ÖAW **AUSTRIAN ACADEMY OF SCIENCES**

MEDIUM-TERM RESEARCH PROGRAMME OF THE INSTITUTE OF TECHNOLOGY ASSESSMENT 2021–2023

VIENNA, OCTOBER 2021 (FINAL VERSION)

1 SCIENTIFIC TECHNOLOGY ASSESSMENT

Over the past decades, technological development and societal change have steeply increased in pace and complexity with rising implications for humanity. Technology assessment (TA) addresses these implications by investigating the consequences of and options for novel or developing technologies from different perspectives. TA examines social, political, legal, ethical and economical, health, and environmental dimensions of technological change. TA attends to precaution, ethics, acceptability and acceptance, equity, responsibility, and sustainability of technologies. Based on scientific evidence and participatory approaches to knowledge creation and decision-making, it contributes to technology governance and takes an active part in shaping technologies to come.

scientific TA research

plus public and political functions

The TA community uses various methods to communicate findings to scientific peers, political decision-makers, and the public. The Institute of Technology Assessment (ITA) is devoted to research addressing the scientific community and the public and political debates on controversial aspects of science and technology. The ITA contributes to knowledge enhancement and problem-solving in these contexts. It pursues these goals by producing academic publications, research reports, and organising media and public events, which target a broad audience such as politicians, government officials, the expert communities, stakeholders, and the wider public.

the ITA's value base

neutral and multi-perspective

The ITA is firmly grounded in the democratic values enshrined in the Austrian Constitution and European Charta when advising politics and society. This includes pluralism and the respect of human rights, and of guiding policy objectives set at the national or international level, such as sustainable development and the pursuit of distributive justice, common welfare, and equality. Based on sound scientific research, the ITA seeks to contribute to well-informed political decisions, which starts with and goes beyond the state of knowledge and the mapping of uncertain aspects of technical change. We focus on and strive for topics relevant and urgent to society (see Section 2 below). We strive for impartiality and a balanced view concerning the particular interests and pursuits of interest groups. Furthermore, we explore alternatives to the status quo and mutually agreed-upon futures by stakeholders and civil society. We seek to address critical issues from multiple perspectives, transparently mapping and making explicit values, interests, and tacit knowledge. We stand for transparency in all our activities and provide open access to all our reports and, whenever possible, to our scientific publications.

drawing on a combination of approaches ...

Scientific TA relies upon theory, advanced methodologies, and inter- and transdisciplinarity to generate new knowledge about technology in society. For instance, TA draws on and contributes to various disciplinary strands to gain insights into transitions in socio-technical systems, the de-

velopment, diffusion, and impact of novel technologies, or handling missing scientific knowledge and irreducible risks. TA as an inter- and transdisciplinary research field applies knowledge from all academic "cultures" (C.P. Snow) and relates to various inter- and disciplinary strands such as science and technology studies (STS), policy studies, sociology of technology, or innovation economics. The study of applied ethics is also of high relevance as it deals with normative questions, such as how to assess and shape technology with fundamental rights and public welfare in mind. In addressing implications of technological change, such as risks to human health and the environment, TA also strongly builds on insights from natural and engineering sciences.

The ITA is an interdisciplinary research institute and employs researchers from the social sciences and humanities and the natural and engineering sciences. Our researchers have different areas of expertise from a wide variety of fields ranging, by way of example, from economics and sociology to informatics, human ecology, or process engineering. We aim to address complex issues of technological change comprehensively and from multiple perspectives. Moreover, the ITA staff is trained to integrate stakeholder expertise and local and situated knowledge in all its work. The ITA involves actors from stakeholder communities or the public (through participatory TA) in many projects. As a rule, internal project teams or research groups with external partners carry out inter- and transdisciplinary research.

... and institutionalised inter- and transdisciplinarity

In a nutshell, the ITA is devoted to scientific TA and, as a rule, our activities have the following characteristics:
- inter- and transdisciplinary
- multi-perspective
- relevant for both politics and society
- based on scientific methods and findings
- impartial concerning political and/or economic interests.

key characteristics of scientific TA at the ITA

2 ADDRESSING THE SALIENT TECHNOLOGY TOPICS

Technological change is multi-faceted, and TA must deal with a variety of issues, for example, the opportunities and challenges associated with evolving technical fields (for instance, artificial intelligence); technology governance to meet so-called Grand Challenges such as climate change, resource scarcity, demographic changes; and controversial aspects of emerging technologies (such as risks of products in nanotechnology, synthetic biology, or the neurosciences). TA topics include the study of relationships between societal problems and technology and governance of emerging technologies. The interactions between technological and societal change are dynamic processes of co-production, which require continuous observation, analysis, and adaptation of scientific approaches addressing them.

typical TA issues

emerging technologies and society as moving and interconnected targets

TA focuses on the present and the future and occasionally uses retrospective analysis. It is paramount for the ITA to keep up to date with current and future technological and societal developments. The ITA continuously needs to be responsive to these changes. To do so, we have the following means and sources of information at our disposal:

how we become responsive to technological and societal developments

– We identify emerging technological trends and societal problem areas at an early stage with the help of our international network of world-leading institutions in TA. The European Parliamentary Technology Assessment (EPTA) network of which we are part regularly conducts "horizon scanning" activities.
– We closely follow the calls of national and international funding agencies, particularly those at the EU level (such as the Horizon Europe Programme and calls from the European Parliament's Science and Technology Options Assessment (STOA) panel).
– We regularly carry out forward-looking and foresight activities and monitoring studies (including media analyses), informing our contracting authorities and the TA community on TA topics. Every half year (autumn and spring), we conduct a monitoring exercise for the Austrian Parliament (together with the Austrian Institute of Technology (AIT)) intending to identify the most important, politically salient technology areas that will affect society in the near-term future.

monitoring for the Austrian Parliament

– We address requests from national public actors, such as federal ministries, the Austrian Parliament, and government agencies. We raise vital issues to specific public actors who can incorporate them into policy and public debates.

horizon scanning as a critical activity of ITA

– Regular internal workshops serve to discuss future issues against the background of our different disciplinary perspectives and individual professional experiences.
– To identify potential TA topics in new socio-technical developments, the ITA team performs short-term exploratory studies. The results of these short studies may serve as a basis for more extensive, externally funded projects.
– The ITA also supports researchers in pursuing academic qualifications such as PhDs and habilitations awarded by universities. Candidates choose their research topics based on their independent research interests in the broad field of technology studies and issues covered at the ITA.

eligibility criteria for ITA projects

Topics covered are eligible at the ITA, if they
– are scientifically pertinent and promise to generate new insights in the field of science, technology, and society;
– are relevant in a national, European, and/or global technology policy context;
– show a scientific, societal, or political urgency;
– are feasible given the expertise and resources available at the ITA and the project consortium; and
– fulfill the general criteria for scientific TA (see the end of Section 1).

3 RESEARCH AREAS AND TOPICS AT THE ITA

The ITA has a vital role in setting future-oriented topics on the research agenda in the TA community. Society and TA are faced with many pressing challenges resulting from the digital transformation of society and the growing use of artificial intelligence, digital ethics, shifting values and normative frames of democracy, climate change, and sustainable energy transition. We deal with these challenges by exploring related socio-technical phenomena from different but intertwined analytical angles. A key asset of our dynamic approach is that the specific areas are not isolated but complement each other. This eases us in making use of synergies where ever possible and reasonable. Each area explicitly involves meta-research questions, which also stimulate us in identifying novel phenomena and future-proof issues for our research activities.

A primary focus connecting the different research areas is the joint alignment on potential ambivalences, ambiguities, tensions, synergies, and corresponding steering measures concerning the interplay between technology and society. This, in particular, includes the interrelations between science, research, and development, innovation and application, technology design, societal and environmental implications. All these issues are relevant in our research activities, which usually involve secondary analysis of existing data, empirical inquiries, and case studies. We cover a broad range of topics with varying focal points in particular projects and activities within our specific research areas. Thematically, our research is grouped in the following four areas:

3.1 DIGITAL TECHNOLOGY, DEMOCRACY, AND SOCIETY

In this area, the ITA studies the proceeding digital transformation of society, the impacts of digital technology, and its fields of development and application, focusing on societal, economic and political (infra-)structures, practices, processes, democratic norms, fundamental rights and governance regimes. Digital technologies and applications of various kinds pervade society in manifold ways, ranging from common ICTs, social media, algorithms, "smart" devices, automated decision-making and autonomous systems, to cyber-physical systems and the Internet of Things, big data and cognitive computing, "Artificial Intelligence" and machine learning. Consequently, digital technology affects almost all areas of life, further altering the relationship between society and technology, humans and machines. How drastic or conflict-laden the involved transitions are, depends on the degree of change and how it affects existing practices, democratic norms, and ethical values. Human rights and values (e.g., liberty and autonomy, security, privacy, dignity, equality, non-discrimination, freedom of speech, etc.) are inextricably linked to democracy. Far-reaching change or severe tensions will impact the quality of democracy, governance regimes, political participation, polity, policy, and politics.

focus on applied technologies and their effects on society and democracy

research questions

In this area, the ITA investigates the following (meta-)research questions: How does this development of a digital transformation proceed? What norms, values, and ideologies influence the making of digital and data-driven technologies? What forms of bias and discrimination do digital infrastructures and algorithmic systems co-create? How do new technologies become applied in society? What societal, economic, or political impacts, potentials, challenges, gaps, and fields of tension are observable in different domains, and why? How does digitisation affect democracy, human rights and values, policy-making, and political discourse? What are possible governance measures to tap potentials and handle likely socio-technical tensions in a constructive, socially responsible manner in accordance with democratic rights, norms, and values? The main emphasis in this cluster lies on innovative technologies, i.e., technologies and their types of applications that are either already in use or where usage soon can be expected (e.g., due to political and economic developments).

current and future topics

Current and future topics until 2023 include the co-creation of a modular self-assessment tool for TA and responsible innovation (RI) in AI firm startups; the societal impact of biometrics and facial recognition technology; prospects and perils of natural language processing and speech technology; data governance and algorithmic accountability; the impact of real-world artificial intelligence applications; approaches for critical AI literacy.

3.2 EMERGING TECHNOSCIENCES, VALUES, AND UNCERTAINTY

focus on emerging technologies and socio-technical uncertainties

In this area, the ITA focuses on ambiguities, ambivalences, and controversies about emerging technoscientific fields, applications, and products. The close coupling of scientific and technological development in the context of nano-, bio-, info-, and cogno-technosciences brings about scientific breakthroughs and radically new applications. This inevitably triggers new uncertainties and controversies regarding the very production of new knowledge and its practical use in contexts of application, as presently illustrated by CRISPR/Cas9. With every emerging technoscientific field, the existing socio-technical regime is challenged regarding the responsible governance of risks and benefits and its powerful socio-political imaginaries and visions.

The Corona crisis has underlined that in science-intense conflicts, even primarily political antagonisms are fought out in the field of expertise. Counter- and pseudo-expertise are mobilized to challenge academic science; anti-elitist movements result in a rise of populism, accompanied by a crisis of rationalism ("post-truth"). For TA, this gives rise to a better understanding of the logic of anti-scientific movements and, in particular,

the technical prerequisites for their success (e.g., digital technologies). Revealing the logic of science denialism will illuminate the complex entanglements between expertise, technoscience, and democracy.

In this area, the ITA addresses the following research questions: How do emerging technosciences, including their research practices, products, and technological applications, affect science and society, as well as science-in-society? What are the main trajectories of research and development in specific fields, and how do they relate to responsible research and innovation? What is the character and role of the distinct innovation regime emerging technosciences result from and are embedded in? What is the role of expertise, stakeholder interests, values, uncertainties, and socio-political imaginaries in fostering, designing, applying, and regulating emerging technosciences? Which governance measures are currently implemented to which effect and which governance options arise from our analyses? What opportunities and risks resulting from the increasingly close coupling of technoscience and society? What challenges result from involving civil society actors in the innovation process? Which specific, probably adapted TA approaches can address emerging technosciences in a scientifically productive way?

research questions

Current and future topics until 2023 include: the emergence of new participatory approaches in the realm of technoscience ('citizen science'; studies on the relationship between the ongoing digital transformation and the increased visibility of conspiracy theories; socio-political implications of an ever closer coupling of science and engineering in fields such as synthetic biology or via techniques such as CRISPR/Cas9 and Next Generation Sequencing; epistemic and normative challenges for TA raised by controversial emerging technosciences; the rise of pandemic politics in the Corona era and its implications for the technoscience-society-relations; an evaluation of (inter-)national policy advice models in the Corona crisis

current and future topics

3.3 INNOVATION, THE ENVIRONMENT, AND SUSTAINABLE FUTURES

In this area, we explore the transformative capacity of socio-technical innovations, their environmental and societal effects, the role of new technologies for systemic change, and the pathways of sustainable futures. Of particular interest are apparent synergies, gaps, and tensions between innovation and sustainability in a broader sense, including environmental, economic, societal, and health issues. Innovations involve socio-technical transformation patterns with multiple effects and dynamics. Depending on their transformative capacity, innovations can entail significant adaptations and changes in well-established infrastructures, organisations, processes, and everyday life practices. These systemic changes bear the potential to foster sustainability in particular domains and tensions between technology design and practical use or conflicting interests of

stakeholders, e.g., entrepreneurs, policymakers, practitioners, users, consumers, patients, or citizens. This is, among other things, observable in recent innovations for efficient and renewable energy systems to mitigate climate change and in sustainable consumption and resource management, smart mobility, digital agriculture, or assistive technologies in the health sector. To tap the potentials of innovation for sustainability and reduce possible risks may require novel or re-adapted research strategies and governance approaches.

research questions

In this area, the ITA investigates the following (meta-)research questions: How does socio-technical innovation emerge, and what are the related local and systemic effects, consequences, risks, and challenges in different fields of application? What are the main requirements, potential scenarios, and constructive approaches to reduce risks and tensions between innovation, sustainability goals, and social responsibility in particular settings? What are the main conflicts and synergies between ecological, economic, technical, and social sustainability?

focus on socio-technical innovations and their potentials and effects for sustainability

This area focuses on the study of potentials, risks, and societal implications of socio-technical innovations with significant potential for greater sustainability. Innovations in this area must increasingly address a fundamental change in social systems of production and consumption. For this reason, TA must not only deal with immediate, local consequences but also with systematic effects and interactions with existing infrastructures.

current and future topics

Current and future topics until 2023 include: intended and unintended consequences and risks of various innovations for the energy transition; the digitalisation and sustainable development in emerging economies; the Covid-19 crisis resilience of sustainable mobility policies in the City of Vienna; crisis resilience of sustainability strategies in different sectors and regions; blackout prevention and security of energy supply; food security for a just transition and production and consumption patterns to reduce waste generation and environmental pressure.

3.4 REFLEXIVE STUDIES: METHODS, CONCEPTS, AND FRAMEWORKS OF TA

reflexive investigation of TA methods, concepts, and frameworks

This area is dedicated to TA's theoretical and methodological advancement based on a critical reflection on the consequences of different TA methods and/or as exploratory projects in particular contexts. Interdisciplinary basic research has always been a central activity of the ITA, significantly contributing to its identity. Mainly backed by quantitative and qualitative methods of empirical social research, we continuously contribute to developing and refining theoretical and methodological knowledge in the scientific TA community. Furthermore, we strive to deepen our interdisciplinary practice and for collaborative learning. Finally, yet importantly, as TA is expected to provide scientifically sound expertise, we critically reflect on the role of policy advice in political decision-making.

This area thus investigates the following (meta-)research questions: How are methods, concepts, paradigms, frameworks, or procedures applicable to specific fields of TA? How and what types of inter- and transdisciplinary approaches contribute to refining the toolbox of TA? What is the role of TA in responsible research and innovation or ethics in technology, and how does TA co-shape technology design and development? What are the limits of predictability in TA, and how do TA and foresight complement each other? What are institutional and epistemic prerequisites for sound, evidence-based policy advice?

The ITA selects one or two topics for in-depth investigation supported by the institute's funds in each medium-term period. These topics address meta-level theoretical questions based in particular on internal research experience but also empirical evidence of other TA institutes. We set up internal project teams that cover a cross-section of all competencies and thematic groups of the institute. The teams for such projects try to achieve the participation of all members of the ITA in varying roles, such as members of the project teams, as advisors, or participants in discussions. The projects focus on reflecting TA methodology theoretically and on exploring specific societal phenomena relevant to TA (e.g., RRI, co-constructive development, or citizen science).

So far, the ITA successfully carried out in-house, reflexive studies on "Policy advice in TA: communicational settings, actor constellations, objectives & standards" (in 2016 and 2017), as well as on "Normativity in TA" (in 2018-2020). We will follow up on these issues with further scientific publications throughout the next period. In 2021-2023, we will carry out a new reflexive study described in the following subsection.

3.4.1 THIRD REFLEXIVE STUDY (2021–2023): RETHINKING PARTICIPATION: ANALYSING KNOWLEDGE CO-CREATION IN PARTICIPATORY TA

The ITA has made extensive contributions to theoretical and methodological debates on public engagement in the last two decades. The ITA has recently been involved with the design of new participatory methods and the organisation of participatory events. In various TA contexts, the involvement of laypersons and stakeholders has been established as a proven method for taking knowledge from different actors into account. We have used an other method, 'invited participation,' which is initiated and organised by professionals. By challenging the deliberation process and the quality of knowledge co-generated, our methodological pluralism seeks to respond to concerns such as the risk of political exploitation of participation activities and its disconnectedness from real-world policy problems.

growing ITA experience with participation

and growing scholarly concern

By focusing on the relationship between the quality of co-created knowledge and the quality of deliberation in participatory processes in this study, we aim to reveal whether and how claimed benefits of participation are realised in practice. Important guiding questions include:

guiding questions

Which participants are involved, and what are their roles in the process? What is the quality of knowledge co-created? Has such knowledge been used in political processes? Does the knowledge reveal new perspectives for assessing or shaping technologies? Does authentic reasoning characterise the deliberation process?

case studies referring to three fields of TA activity

In terms of method, the study will be an in-depth analysis of ongoing and completed ITA projects dealing with a broad range of TA studies focusing on nanotechnology, neuro-enhancement, renewable energy, artificial intelligence, or climate change. The relevant case studies refer to different fields of activity of TA using non-expert knowledge: (1) in support of political decision-making (Participatory TA), (2) in responsibly shaping technology (Constructive TA), and (3) in forward-looking activities where citizens' visions of desirable futures are taken into account (participatory foresight CIVISITI method).

3.5 FROM THE SOCIETAL CHALLENGES OF THE COVID-19 PANDEMIC TO A TA IN SITUATIONS OF CRISES

Since spring 2020, a pandemic of unimagined dimensions confronts the entire world, including Austria. Not least, scientific institutions are called upon to contribute to the necessary processing of the resulting societal challenges following their respective competencies and capacities. We at THE ITA have already started and will continue to answer this call.

the ITA is well-positioned to contribute to the societal challenges of the Covid-19 pandemic

For TA and the ITA, there is a multitude of paths, topics and methods, which make such a contribution possible: The ITA team holds unique expertise in interdisciplinary and transdisciplinary research, connecting science, politics, and the public – a kind of expertise crucial in the current situation. On a theoretical level, the ITA brings special competence in questions of quality assurance of evidence-based policy and the specific role of experts, the consideration of knowledge gaps, uncertainties, and normative ambivalences. On the methodological level, the ITA holds particular competencies in expert, stakeholder, and public participation. Thematically, the ITA is familiar with the analysis, evaluation, and socially acceptable development of technological solution components (such as tracing apps). Furthermore, we are concerned with the direct or indirect consequences of the Covid-19 pandemic and policy on the technological innovation field.

In 2020, we started relevant activities: On the one hand, members of the ITA have appeared in public as experts, have published articles in daily newspapers and online media, and have participated in panel discussions. The ITA researchers have participated in Covid-19-specific funding calls and have started a first Covid-19-specific research project (see above). Since 2020, the ITA is also part of transnational networking activity, supports the Dutch Rathenau Institute in the establishment of an online review service for Covid-19 tracing apps on behalf of the European Commission, and participates in the organization of conferences and the establishment of a working group on various aspects of the Covid-19 crisis.

the ITA's contributions so far

In the years 2021-2023, the ITA will continue to work on the Covid-19 crisis. The ITA will focus on three overarching goals:

three goals:

First, as a publicly funded research institution, the ITA will signal solidarity to the public by providing insights into the specific effects of the crisis on everyday scientific life and contributing to the public discussion of the crisis and its management in public media. Thus, ITA staff members will act as necessary „ambassadors of science" in times of public unsettledness and potential fragmentation.

ambassador of science

Second, the ITA will continue to gather new insights in Covid-19-specific research projects and provide expertise in relevant expert panels. Both activities will contribute to assessing the impact of the crisis and to dealing with it constructively. The ITA thus fulfills the essential function of „scientific policy advice." The exercise of these two functions will be quantitatively oriented to the capacities available at the institute and ensure that other essential tasks and research topics of the ITA are not neglected.

scientific policy advice

In the longer term, we will pursue a third goal, targeting the development and expansion of expertise for „TA in situations of crises" in and beyond the Covid-19 pandemic, as it is foreseeable that this is not the last pandemic and not the only crisis in which technology assessment can make significant, constructive contributions. For this third task, we shall lay the essential foundations in the years 2021-2023, and we shall implement it in a focussed manner in the following medium-term program.

capacity building for „TA in crises"