of the 20th century and the beginning of the 21st century the relative impact and the basis of cooperation between the factors of production now in use have transformed significantly.

We may conclude that our society has gone through a certain stage in its development and has returned to a situation, similar to the pre-manufacturing period, when the quality of output was determined by the qualification of the craftsman. Human assets (personnel with their capacities and knowledge, skills, level of education and personal peculiarities) are the basis of development and effective operation of any economic system in the new economy. Material factors do not determine the level of economic development and economy output any more. The needs and capabilities of leading employees, the carriers of human capital, determine the requirements for the fixed assets used. As a result, the most important task of the society and any enterprise is the shaping and development of their own human assets, i.e. employees who possess a certain level of knowledge, abilities and skills, and the main managerial task is to encourage creative activity.
IV
TRENDS IN THE KNOWLEDGE-BASED SOCIETY

Table 1 shows how the number of major production factors increases in the course of transition from classic capitalism to an industrial society and, afterwards, to a knowledge economy: these factors included only labour, capital and natural resources (though J. B. Say included entrepreneurial activity here as well) during classic capitalism; they were complemented by entrepreneurial activity in the industrial society and, as far as a knowledge economy is concerned, intellectual capital became one of the main factors of production.

There are a good number of definitions of intellectual capital. For instance:

S. Wallman, Speaker of the Security and Exchange Commission (1995): “…intellectual capital is represented by assets, whose value is equal to zero in the balance sheets” (Los Angeles Times).

T. Stuart, Editor of Fortune Magazine (1991): “…patents, processes, managerial skills, technologies, experience and information on users and suppliers — all together, this knowledge forms the intellectual capital” [3, p. 42].


K. Bradley, Professor of International Management at the Business School of the British Open University (1996): “Intellectual capital is the transformation of knowledge and intangible assets into useful resources that provide competitive advantages to individuals, companies and nations” [5].

TABLE 1. Major production factors at different stages of market economy development

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<tr>
<th>Stages of market economy</th>
<th>Major production factors</th>
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<td></td>
<td>Labour</td>
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<tr>
<td>‘Classic capitalism’</td>
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<td>Industrial society</td>
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| Knowledge economy        | +      | +                      | +                 | +                         | +
F. Brooking, Head of The Technology Brokers consultancy (1997): “We identified four categories of intangible assets (human resources, intellectual property rights, infrastructure and market position) that are defined by the general term intellectual capital” [6].

H. Saint-Onge, Top-manager of Canadian Imperial Bank of Commerce (1996): “Intellectual capital consists of three elements: (1) human capital, (2) consumer capital and (3) structural capital” [7].

The definition given by B. Z. Milner [8] is also worth mentioning as it describes intellectual capital as a complex of intellectual assets that can be represented by the following:

— market assets (intangible assets connected with market operations);

— intellectual property as an asset (patents, copyright, trademarks of goods and services, know-how, trade secrets and so on);

— human assets (combination of the collective knowledge of corporate personnel, their creativity, problem-solving abilities, leadership qualities, entrepreneurial and managerial skills as well as psychometric data and information on behavioural models of certain individuals in different situations);

— infrastructure assets (technologies, methods and processes that ensure the operation of the enterprise).

It is obvious that this definition includes entrepreneurial activity to some extent.

It should be noted, though, that almost all researchers agree with the inclusion of intellectual capital into the major factors of production.

Due to such change in the major factors of production, we observe the principal changes in approaches to production activity organisation and management. We recall the well-known thesis by Karl Marx about the capitalist society in its classical form being based on the separation of the labour force from the means of production [9]. In other words, capitalism started to develop when the labour force was separated from other factors of production (otherwise they would be able to support themselves economically, without selling their labour).

However, at the stage of an industrial society we begin to observe that the two factors are inseparable from each other: entrepreneurial
activity is inalienable from labour, but quite a small and highly peculiar part thereof — the managers; and then it became evident only after the actual separation of property and management.

Indeed, this trend has developed to become a determining trend in the modern economy. People and human capital, materialised in them, become the main factor of production. Here, it is obvious that people and human capital are principally inseparable. Moreover, we come to the idea of the inseparability of three of five major factors of production: labour, entrepreneurial activity and intellectual capital.

Table 2 demonstrates that only capital and natural resources may be fundamentally separated from other factors of production. Labour, entrepreneurial activity and intellectual capital are fundamentally inseparable: entrepreneurial activity can not exist without labour (though labour can exist without entrepreneurial activity); intellectual capital includes human assets, and therefore, it is inseparable from them. If we proceed from the above definition by B. Z. Milner, entrepreneurial activity is a constituent of human assets.

Such inseparability determines certain peculiarities of the economy, when the output of economic activity depends, first of all, on the skills and knowledge of the employees, not on the facilities and the equipment — a situation similar to pre-capitalistic workmanship. This requires changes in the economic science approaches that correspond to the glob-

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<th>TABLE 2. Separability of major production factors</th>
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<td>Capital (basic assets)</td>
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<td>Entrepreneurial activity</td>
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<td>Intellectual capital</td>
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IV

TRENDS IN THE KNOWLEDGE-BASED SOCIETY
al transformations of the bases of the economy, including changes in the theory of management aimed at the search for new ways of effective management of personnel whose creative activity is vital for production in the modern society.

The fact that under the new conditions the scientific and technical level of production and output as well as all economic characteristics and capabilities of economic systems are determined by the qualification, education, and competence level of the personnel sets new requirements for the economic science approaches. For instance, new systems that assist in management and motivation of creative activity of highly qualified employees are being introduced into management and we observe a transition to new forms of management.

However other conclusions may be made in this connection. Let us analyse in more detail what specifically could encourage an increase in the efficient use of major production factors. An increase in labour efficiency will require the development of educational systems of all levels, since they determine the level of personnel qualification. The level of major material factors used is determined by the innovative-reproduction system that functions in the society. The efficiency of use of natural resources depends on the developmental level of the science and technology. Acceleration of entrepreneurial activity requires an appropriate system of business education. In order to enable steady development of intellectual capital as a whole, we need a well-developed system of additional education and the lifelong learning as a whole. Note that under the concept of additional education we shall understand the system of postgraduate education, and under the concept of lifelong learning we shall understand the whole educational system that needs to ensure a progression from the level of preschool to the level of additional education, and we do not only mean additional education as it is sometimes implied.

It should also be noted that education has been mentioned three times when enumerating the major factors that increase efficiency of exploitation of the basic production resources: as a factor of labour efficiency increase, entrepreneurial activity, and intellectual capital. In other words, educational systems may become a major factor of labour efficiency increase in the new economy.
IV
TRENDS IN THE KNOWLEDGE-BASED SOCIETY

We would now like to turn our attention to the scientific sphere that was quite an isolated and elitist sphere of society in the pre-capitalist period. When it proved to be an important factor of economic growth and became a productive force, it transformed into a powerful innovative-reproduction sphere which is of vital importance for all social elements today, and it possesses immense resources and growth potential.

The above analysis enables us to conclude that the educational system of society will increase its role in the future. The same conclusion may be drawn from the fact that the requirements placed on human resources have been constantly increasing and changing over the last few years. To date, most employees have changed their career profile at least once. This tendency will accelerate as the requirements placed on human resources change more dynamically (that is, in turn, determined by the acceleration of scientific and technological change).

We may suppose, therefore, that the next (or even more distant) technological structure will be based on transformations in production technology as well as on the development of educational technologies.

Certainly, today we can not comprehend the role that the educational system will play in the future (just like several centuries ago people could not perceive the modern role of science). However, we may make some assumptions, using an approach, developed by I. Nonaka and H. Takeuchi [10]. It is based on the idea that the knowledge production process in its continuity (constant reproduction of knowledge) must go through four successive stages of transformation (Fig. 1).

Nonaka and Takeuchi identify two basic types of knowledge: explicit (formalised) and implicit (non-formalised). Consequently, there are four types of knowledge transformation: implicit knowledge into implicit (socialisation), implicit into explicit (externalisation), explicit into explicit (combination) and explicit into implicit (internalisation).

Socialisation (transformation of implicit knowledge into implicit knowledge) means that skills are transferred directly from one person to another (analogous to tutorship). Combination (transformation of formalised knowledge into formalised knowledge) may be described as scientific and technological activity. Unfortunately, modern fundamental science often restricts itself to combination only. Internalisation (transformation of formalised knowledge into non-formalised) is also
quite common nowadays. These are the possible ways of using formalised knowledge, which can be anything up to the introduction of guidelines. On the other hand, externalisation (formalisation of implicit knowledge) is hardly ever used in our activities today. Consequently, real-life practical requirements are not taken into consideration in scientific and technological activity.

In a sense, the scientific and technical change in this country is of a linear type: from basic, applied science to developments, experimental samples and introduction. It is impossible to transform the constant progress into cyclic, non-linear type without the broad use of externalisation procedures, i.e. experience and skills formalisation.

According to Nonaka and Takeuchi the process of organisational knowledge production requires its constant transformation: socialisation (generalisation of skills and knowledge about peculiarities and problems of implementation and production), then externalisation (their formalisation), and then combination (correlation with other formalised knowledge) and, finally, internalisation (implementation of the results) and socialisation (how it changed the reality and what new problems arose).

All four stages are realised with the help of certain mechanisms and procedures, where middle managers play the main role in the organisa-
IV
TRENDS IN THE KNOWLEDGE-BASED SOCIETY

tion of the entire process. They are the linking element between the top management level, i.e. the level of scientific knowledge, and the front-end divisions that are sources of non-formalised knowledge (Fig. 2).

If we set a task to apply this process on a society level, then education could be the most effective linking element that connects abstract theory and fundamental knowledge with real production (the front line). Indeed, professors and tutors are actually carriers of formalised knowledge. Moreover, very often they are the main subjects of scientific activity.

Their task at least in teaching adults (andragogy) is to transfer knowledge to their students and help them implement this knowledge in practice, i.e. to ensure the process of internalisation. Even today, during classes, they encourage the exchange of experience between the students (socialisation) and use different externalisation methodologies ('brainstorms', business games, moderation, etc).

If we prolong the development of such elements of the educational process, we will be able to construct a comprehensive system of knowledge production in the context of the whole economy, while educational systems and their subjects will play an important role in this economy.

**FIG. 2. Knowledge production process 'up and down from the middle'**
It should be noted, though, that this is quite a bold forecast. At the same time it is understood that the country that will be the first one to construct such system, will ensure competitive advantages and an intellectual revenue.

References

Socio-economic trends in the EU and Russia illuminate the changing nature of work, family life and relationships, lifestyle, and patterns of consumption. Technological developments, global markets and financial institutions, and patterns of migration have led to exchanges in ideas and beliefs. Tensions are evident too as groups and individuals are fearful of potential challenges to their socio-economic position given economic downturn. My critical overview is aimed at key aspects of these trends illustrated through the economic and social limitations of consumer societies. Consumers are active in many aspects of product development, specialisation of markets and innovation, though recent changes in markets certainly influence on consumer behaviours. Trends in the amount and type of consumption are also critical to economic fortunes. This is an extensive topic, and given the growth in consumerism and related economic and social activities, this paper provides a resume of some debates in social sciences on consumer societies, an overview of the economies of the EU and Russia, and suggestions for collaborative research taking into consideration the rising focus upon transdisciplinary debate.

Drawing upon the disciplines of social policy and sociology my own research considers the inter-weaving topics of gender, organisations, work and care. Employment experiences to date include research work in four universities located across the UK, a visiting professorship in Finland, a fellowship in the USA and two periods of work in the UK civil service. A commitment to addressing social problems and socio-economic inequalities has underpinned my career. A woman and mother, part of a large Irish-Scottish family, and work and friendship groups, I consume goods and services to provide for others as well as myself. Like many I achieve a range of identities through various forms of consumption. This paper represents my interpretation of literature,
available data and debates, thoughts on the potential for transdisciplinary research, together with reflections on the experiences of others and myself as consumers in Western Europe.

1. PERSPECTIVES ON CONSUMING SOCIETIES IN THE SOCIAL SCIENCES AND HUMANITIES

This is an exciting, complex, and tense time to reflect on consumer cultures. Dominant images of the consumer, the lively shopper using the Internet or scanning shop displays for bargains, remains relevant but has come under challenge by events of the last year. Speculation is rife; how will consumer societies and consumers weather the current economic downturn? Governments urge spending to generate economic activity and, potentially, growth. Consumers are witnessing a decline in the value of the major item most aspire to, namely, their own home. Levels of personal debt have grown to an all time high while interest rates on savings have declined posing particular problems for those on fixed incomes; for example, pensioners. Financial services are accused of irresponsibility; of selling products to consumers they knew could not manage the repayments. They respond by arguing that consumers were looking for a quick gain and often failed to take on board risks that were explained or written in contracts, albeit in small print. Accused of nativity and greed consumers, and consumer groups, express anger with banks and governments for promoting consumption at levels that are unsustainable. Many groups blame banks and financial services and look to governments to achieve stability. At the same time consumers are encouraged to shop in order to aid the economy! Debates are fierce and in the winter of 2008/2009 media reporting is dominated by speculation about consumer markets and economies. In many of these debates contradictions abound and much of the debate draws upon dynamic discourses about consumption which are moralistic in tone as economic recession deepens.

Some thirty years ago the study of the consumer was organised around two broad schools of thought. Central to economic theory was the notion of the consumer as an active and calculating being. Consumers were considered reflective and relatively careful allocators
of resources, reviewing needs, wants and resources in a manner that maximised outcomes. Contrast this notion of the rational being with social science debates on the ‘passive, manipulated and exploited’ consumer. A wide range of social and cultural scholars have critiqued consumption in ‘the mass society’; societies in which market forces constrain and manoeuvre people to consume in ways that do not meet needs and generate waste. Sociological perspectives have referred to these contrasting images as ‘the hero’ (economic rational being) and ‘the dupe’ (passive, manipulated consumers) [1].

More nuanced explanations, drawing upon postmodern theories on the multi-faceted nature of social identities and practices, interpret consumption as neither rational nor manipulated but as self-conscious; offering opportunities to create impressions or a lifestyle [2]. Current developments include Campbell’s notion of ‘the craft consumer’; someone who has a “clear and stable sense of identity <...> [giving] rise to their distinctive mode of consuming” [3, p. 24]. This framework is based upon sociological work on ‘craft’, a quintessential and highly prized form of labour. The craftperson is both designer and producer unlike common manufacturing practices in which a dichotomy exists between ideas and production. Transpose this to explain consumption and the ‘craft’ consumer is someone who ‘takes ownership’ of goods to fashion their ‘own world of meaning’ [3, p. 29]. Consumers personalise and customise goods to ‘ensemble’ identities. This defines difference, illuminating levels of income and cultural standing that enable people to engage in specific forms of consumption. There would seem to be “a yearning for singularization in complex societies” [4, p. 80] which inter-weaves with more mainstream forms of consumption. Further some commentators have suggested that as forms of work loose their professional character consumers seek personal satisfaction and recognition through ‘craft’ consumption [5].

The last decade was one of growth in most European economies. The economic growth has generated wealth that has had a notable impact on the lives of some. As Campbell comments, “...it is increasingly the consumption needs of those with disposable income and ample leisure time that dictate the nature of the commodity world and the way in which those products are marketed and used...” [3, p. 39].

IV
TRENDS IN THE KNOWLEDGE-BASED SOCIETY
Others have witnessed little change in their socio-economic situation and the suggested trickle down of resources has not followed. Inequalities have widened, poverty deepened and consumption become focused on everyday survival and engagement in local networks. The deepening economic recession begun in 2007 has thrown economic and sociological theories open to review [5]. Historians have charted the appearance of markets and the domination of contemporary societies by markets [6]. Economists have offered analysis that ranges from the rational consumer, to the critical assessment of preferences, prices and profits. Socio-economic inequalities, social disruption and role of markets and consumer societies in unequal, global markets currently exercise economic thinking and research. Media studies offers analytical perspectives on perpetuating and manipulating consumer cultures through myriad forms of media. Environmental studies has charted the implications of consumption and waste. The growth in what is termed ‘responsible’ consumption, which includes Fairtrade products, organic produce and recycled goods, has given rise to a range of new perspectives on consumer societies [7]. The ethics of consumer societies and ecological changes are paramount in many academic and political debates.

2. THE EU AND RUSSIA – FREEDOMS TO CONSUME

The EU and Russia are drawn together through trade, migration, the outcomes of war, conflict and the search for peace, and the ebbs and flows of consumer societies [8]. Whilst the EU is promoting harmonisation and open markets across member states, Russia remains relatively isolated in geographical and political terms. Russia is, however, active in many dimensions of consumer markets albeit that access to these is restricted to a limited number of wealthy and middle class consumers. Further, the concentration of wealth in the hands of a few has promoted corruption and organised crime. With richness in energy resources and minerals, and the potential to control and withhold these, Russia will be both courted and feared. Russia maintains a major place in global politics and markets.

Russia is the largest county on earth, spans 10 time zones and is a world power in foreign and economic affairs. The population is 142.5
IV
TRENDS IN THE KNOWLEDGE-BASED SOCIETY

million with 10.5 million living in the Moscow area. The climate ranges from an Arctic north to a temperate south. Large areas are uninhabited or sparsely populated and in these locations a vast mineral wealth gives Russia a prominent place in global energy markets and policies. The fall of communism between 1989 and 1991 gave way to a capitalist economy with a rush to privatise large parts of the public sector. As a consequence major interests in energy and media are held by a small number of wealthy businessmen. Political life is also highly controlled and dissent is harshly dealt with, whether in the media or business. One example is the former head of the Yukos oil company, Mikhail Khodorkovsky, who became involved in liberal politics and subsequently was charged with tax evasion and fraud. He is now serving a prison service.

Russia’s larger cities resemble their EU counterparts with shopping centres, expensive restaurants and clubs. Moscow is the most expensive city in the world and for a few the scale of wealth is impressive; in 2008 Russia was home to more billionaires than the US. In November 2008 Moscow hosted its fourth millionaire’s fair; a luxury shopping and entertainment event for the super-rich. By contrast in the suburbs of Moscow, other cities and rural areas, little has changed over the decades and many struggle to survive. Levels of poverty, alcoholism, violence and hopelessness are high. Male mortality rates have risen and life expectancy for men has fallen by nearly ten years to 59 years. This reversal of longevity is notable and illustrates the depth of inequalities. One growing social problem is the situation of pensioners. Just under 3 million pensioners live in the city of Moscow; a third of the population. Whilst a powerful social movement many are living a subsistence lifestyle. For younger people without opportunities private security services offer employment as they work to protect the wealth of the better off. Struggles abound, compromises are forged, as people make the best of available resources and opportunities.

Besides the Slavs (Russians, Ukrainians, and Belarusians), who account for about 85% of Russia’s population, three main ethnic groups within the Russian Federation. The Altaic group includes mainly speakers of Turkic languages widely distributed in the Middle Volga, the Southern Ural Mountains, the North Caucasus, and above the Arctic
Circle. The Uralic group, consisting of Finnic peoples living in the Upper Volga, the Far North-West, and the Urals, includes the Karelians, Komi, Mari, Mordovians, and Udmurts. The Caucasus group is concentrated along the northern slopes of the Caucasus Mountains; its main subgroups are the Adygeis, Chechens, Circassians, Ingushs, and Kabardians, as well as about thirty Caucasian peoples. The largest religious group is the Russian Orthodox Church followed by the Muslim community. Though the country is generally peaceful there are tensions, civil unrest and violence on-going in Chechnya, and at the Russian and Georgian borders in Abkhazia and South Ossetia. Fear of insurgency and the potential break-up of the country have lead to a renewed sense of nationalism. The ideology of communism has been superseded by a market economy which is highly dependent on natural resources. Recent political tensions with the US have lessened as interests coalesce around concerns with the implications of fundamentalism for insurgency and terrorism.

The European Union (EU) was formed following the devastation caused by the Second World War. The philosophy was established through the Treaties of Paris, 1951, Treaty of Rome, 1958, and culminated in the Maastricht Treaty of 1991 which formally established the EU. The principle, that the best way to achieve European bonding is by developing economic ties, has promoted market based economies. Consumption and consumerism have been key forces in evolving economic ties.

In 2009 the EU comprised 27 countries. Given the availability of data, however, in this paper I consider EU-15 and EU-25\(^1\). This is the world’s largest single market [9]. Current economic and social policies emphasise stable knowledge based economies in which workers are offered minimum rights in return for participating in employment and training, whilst active in consuming goods and services. Consumerism

\(^1\) EU-15, also known as ‘old’ EU, comprises, Belgium, France, Italy, Luxembourg, Netherlands, West Germany who were, in 1952, founding members of an economic collaboration that provided the basis for the European Union. In 1973 Denmark, Ireland, United Kingdom joined; in 1981 – Greece; 1986 – Portugal and Spain; 1995 – Austria, Finland, Sweden. EU-25, also known as ‘new’ EU, includes the 15 plus 10 countries that joined in 2004 and are predominately Eastern European: Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia. In 2007 Bulgaria and Romania joined forming EU-27.
IV
TRENDS IN THE KNOWLEDGE-BASED SOCIETY

is keenly observed and monitored by analysts. Migration has been central to economic plans and the notable movement of workers from east to west EU has halted with the on-set of recession.

Given the expanse of the EU, consumer societies and patterns of consumption range widely. The highly fashionable 'craft' consumers of Bond Street London, the Champs-Elysees Paris or Via del Corso Rome, inhabit a world that can only be glanced at by those in the socially excluded communities in, for example, Southern Italy, south side Glasgow, UK, and the outskirts of Riga, Latvia. Based on World Bank Development Indicators published in July 2006, in the EU-25 Luxembourg has a gross national product (GNP) per capita based on global purchasing power parity in international dollars, 5 times greater than that of Latvia\(^2\). These trends and figures illustrate inequalities in consumption between and within EU member states.

Free movement of people between member states was enshrined in the Maastricht Treaty. A common passport was followed by a common currency with the single European currency, the Euro, introduced in 1999 and adopted by all but 3 member states. At the time of writing the move to an EU constitution, to streamline and replace the varied treaties and agreements, has been halted by voters in Ireland who voted no to this proposal in a recent referendum. Whilst a shock to the European Commission, negotiations are on-going to move ahead with ratification of this, or a revised version, of an EU constitution.

3. LIMITATIONS – ‘BANKING’ ON FUTURES

Economic downturn has taken many by surprise in both the EU and Russia, especially the collapse in property markets and financial services. Whilst the impact of what has been termed by some the ‘credit crunch’ is not uniform it has major implications for consumer societies [10]. Is this a pivotal moment in consumer societies? Or will this be viewed as merely a blip in the onward march of global consumer markets?

\(^2\) GNP per capita, also referred to as Gross National Income, represents the total amount of money that a country’s consumers spend on all goods and services in a year divided by that country’s population.
In the former viewpoint global capitalism is changing in fundamental ways. Much of this change is imposed through the collapse of banks and financial services. In the US and UK cultures of debt have replaced cultures of borrowing. Consumption has been slowed with many imposing restraints upon their personal spending. Others have had limitations on their consumption imposed through loss of income or levels of debt. Banks have received massive levels of funds from governments but continue to have independent boards, shareholders, and act as private employers. Regulation and monitoring of banks and related services have risen but the spending on banks will divert funds from public services and, as a consequence, from those on the low incomes. Relationships between businesses, customers, governments, employees and employers are in a process of re-negotiation.

In re-negotiating relationships can openness be promoted through re-structuring financial and consumer services? To explore these issues transdisciplinary and transnational research is imperative to inform the topic of the economic and social limitations of consumer societies in a global world. A social science and humanities research agenda for collaborative projects across the EU and Russia could include:

— A mapping of demographic and socio-economic trends in consumption. What are the implications of resultant data for theories and models of consumer societies? A start has been made in the EU with the recently established Consumer Markets Scoreboard which documents consumer experiences and monitors the workings of the EU single market but there remain many gaps in data [11].

— Who are the consumer groups, government departments, agencies and individuals engaged as users and knowledge exchange stakeholders? How might communication and active involvement of consumers and groups be achieved across a research programme (e.g., establish a virtual consumer panel)?

— Identification of differences in science, technology and innovation in Russia and the EU and their influence on consumer markets and consumer behaviours.

— Given differences in access to technology and markets how might consumers be involved in innovation and market specialisation?
The above list is not exhaustive. It offers suggestions for research, on-going stakeholder involvement, and dissemination, to identify changes in consumer behaviours. It also proposes an agenda on how to relate changes in consumption to shifts in lifestyle, values, global economic trends and responses by business and government. Crucial are innovation and developments in science and technology. How might these be supported in robust ways with appropriate governance and ethics, to promote lateral thinking and innovative developments in products, good, and services? There is a wealth of information and ideas. The challenge is to bring diverse data sources, shared and differing ideas to collaborative research across the EU and Russia.

References

1. INTRODUCTION TO OPEN INNOVATION AND CROWDSOURCING

By following Joseph Schumpeter [1], the mainstream in theoretical and practical innovation assumes the exclusivity of an innovation to be an innovator’s most crucial competitive advantage: “There was a time, not so long ago, when ‘innovation’ meant that companies needed to invest in expensive internal research laboratories, hire the most brilliant people they could find, and then wait patiently for novel products to emerge. Not anymore” [2, p. 12]. Since Henry Chesbrough introduced the concept of open innovation [3] we no longer ask whether open innovation will be replacing the former concept of closed innovation. Rather we ask how open or closed specific innovation processes need to be in order to succeed.

More and more often we find that it can be an advantage to integrate as many actors as possible into the innovation process and to do so as early as possible [4]. This is reflected in the following three dimensions of innovation [5]:

1. Robust novelties: the early integration of customers’ and stakeholders’ ideas, knowledge and needs leads to more marketable products, procedures, or services.

2. Robust change: broader participation of members increases the organisational changeability.

3. Robust competitive advantage: the early integration of customers and stakeholders into the development process can serve as a marketing strategy as well, because the product is already known to a sometimes large number of potential consumers before its market entry.

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1 Open innovation strategy is the use of both internal and external ideas and paths to markets by means of systematic integration of customers and stakeholders.
IV  
TRENDS IN THE KNOWLEDGE-BASED SOCIETY

The bottom line is that open innovation strategies effect more robust innovations. This applies to both IN- and for OUT-processes of open innovation, with the first referring to the insourcing of ideas or knowledge and the second referring to the outsourcing of parts of the innovation process [6].

Sometimes, crowdsourcing is said to be a special case of insourcing as the corresponding methods are most commonly used to significantly increase the idea flow into companies, but they can also be interpreted in terms of the predominantly internet-mediated outsourcing of specific elements of the innovation process to an entity that is something between a community and a clientele [7], i.e. in other terms to large numbers of ‘working customers’ [8] or ‘prosumers’ [9]. In any case, following Frank Kleemann, Günter Voss and Karin Rieder [8], crowdsourcing can be defined as a both qualitative and quantitative expansion of yet more common R&D outsourcing concepts ([10] and Fig.1). The result of this expansion can then be interpreted as a new type of market interface [11] or as a new form of value creation [12].

In this paper I will show how open innovation strategies in general and crowdsourcing in particular can be used to reduce or even invert the brain drain from CIS countries to the Western world. In the next section we will therefore discuss the increasing relevance of transnational open innovation strategies against the background of the contemporary global innovation competition. Subsequently, I base on data from the Global Competitiveness Report in order to demon-

FIG. 1. The innovation continuum

[Diagram showing the innovation continuum with stages from Closed innovation to Open innovation, including R&D outsourcing, Crowdsourcing, and Open source]
strate at a global level that the return on investment in the CIS country’s excellent educational infrastructure is still very poor, indicating that the brain drain topic is still acute. I thus focus on two relevant business cases from Switzerland, which practice is most inspiring for the subsequent development of transnational open innovation and crowdsourcing strategies against the brain drain. In a final section, I shall discuss limits of these strategies and corresponding further research questions.

2. ON THE RELEVANCE OF TRANSNATIONAL OPEN INNOVATION AND CROWDSOURCING

“Many western companies create productive partnerships to drive innovation activity but these are generally very limited in scope and impact <...> companies in China have become much more adept at mobilising large networks of specialized partners to support innovation initiatives” [13, p. 13]. This quotation from a contribution to the World Economic Forum in Davos 2006 reflects two different pictures of globalisation at the same time: on the one hand, we are told about a global competition between closed innovation regimes that are shaped by political, economic, legal, educational or scientific borders: China versus the West. On the other hand, “(g)lobalisation is a major driver for open innovation processes, not only because it means more intense and global competition but also because it creates a more global landscape for innovation” [14, p. 27].

Against the historical background, we might even say that open innovation re-creates these global innovation landscapes. “During the late 19th and the early part of the 20th centuries, practically all research was conducted outside the firm in stand-alone research organisations” [15, p. 53]. Between 1950 and 1990, the open innovation culture bottomed out. With the new millennium, external knowledge sourcing is back to post-war level(s). Thus, in the long term, it seems as if the age of closed innovation has been just some kind of the Cold War mode of innovation.

But, even after the end of the Cold War we still experience the logics of closed innovation regimes as well as their consequences: classi-
IV
TRENDS IN THE KNOWLEDGE-BASED SOCIETY

cal forms of open innovation, i.e. B2B innovation cooperation or co-patenting, are if at all, then mostly set-up between partners within the same industry, the same country, or the same economic area [14, p. 59–70]. Again we find that economic, political, scientific, legal, or educational borders hinder open innovation strategies. As a result we experience a waste of chances and resources (Table 1).

While Western European countries are well equipped with economic capital and business know-how, they suffer from skills shortages and a lack of ideas and are in need of new markets. Over the prosperity gap we experience lower household income, lower mobility, and poorer market access in the face of a good supply of well-trained talents with relatively high intercultural competence. This means that open innovation in general and crowdsourcing in particular may bring substantial benefits for both sides: western companies could benefit from low-cost idea flows from CIS countries and first-hand information on their emerging markets. In return for this now only virtual brain drain, CIS countries could profit from income that local people (and not members of a distant Diaspora) earn and that is thus allocated on-site the CIS.

TABLE 1. Open innovation as an interface between European economies

<table>
<thead>
<tr>
<th>Resources</th>
<th>Western countries</th>
<th>CIS countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open innovation (OI)</td>
<td>Capital</td>
<td>Talents</td>
</tr>
<tr>
<td></td>
<td>concepts</td>
<td>Intercultural competence</td>
</tr>
<tr>
<td>Constraints and lacks</td>
<td>Talents</td>
<td>Mobility</td>
</tr>
<tr>
<td></td>
<td>Ideas</td>
<td>Capital</td>
</tr>
<tr>
<td></td>
<td>Markets</td>
<td>Markets</td>
</tr>
<tr>
<td>Benefits from OI</td>
<td>Idea flow</td>
<td>Capital flow</td>
</tr>
<tr>
<td></td>
<td>Cost reduction</td>
<td>OI know-how</td>
</tr>
<tr>
<td></td>
<td>Robust innovations</td>
<td>Brain gain, no brain drain</td>
</tr>
</tbody>
</table>

Eastern Europeans know more about Western Europe than vice versa. The same applies to language skills in one language of the respective other part of Europe.
Such, open innovation in general and crowdsourcing in particular could provide a solution for a sometimes over-emphasised, sometimes denied, in any case intensively discussed problem of CIS countries: the brain drain to Western countries.

3. THE BRAIN DRAIN OF CIS COUNTRIES

In this context the Armenian data are most striking. Six years ago the World Bank (in 2002) reported that Armenia had lost a workforce of one million people since 1988\(^3\) [16]. There is no denying the fact that this mostly high-skilled migration massively hinders economic growth [18]: being among the top remittance-receiving countries of the world [19] obviously does not compensate the negative effects of the still continuing brain drain, because, once drained, the brains’ interests in supporting not only their own family but also the overall Armenian economic situation becomes very low quite fast [20]. The same applies to Ex-CIS-member Georgia where “efforts to channel remittances to investment, meanwhile, have met with little success” [21, p. 71]. Therefore, the prevention or at least the containment of further brain drain from the Caucasus seems to be the order of the day. Again, the challenge is to sustainably transform the region’s still strong intellectual capital into economic capital. Consequently, new organisational forms of cooperation on the “supra-national level attracting necessary human and financial resources and elaborating fair access of the countries to innovative technologies” [22, p. 10] as well as the “transfer of business skills (helping Armenian enterprises to enter world markets; supporting business and managerial training of new business owners and managers in new companies)” [23, p. 7] are demanded. And, if the competitive advantage of the Caucasian Republics really is the educational background of their citizens then the “efficient creation, dissemination, and use of existing knowledge” [24, p. 117] truly is the key to a Caucasian success story.

\(^3\) This equates to more than 25% of the original population. In Eastern Germany, a much lower brain drain ratio used to be the major building block of the Berlin Wall [17].
Regarding Russia, the case is in some way different not only because of the fact that Russia is an in any dimension resource-rich country but also due to an ongoing discussion about the question whether there is a Russian brain drain, or not. On the one hand we are informed about over 100,000 pre-dominantly young scientists who have left the country between 1991 and 2002 and thus caused an estimated loss of 50 milliard US dollars [25, p. 10]. Against this background we could be speaking of a “huge brain drain” [26, p. 889] if there were not voices that relativise the brain. In his brief history of Russia’s post-Soviet brain drain Erik Volz came to the conclusion that the quota of Russian scientists who are permanently leaving the country is very low and that high quotas of permanent emigration can only be observed in specific disciplines (the ‘hard sciences’) and against specific ethnical backgrounds of the scientists [27, p. 38–40].

In order to being able both to critically reflect the two versions and compensate the lack of information on brain drains from further CIS countries, in the following, this paper focuses on two indicators from the Global Competitiveness Report of the World Economic Forum [28] and combines them to a brain drain indicator (Table 2): the ratio between a country’s GCR-rank in indicator 5.02 gross tertiary education enrolment (Enr) and its rank in 12.06 availability of scientists and engineers (AoSE)\(^4\).

Concerning CIS countries, it should be noticed that Azerbaijan surprisingly is a brain gainer (ranked 10) while all of the other CIS members being brain-draining countries: Tajikistan (75), Armenia (84), Russia (117), Kazakhstan (119), Kyrgyzstan (120), and Ukraine (128)\(^5\).

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\(^4\) This indicator thus replaces the GCR’s own brain drain indicator 7.09 that is based on the answer to the question: “Your country’s talented people (1 = normally leave to pursue opportunities in other countries, 7 = almost always remain in the country)” [28, p. 446] because the GCR brain drain indicator is more subjective and diffuse than the presented hard-data based alternative.

\(^5\) Additionally, it would be interesting to notice that in this rating India ranks first due to the fact that the country combines a substandard educational performance (Enr 98) with a job market that perfectly provides the country with the needed workforce (AoSE 3). In other words, India does not suffer from brain drain, rather it profits from the educational efforts of other countries. The opposite situation is represented by Slovenia that performs excellent at the level of tertiary enrolment (Enr 5) without being able to cover its demand for academics (AoSE 85). In this sense, the country is thus the most effective exporter of its own brainpower.
### TABLE 2. Ratio GCR-ranks in ‘tertiary enrolment’ (Enr) and ‘availability of scientists’ (AoSE) in European and CIS countries\(^a\)
(ranked among 134 countries)

<table>
<thead>
<tr>
<th>ID</th>
<th>Country name</th>
<th>Enr</th>
<th>AoSE</th>
<th>Enr/AoSE</th>
<th>Rank rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>France</td>
<td>30</td>
<td>5</td>
<td>6.00</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Czech Republic</td>
<td>38</td>
<td>11</td>
<td>3.45</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Azerbaijan</td>
<td>95</td>
<td>28</td>
<td>3.39</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Switzerland</td>
<td>45</td>
<td>16</td>
<td>2.81</td>
<td>17</td>
</tr>
<tr>
<td>5</td>
<td>Cyprus</td>
<td>62</td>
<td>23</td>
<td>2.70</td>
<td>18</td>
</tr>
<tr>
<td>6</td>
<td>Sweden</td>
<td>9</td>
<td>4</td>
<td>2.25</td>
<td>20</td>
</tr>
<tr>
<td>7</td>
<td>Finland</td>
<td>2</td>
<td>1</td>
<td>2.00</td>
<td>22</td>
</tr>
<tr>
<td>8</td>
<td>Austria</td>
<td>37</td>
<td>20</td>
<td>1.85</td>
<td>27</td>
</tr>
<tr>
<td>9</td>
<td>Slovakia</td>
<td>48</td>
<td>29</td>
<td>1.66</td>
<td>32</td>
</tr>
<tr>
<td>10</td>
<td>Germany</td>
<td>43</td>
<td>26</td>
<td>1.65</td>
<td>33</td>
</tr>
<tr>
<td>11</td>
<td>Netherlands</td>
<td>25</td>
<td>25</td>
<td>1.00</td>
<td>66</td>
</tr>
<tr>
<td>12</td>
<td>Tajikistan</td>
<td>86</td>
<td>98</td>
<td>0.88</td>
<td>75</td>
</tr>
<tr>
<td>13</td>
<td>United Kingdom</td>
<td>26</td>
<td>32</td>
<td>0.81</td>
<td>83</td>
</tr>
<tr>
<td>14</td>
<td>Armenia</td>
<td>65</td>
<td>80</td>
<td>0.81</td>
<td>84</td>
</tr>
<tr>
<td>15</td>
<td>Moldova</td>
<td>53</td>
<td>109</td>
<td>0.49</td>
<td>115</td>
</tr>
<tr>
<td>16</td>
<td>Spain</td>
<td>18</td>
<td>38</td>
<td>0.47</td>
<td>116</td>
</tr>
<tr>
<td>17</td>
<td>Russia</td>
<td>16</td>
<td>34</td>
<td>0.47</td>
<td>117</td>
</tr>
<tr>
<td>18</td>
<td>Kazakhstan</td>
<td>36</td>
<td>83</td>
<td>0.43</td>
<td>119</td>
</tr>
<tr>
<td>19</td>
<td>Kyrgyzstan</td>
<td>50</td>
<td>116</td>
<td>0.43</td>
<td>120</td>
</tr>
<tr>
<td>20</td>
<td>Italy</td>
<td>19</td>
<td>45</td>
<td>0.42</td>
<td>121</td>
</tr>
<tr>
<td>21</td>
<td>Hungary</td>
<td>17</td>
<td>49</td>
<td>0.35</td>
<td>123</td>
</tr>
<tr>
<td>22</td>
<td>Poland</td>
<td>20</td>
<td>69</td>
<td>0.29</td>
<td>125</td>
</tr>
<tr>
<td>23</td>
<td>Estonia</td>
<td>21</td>
<td>74</td>
<td>0.28</td>
<td>126</td>
</tr>
<tr>
<td>24</td>
<td>Ukraine</td>
<td>14</td>
<td>54</td>
<td>0.26</td>
<td>128</td>
</tr>
<tr>
<td>25</td>
<td>Lithuania</td>
<td>11</td>
<td>65</td>
<td>0.17</td>
<td>129</td>
</tr>
<tr>
<td>26</td>
<td>Latvia</td>
<td>12</td>
<td>112</td>
<td>0.11</td>
<td>131</td>
</tr>
<tr>
<td>27</td>
<td>Greece</td>
<td>1</td>
<td>17</td>
<td>0.06</td>
<td>133</td>
</tr>
<tr>
<td>28</td>
<td>Slovenia</td>
<td>5</td>
<td>85</td>
<td>0.06</td>
<td>134</td>
</tr>
</tbody>
</table>

\(^a\) Calculation based on [28].
With special regard to Russia one can find its poor rank in the ratio due to the fact that it performs very good at the level of tertiary enrolment, but looses students on the way from the university to the national scientific and technological job markets. This means that Jason Bush (is absolutely right to agree with the president of Intel Russia, Steve Chase, whom he cites in the Business Week: “We continue to see very good students come out of the universities <…> the Russians are absolutely tops”. But this positive impression does not support the author’s vision of a “Renaissance for Russian Science” [29, p. 1]. The only thing that can be deduced from this quote is a renaissance of the Russian system of tertiary education. But, against the background of a constant lack of scientists, this reborn excellence draws the attention to rather poor return on educational investment that Russia is suffering from. After enjoying on of the benefits of one of the world’s leading educational systems, many top students in science and technology are still leaving the country.

Accordingly, the question of how crowdsourcing could stop or even invert this brain drain is most relevant for Russia, as well. But how could transnational open innovation and crowdsourcing work in concrete terms, then? What specific techniques are to be applied? How do they need to be implemented to serve as a bridge across the prosperity gap?

To answer these questions, in the following pages I present two business cases of Swiss open innovation service providers.

4. TWO SWISS BUSINESS CASES

Since 1989, Brainstore AG has acted as a service provider for open innovation solutions, located at the language border between the German and French speaking part of Switzerland in the bilingual city of Biel/Bienne. Being sited in an ancient factory building, the idea of factory actively cultivates an industrial image: new members of staff are selected on the basis of standardised screening tests and then integrated into a strict division of labour.

Ideas are produced by means of an idea machine. The machine is made up of five elements: idea-boosting, compression, selection, ma-
nagement, and implementation support. Usually, a project starts with a kick-off meeting where the client defines the problem, the parameters for calibration of the idea machine and the corresponding management decisions.

During the ‘IdeaBoosting’ stage different tools are used to boost the collection of up to several thousands of inspirations. First results of net-scouting, trend-scouting and different forms of interviews are presented to the participants of ‘CreativeTeams’ in order to stimulate their output. These teams of up to 50 people, consisting of client employees, representatives from particular target groups, lateral thinkers (mostly teenagers) and a management team, then meet in the Brainstore building and develop thousands of inspirations per hour.

The subsequent compression process is made up of three steps: a) an ‘IdeaCity’ in which the inspirations collected in the boosting process are combined and forged into about 200 concrete ideas by a large team; b) a think-tank where experts assess the remaining ideas according to the project criteria; and finally c) the step of the idea design in which the best few dozens of ideas are clearly and comparably visualised.

The highlight of the selection process is, of course, the idea selection. The best ideas are presented to a panel of decision makers and specialists who systematically evaluate them and provide feedback. Rough evaluation, the valuable first impressions, ranking lists and analyses serve as decision bases for the choice of the ideas to be implemented.

Finally, implementation support is also offered. In ‘RoadMap workshops’, Brainstore develops the further steps required for the realisation of each idea together with the project team. Favourite ideas are visually prepared according to their content so that they can emotionally inspire the implementation team on an internal or external level, and so that the significance of the ideas can be grasped. A catalogue of usage possibilities rounds out the programme.

Summarising this we find that the core business of Brainstore is idea production based on real-life interaction between up to 100 clients, target group representatives, external experts and lateral thinkers. Basically, the company makes an annual turnover of more than 5 million Swiss francs (CHF) with three products: the ‘IdeaPackage’ (idea production), the ‘IdeaEvent’ (production of sup-
port for ideas), and the ‘IdeaFactory’ (the implementation of in-house idea production processes based on the Brainstore method). Depending on the dimension of the project, the prices for the first two products range from less then 100 CHF to up to several 100,000 CHF. The prices are a matter of negotiation. Depending on age, qualification, availability and action time, participants in the idea production process are rewarded mostly within a range of 100–800 CHF (plus catering and transport).

Brainstore operates on a multilingual and international basis: projects can be realised in German, English, and French both in Switzerland (Biel) and Germany (Frankfurt am Main). The company’s list of clients includes Allianz, BASF, BMW, British Telecom, Coca-Cola, CreditSuisse, and many more.

Open Innovation GmbH (Atizo) is a specialist in crowdsourcing and IT-based open community management located in the Swiss capital Berne. Founded quite recently in May 2007, the company has already been able to attract an impressive list of partners: PostFinance, CreditSuisse, Swiss Post, Swisscom, Toshiba, Fuji, Mammut, and Google are among the clients of the provider of Switzerland’s first crowdsourcing platform.

At first sight, Atizo looks like just another Web 2.0 platform: after the login there is a start page informing the community member about the activities of other members, each member can create a profile, there is a message function, and a contact management area. But unlike facebook.com, xing.com, or odnoklassniki.ru, at atizo.com the community is not the client but the business partner of the platform provider. This is indicated by two further links called ‘projects’ and ‘rewards’: By following the first link a community member enters an area where Atizo-clients, i.e. companies with a need for ideas, call for solutions to a given problem. For instance, in one of the projects, the Alpine sports supplier Mammut invites ideas for global marketing campaign on the
occasion of its 150th anniversary and attracts community members with a prize of 1,000 CHF for the best ideas. This rather small financial incentive\(^8\) indicates that the company relies much on its brand power which is indeed quite strong in Switzerland.

If, for whatever reasons, a community member is interested in contributing an idea to the concrete project then he fills in a form consisting of a head-line of max 50 characters, an idea description of max 500 characters, at least three keywords, and an optional visualisation of the idea. All these data are then included in a list of all ideas posted by \textit{Atizo} community member.

Besides the idea description, the list also includes information on the creative mind that gave birth to the idea. Most important are the dots and number next to the innovator’s name indicating his activity level as well as the number of ideas that have been rated or commented by further community members. Often rated or commented ideas are more likely to be perceived and therefore rewarded by the clients. Nonetheless, the client may also reward non-rated ideas when he considers them to be the best.

So far, since the set-up of the platform in May 2007, 90 innovators have received rewards of 40,000 CHF for ideas on 12 projects which equates to an average price of 3,333 CHF per project and an average prize of 444 CHF per top idea.

Two weeks after the start of the first three of the current five projects, a pool of over 2000 innovators has already been contributing more than 600 ideas. 80\% of the innovators are men, 70\% Swiss, and 90\% German speaking\(^9\). The average age of the community is 32 years. It is obvious that \textit{atizo.com} would benefit from more female, non-Swiss, English or French speaking contributors, and more mature community members from all over the world.

As of 2009, \textit{Open Innovation GmbH} will also provide its clients with a concept development service that complements the triad of the call for ideas, the idea generation, and the idea evaluation (Table 3).

\(^8\) At present, standard prizes range from 3000–5000 CHF.

\(^9\) Even though there is an English and a French version of the platform.
Based on his experiences in the idea development stage a client may ask specific members to support him in a more closed product development process and to earn more exclusive rewards.

5. TWO OPEN INNOVATION STRATEGIES FOR THE CIS COUNTRIES?

If we compare the two open innovation concepts of Brainstore AG and Open Innovation GmbH against the background of the specific open innovation demands of CIS countries then we soon find that the Brainstore model of open innovation can hardly be considered as an interface that links the CIS to the western innovation society: The Brainstore model is based on the physical co-presence of and the direct interaction between the clients, a handpicked small community, and the management of the idea factory. Thus, on the one hand, the model can hardly be of use in a transnational context where visa restrictions and transport costs hinder personal encounters. On the other hand, the example also indicates that open innovation can perfectly work without a large IT-infrastructure. Thus, maybe, the Brainstore model could be an inspiration for intra-national open innovation strategies within societies whose members favour direct interaction and lack of IT-infrastructure.

By contrast, crowdsourcing methods like Atizo require access to the World Wide Web, which is still more a privilege than a standard in most CIS countries. But, once a person is provided with access,
atizo.com works perfectly at the transnational level because it transcends mobility barriers by means of virtual integration. One could easily imagine the well-educated and IT-equipped elites of the CIS countries working at the ‘intellectual workbenches’ of a global innovation society without even leaving their countries.

Of course, for the CIS this would mean still suffering from a brain drain to western societies. But, at least, this specific form of a brain drain would be merely a virtual one: gains in terms of money and knowledge would be realised within the idea-giving CIS countries, and not in the context of distant Diasporas that are hardly connected to their home countries anymore.

Furthermore, crowdsourcing can also be used as a strategy to turn the tables on the brain drain. If we can imagine crowdsourcing agencies situated in CIS countries and specialised in sourcing knowledge and ideas of their Diasporas, then we are talking about a brain drain in the opposite direction. In such a way, crowdsourcing could effect an immense ‘brain gain’ for CIS countries.

Actually, this big leap is just a small step away: where web 2.0 platforms like odnoklassniki.ru are concerned it simply means stimulating existing virtual Diaspora communities to exchange not only snapshots of their latest beach holidays, but also ideas on how to solve the problems of companies and other organisations in their home countries.

6. CONCLUSIONS AND RESEARCH QUESTIONS

In this paper I have shown that both intra-national and transnational strategies of open innovation could be used to reduce or even invert the brain drain from the CIS countries to the western societies. This especially applies to transnational IT-based crowdsourcing strategies that could both virtualise the current physical brain drain and effect ‘brain gains’ by means of the re-integration of the Diasporas’ know-how into the innovation systems of the CIS countries.

With regard to the first aspect, the major problem with the virtual integration of resident citizens of CIS countries into a pan-European innovation system is a legal one: the theft of intellectual property is perceived to be the most significant risk of transnational open innova-
IV
TRENDS IN THE KNOWLEDGE-BASED SOCIETY

tion [14, p. 42]. Thus, the question is whether and how CIS countries could guarantee the IPR compliance of their citizens in transnational open innovation projects.

The second vision of turning the tables on the brain drain draws our attention to possible immaterial incentives that stimulate the Diasporas’ contributions to crowdsourcing projects that are set up by resident CIS companies, research institutes, or (non-)governmental organisations.

Moreover, crowdsourcing can not only be a strategy against the international brain drain but also against the intra-national brain drain of CIS countries: “Leaving does not necessarily mean leaving the country; many capable young people go into business. While that might be good for the country in general, it is bad for science” [26, p. 889]. Against this background, crowdsourcing can be discussed as a source of additional income for young scientists that could thus ‘afford’ to stay in science without investing the major part of their working hours in business companies.

At any rate, thinking about the launch of crowdsourcing services we have to keep in mind that only strong brands can attract a critical mass of participants in crowdsourcing projects [30]. Hence, it is a crucial and most interesting research field to find out what foreign and home market brands are sufficiently popular for crowdsourcing in the CIS. Additionally, against the background of quotas of Internet users ranging from 18% in Russia and 0.3% in Tajikistan [28, p. 460], the question of a crowdsourcing-compatible IT-infrastructure in the CIS countries has to be raised and answered either in terms of strategies for an increasing diffusion of Internet or of alternative forms of crowdsourcing in the CIS. For example, the mobile phone could connect a crowd of innovators with a hub that is provided with Internet in order to collect the ideas and send them to idea-demanding partners.

Finally, the impact of cultural differences on transnational open innovation projects between western and CIS societies must be studied against the background of the specifics of their innovation systems. According to Rajes Pillania [31] this also means dealing with a basic research gap in the field of innovation management in CIS country’s emerging markets.
References

IV

TRENDS IN THE KNOWLEDGE-BASED SOCIETY

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