Introduction: Technology Assessment Beyond National Boundaries

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Modern societies are immensely permeated by technologies and thus also dependent on them. Increasingly, this is also true for countries in the global South. As a result, questions about the interdependencies of technology and society, the possible mutual influences and the social governance of technology are becoming a global challenge. In addition, innovation cycles have become shorter and shorter, and more new products and services are being offered at shorter intervals. Many of these new

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technological processes, products and services are provided primarily unchanged on global markets, encountering societies with different cultures and socio-economic conditions.

1 A Brief History of Technology Assessment

Since the 1970s, attempts have been made under the label of "Technology Assessment" (TA) to scientifically investigate the possible effects of technological innovations and, based on the findings, to advise civil society and political actors in this regard (for an overview see, e.g. Grunwald, 2018; Vig & Paschen, 2000). From a scientific point of view, TA is an interdisciplinary activity that responds to the emergence of new scientific and technological developments, artefacts, processes, services, societal problems and concrete policies, and attempts to identify the possible effects on different areas of life. Particular emphasis is placed on unintended consequences—the non-obvious is to be made visible through interdisciplinary exchange, often involving stakeholders and those affected, and is thus made accessible for evaluation.

There is currently no generally accepted definition of TA, but the definition used in an international project on TA[1] methods can be regarded as a sound basis:

> Technology Assessment is a scientific, interactive and communicative process which aims to contribute to the formation of public and political opinion on societal aspects of science and technology. (Bütschi et al., 2004, S. 14)

This very general definition contains many aspects of modern TA. It goes beyond "classical" informing (science to policy) and acknowledges that values and interests influence technology development. Bringing stakeholders and the broader public on board through TA processes also helps open up issues to public debate and to set public agendas. This endeavour needs interactive settings and communicative skills to bridge different perspectives and disciplines.

However, beyond a formal discussion, the mission of TA is clear: It is about reflection on technological progress, which should be used to enable a scientifically elaborated knowledge base for political decision-making, and social discourse on questions of shaping futures in an increasingly technology-dependent world. Since technological development is global, reflection on technological progress and governance needs to take a global perspective. However, a particular challenge is that the social embedding of global technologies can lead to regionally, culturally and socially different impacts. The effects of new technologies cannot be assessed independently of the socio-economic environments they are used in, as there are no universal deterministic impacts of a specific technology. So, the particular challenge for global TA is to analyse global technologies, which are often uniform—with generic challenges

[1] TAMI (Technology Assessment in Europe. Between Method and Impact) was a European project from 2002 to 2003 focussing on providing a basis for discussions on the methods and impact of TA. For details see: https://www.itas.kit.edu/english/projects_grun02_tami.php.

for human beings and the environment—but at the same time to appreciate their interdependent embeddedness in socio-cultural and socio-economic conditions.

Another challenge is that TA is primarily an element of policy advice, and policy systems vary widely internationally. An example of this is provided by the different forms of institutionalisation of TA in Europe. Although all full-member countries of the European Parliamentary Technology Assessment network (EPTA)[2] follow the same, or very similar, models of parliamentary democracy, a colourful diversity of institutionalisation forms and preferred methods is evident. On the one hand, these are historically justified, but on the other, they are mostly highly functional and tailored to the specific parliamentary system.

The beginnings of institutionalised TA can be located in the Office for Technology Assessment (OTA) in the USA in the 1970s. In the founding law, the foundations for and the demands on TA were formulated in a way that can still be regarded as valid:

> To establish an Office for Technology Assessment for the Congress as an aid in the identification and consideration of existing and probable impacts of technological application. […] As technology continues to change and expand rapidly, its applications are […] increasingly extensive, pervasive, and critical in their impact, beneficial and adverse, on the natural and social environment. Therefore, it is essential that, to the fullest extent possible, the consequences of technological applications can be anticipated, understood, and considered in determination of public policy on existing and emerging national problems. […] It is necessary for the Congress to equip itself with new and effective means for securing competent, unbiased information concerning the physical, biological, economic, social, and political effects of such (technological) applications. (United States Senate, 1972)

From the beginning, the need for policy advice was central: Congress wanted to better exercise its control function vis-à-vis the executive branch, but was increasingly confronted with studies that contradicted each other and lacked decision-related information (see, e.g. Herdman & Jensen, 1997). The OTA relied on interdisciplinary, strongly scientifically oriented in-house expertise and the most comprehensive presentations possible. From the beginning, the OTA tried to enhance the readability of its reports with the help of professional scientific writers. After 23 years of practising TA for Congress, the OTA was closed in 1995. For a long and fruitful period, the OTA served as the blueprint for TA internationally. "The OTA Legacy"[3] describes the history of the OTA and presents all 700 reports.

Soon after the founding of the OTA, the discussion about TA started in Europe. After lengthy discussions, several PTA institutions were established around the mid-1980s, beginning in France, Denmark, the Netherlands, the European Parliament, Austria, the UK and Germany. The European Parliamentary Technology Assessment (EPTA) network emerged from these foundations. The second wave occurred towards the end of the 1990s and a third in the first decade of the twenty-first century. Thus, EPTA now includes 25 parliamentary TA (PTA) institutions. Since the US Government Accountability Office (GAO) became an associate member in 2002, EPTA has extended beyond Europe. This process of global networking of PTA has

[2] https://eptanetwork.org/.

[3] www.princeton.edu/~ota/.

continued, with the admission of members from Japan, Mexico, Chile, South Korea and most recently Spain and Lithuania.

In the 50 years since the first foundations of TA, both the social framework and the political conditions for parliamentarism have changed. Thus, PTA has also evolved. An overview of the institutionalisation of PTA and its development, especially in Europe, can be found in Vig and Paschen (2000), as well as Cruz-Castro and Sanz-Menéndez (2005), and more recently in Ganzevles et al. (2014), Est et al. (2015), Klüver et al. (2015), Nentwich (2016), and Peissl and Grünwald (2021).

Even though its institutional focus still lies in the area of PTA, TA has differentiated, addressing governments and establishing itself in academia. A chronological sequence of different concepts and approaches to TA shows that OTA's expert-oriented classical TA concept, with interdisciplinary project groups to develop "unbiased information" as a basis for options for action, quickly developed further into participatory TA, primarily in Denmark and Switzerland. Participatory TA (pTA) recognises the social nature of technology and thus the importance of its inherent values. Therefore, it includes a wide range of stakeholders and the general public in the TA process (Durant, 1999; Hennen, 1999; Joss & Bellucci, 2002). Other approaches, e.g. from the Netherlands, were particularly fruitful for academic discourse on the further development of TA. Constructive TA (CTA) envisages an active role for TA as an actor as early as possible in the technology development process, mainly to introduce social issues (Genus, 2006; Rip & van den Belt, 1986; Rip et al., 1995; Schot, 2001; Schot & Rip, 1996). The concept of real-time TA, introduced in the USA in the 2000s, attempts to do something similar by early integration of social science knowledge into scientific and engineering ventures (Guston & Sarewitz, 2002).

2 Technology Assessment and Its Relatives

In the international context, a particular success story is Health Technology Assessment (HTA). HTA developed almost simultaneously from classical TA and pursues the same fundamental goals in terms of policy advice on an evidence basis, albeit restricted to medical products, interventions, therapies and preventive measures. The formal definition of HTA reads like this:

> HTA is a multidisciplinary process that uses explicit methods to determine the value of health technology at different points in its lifecycle. The purpose is to inform decision-making to promote an equitable, efficient, and high-quality health system. (O'Rourke et al., 2020)

The specialisation in health technology made it possible to reach a consensus on methods and procedures and anchor them in the HTA community. An international community emerged early on, now represented by the International Network of Agencies for Health Technology Assessment (INAHTA), and Health Technology Assessment international (HTAi). INAHTA has a membership of 50 agencies with 2100 staff from 31 countries, and HTAi has 82 member organisations, and over

2,500 individual members from 65 countries worldwide. A detailed history of the development of HTA and its organisations is described by Banta et al. (2009).

In contrast to the precise requirements posed in HTA, the world is confronted with many highly complex issues, from managing and preventing conflicts to mitigating global warming, dealing with increasing inequality which threatens the social fabric on a global level, or new pandemics that threaten both our health and the global economy. In all these challenges, Science, Technology and Innovation (STI) plays a vital role as an essential factor in either causing or mitigating the problem. These challenges are severe and require rapid coordinated action on a global scale. Many technological developments require urgent global coordination, from digitisation to gene editing, nanomaterials, artificial intelligence (AI) and robotics.

However, while global interaction in economic and technical terms has increased, we are faced with a lack of global governance. To address the global challenges and govern the global development of technology, it is imperative to identify, assess, discuss and regulate the impacts (e.g. societal, environmental, ethical or legal) of STI in a timely manner. As this is the main focus of Technology Assessment, TA can help support the global governance of technologies, find alternatives to problematic applications or promote key technologies' positive attributes.

While similar activities exist in many areas of the world, the term "TA" is often unknown. These other "TA-like activities" range from research into the relationship between Science, Technology and Society (STS), to more project-oriented consultancy in environmental issues, such as the Environmental Impact Assessment (EIA). STS research to understand and clarify the relation of science, technology and society splits in two basic directions—first, scientific understanding of the nature and practice of S&T and, secondly, (similar to TA)—investigating more deeply into the impacts and control of S&T, focussing on risks and benefits that might concern values such as peace, security, community, democracy, environmental sustainability and human values.[4]

Responsible Research and Innovation (RRI) has been developed and strongly promoted in Europe under the patronage of the European Commission. RRI takes up several approaches and methods of TA and aims at creating a "transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products" (von Schomberg, 2011). A considerable effort was made to understand the innovation process under the frame of RRI, and to further advance its implementation with the help of concrete criteria and tools through numerous European-funded projects (Owen et al., 2021). Even though the new European funding frameworks (e.g. Horizon Europe) have shifted focus towards "Open Science", the more conceptual levels or "dimensions" of RRI remain relevant, including for TA. These dimensions are procedural in their approach and include anticipation, reflexivity, inclusion and responsiveness (Stilgoe et al., 2013). Several discussions on whether RRI is a critique of TA (van Lente et al., 2017) or whether TA should take on the role of a lighthouse for approaches such as RRI

[4] Further reading: https://sts.hksharvard.edu/about/whatissts.html.

(Nentwich, 2017) have taken place. Further, activities in EU projects (RRI Practice[5]) have aimed to expand RRI to countries outside of Europe, such as India, China or Brazil, which in turn raises questions of the value basis of the concept and how this varies in different national contexts (Wong, 2016). This of course is also a key question for a global TA.

Additionally, Foresight has evolved as an often- and widely used tool for strategic planning and long-term decision-making. According to a well-established definition, Foresight is a systematic, participatory, future intelligence-gathering and medium- to long-term vision-building process aimed at enabling present-day decisions and mobilising joint actions.[6] Its roots go back to the early 1980s and took off in the 1990s, as European and then other countries sought new policy tools to address problems in their science, technology and innovation systems (Miles, 2010).

Finally, impact assessment is a way of dealing with the concrete effects of technological interventions in nature and society. A large international professional community focussing especially on environmental impacts is organised in the International Association of Impact Assessment (IAIA).[7] Environmental Impact Assessment (EIA), as a widely standardised tool, deals with the environmental implications of concrete planning processes, mainly on a regional level. Through the evaluation of many projects and their regional focus, it soon became apparent that, in addition to environmental impacts, it was above all the effects on the social fabric and socio-economic status that had to be taken into account. So, the Social Impact Assessment (SIA) evolved. SIA is seen as a field of research and practice that addresses everything associated with managing social issues throughout the project lifecycle (pre-conception to post-closure). SIA has transformed from a regulatory tool to being the process of managing a project's social issues, used by developers, financiers, affected communities and environmental licencing agencies (Vanclay, 2020).

Several activities at different levels are dedicated to the tensions, interdependencies and opportunities between technology and society—both in the relationship and its governance. They all have alliances, platforms, organisations and networks that aim to establish professionalisation, exchange, further development and visibility for the respective approaches. Of course, this also applies to TA. In addition to the EPTA Network[8] mentioned above, the TA network (NTA)[9] of the German-speaking countries is particularly noteworthy. In this network, 55 institutional members from Germany, Austria and Switzerland work together. Within the context of these networks (e.g. EPTA, NTA), and wider international cooperation in projects such as GEST,[10] PACITA[11] or RRI Practice, the wider importance of a global perspective for TA activities has become more and more distinct over the years. Technologies

[5] https://www.rri-practice.eu/.

[6] http://www.foresight-platform.eu/community/forlearn/what-is-foresight/.

[7] https://www.iaia.org/about.php.

[8] https://eptanetwork.org/.

[9] https://www.openta.net/.

[10] https://www.itas.kit.edu/projekte_deck11_gest.php.

[11] http://www.pacitaproject.eu.

develop globally and have worldwide impacts; grand challenges go beyond national boundaries, and assessments should take this into account.

3 The Need for Technology Assessment to Go Global

The first discussion on global TA was initiated with the book "Constructing a Global Technology Assessment" (Hahn & Ladikas, 2019), which examined science and technology policy systems, decision-making frameworks, priorities and values as well as TA(-like) activities in various countries, such as Australia, China, India and Russia. This discussion highlighted the existence of a "TA Habitat" (Hennen & Nierling, 2015) as a prerequisite for the creation of a global TA. The Habitat refers to the elements that are needed in order to have a functioning TA in the national context, that can then be assimilated in the multilateral context. In detail, it revolves around the decision-making structures, the public accountability system, the existence of problem-oriented or hybrid research activities in the academic sector, public awareness of STI issues and a wish to articulate societal implications in policy-making.

More importantly, this first discussion arrived at an agreement on the parameters that would help delineate the functions of a global TA. These include:

Political System: with a wide range from multi-party to one-party systems, from liberal to authoritarian, from socialist to capitalist, from social welfare-oriented to free market-oriented, etc., the political system of the country affects the type of TA that can be undertaken. Disregarding extreme political systems that are not conducible to any type of TA, the prevalent view is that any system that allows freedom of expression and includes willingness to accept open debates is a good candidate for inclusion in global TA. This also presupposes willingness to accept different perspectives, and not simply to accept, or not, the most public forms of TA.

S&T Governance System: refers to the administrative setup around the STI decision-making process, and in particular, how centralised or decentralised this might be. The European Union's multi-national (or transnational) governance provides a good example of a multi-national organisation that can perform successful TA at central level. The UN's Intergovernmental Panel on Climate Change is another example of TA-type activity at centralised global level.

Socio-economic Development Stage: refers to national STI priorities that are closely connected to development needs and require particular types of technological development. For instance, frugal innovation, i.e. low-tech innovation that is evident in less developed regions, requires other approaches to assessment than the high-tech innovation sector that TA usually focuses on.

National Values: refers to norms of behaviour and cultural specificities that are key ingredients in every STI debate. These must be analysed and understood in order to identify their impact on decision-making and their role in developing a global TA.

Next to such conceptual thinking, the globalTA Network[12] was founded with the aim to concretely develop cooperation among researchers and institutions active in research and advice on technology policy, and to establish long-term working structures for a global TA. More than 30 members from across the globe represent TA(-like) activities from non-profit institutions committed to developing a global framework for the assessment of the impacts of technologies, facilitating global cooperation and supporting anticipatory governance of new technologies in line with the UN Sustainable Development Goals (SDGs). This book is a project of the globalTA Network. The contributions here result from thorough discussions among members of the network, in a process that has already strengthened its co-operative links and potential. The next step is to analyse systematically the framework conditions, opportunities and challenges for setting a global TA into practice. The book can thus be regarded as a conceptual endeavour for further activities in the globalTA Network.

4 The Book and Its Contributions

The contributions to this volume share an understanding that the development of S&T, including its social and environmental consequences, can no longer reasonably be dealt with solely on a national level. With a view to the economic, social and environmental challenges ahead, and the growing interweaving of economic and socio-cultural life around the globe, they regard globalisation as a reality in the making and hold it to be a political task for the next decades to react to the urgent need for democratic and open transnational modes and processes of global governance. Indications of militant and aggressive nationalism, and authoritarian attempts to prevent nation states and civil societies from open global interchange and socio-political discourse are virulent and have been shocking the world again as work on this volume was completed in early 2022. The contributors to this book are however convinced that these tendencies do not offer any viable way to secure the future of the globe. They hope in all confidence that in the long run these tendencies will not prevail against the civil, cultural, professional, scientific and political communities that constantly strive for open and equal interchange on just solutions for global problems, leading to legitimate transnational decision-making. Holding that such efforts towards processes and structures of global interchange and understanding are all the more urgent, the present volume is a step in this direction in the field of science and technology policy, and specifically in TA as an instrument through which to base political decisions on the best knowledge available, and on inclusive democratic deliberation on norms and values that can guide decisions.

Triggered by ongoing exchanges within the globalTA Network on the need and options for better global cooperation in the field of TA, the volume explores what globalisation means and can offer for our common efforts, and which parameters

[12] https://globalta.technology-assessment.info/.

have to be taken into account when jointly working for a global TA. This includes the recognition of different cultures and understandings of scientific policy advice, and hence different concepts of TA. It includes a reflection on the relevance of processes of globalisation for both the mission and practice of professional TA practitioners. It also includes a reflection on salient problems and fields of advanced development of technologies and the possible contributions from TA. Finally, it includes a reflection on structures of global discourse and decision-making, and ways for TA to respond to these and bring our debate on ways and modes of improved cooperation to the next level.

The volume starts (**Part I**) with an overview of the global state of play in our professional community and the relevance of TA in international governance. In the contribution by *Julia Hahn*, *Nils Heyen* and *Ralf Lindner* we—the global TA community—try to validate our knowledge of practices of TA-related activities worldwide. Based on interviews with colleagues from the globalTA Network, the chapter describes and highlights current and relevant developments of technology assessment (TA) across several countries and clusters these according to main areas of activity or modes of institutionalisation. The focus of this chapter is on twelve (mainly) non-European countries which are part of the globalTA Network: Australia, Brazil, Chile, China, Czechia, India, Poland, South Africa, South Korea, Slovakia, Russia and the USA. This provides an overview of the heterogeneity of socio-political systems which TA may relate to, and modes of institutionalisation that characterise TA activities around the world. At the same time, a TA core becomes visible: addressing potentials and risks of emerging technologies, reflecting ways of doing responsible research and innovation, inclusion of stakeholders and the public in assessment processes, and others. The supplement of the book provides brief Country Reports that serve as an information pool to the overview chapter. In these briefs, colleagues from the respective countries reflect on the state and challenges of national TA activities.

Shifting from the national to the international policy-making level, *Miltos Ladikas* and *Andreas Stamm* identify TA's role in the existing STI multilateral system and localise it within existing global decision-making structures. The paper shows that a wide spectrum of TA methodologies is employed at the United Nations and multilateral agencies in their efforts to analyse the significance of new and emerging technologies for development. The paper concentrates on the United Nations Conference on Trade and Development (UNCTAD), where TA is specifically commissioned as an aspiration for the achievement of its development goals. It is especially the activities related to the UN SDGs that promise options to overcome the numerous challenges that TA faces when applied in developing countries. The chapter concludes with a discussion of possible models for organising TA on a global level and discusses the significance of the Intergovernmental Panel on Climate Change (IPCC) as a role model for an independent and effective global TA.

Part II of the book is dedicated to three challenges that TA faces when trying to go global. *Leonhard Hennen* and *Rinie van Est* explore the dimensions and problems of globalisation, as discussed in the scholarly literature of the last decades, to provide

a general reflection on the meaning of globalisation in the field of science and technology governance and identify the challenges of transferring TA activities to the global level. Globalisation is understood here as an articulation of "reflexive modernisation", and thus features to a high extent "reflexive" problems of governance-making, such as systematic uncertainties of knowledge and cultural diversity of relevant values and norms. Great economic interdependencies as well as inequalities, together with the fact that technological and environmental risks are largely of global character and transcend the reach of national policy-making bodies, make up the challenges of globalisation. TA is presented as an instrument tailor made for reflexive governance, and thus as a natural support for politics under the conditions of globalisation, if it manages to strengthen its global character.

TA as a democratic mode of policy advice has a strong relation and commitment to the public sphere as a space to express and discuss common concerns and collective social interests. *Rinie van Est* and *Leonhard Hennen* reflect on the challenges implied in relating TA's activities to a global public sphere. The chapter's reflections follow the "all-affected" principle, which implies that TA should take into account all kinds of people that are affected worldwide by science, technology and innovation (STI). It first examines the relationship between TA and public spheres that deal with the societal significance of STI from a national context, because both are mainly approached from the point of view of national political decision-making. The authors then reflect on public spheres in a context of globalisation and describe how TA institutes, networks and activities are organised beyond national borders. The exploration of the link between public spheres and TA in a global context leads to a sketch of a blueprint for the future of global TA.

One of the main challenges for global TA is transferring the concept of TA as democratic policy advice from its origins in the Western world to developing countries which not share the same cultural and political background and mainly do not have the same economic capacities. *Ravi Srinivas* and *Rinie van Est* draw some lessons for the transfer of TA from the example of India. The chapter provides an overview of the TA landscape in India, as an example of TA in a developing country. The authors start with a reflection on the role and relevance of TA for developing countries in general. Focussing on the development of S&T governance in India, where most TA-like activities and practices are organised by and for governmental agencies, five examples of formally institutionalised governmental TA-like activities are given: governmental TA-like capabilities for technological foresight in general, for agricultural, medical and pollution abatement technologies in particular, and finally the only government-organised participatory TA, regarding the introduction of a genetically modified eggplant. In addition, three informal TA-like grassroots activities are described. Concluding by reflecting on the TA landscape in India, some lessons are drawn for the role and conditions for TA in developing countries.

Part III of the book provides an exploration of four selected fields of technology, respectively, policy-making problems—climate change, biotechnology, artificial intelligence and the COVID-19 pandemic—that clearly show the need for and the challenges of global governance, as well as global cooperation and interchange

regarding the scientific analysis of the social significance and effects that emanate from these fields and develop into global policy-making issues.

Climate Change can be regarded as the most serious challenge for global policy-making and is an ongoing exercise in finding ways to globally shared strategies for solutions. *Peta Ashworth* and *Elliot Clarke* explore the structure, practices and methods of the Intergovernmental Panel on Climate Change (IPCC) as a legitimate scientific institution, and its interplay with the global political decision-making forum of the United Nations Framework Convention on Climate Change (UNFCCC). By examining the successes and shortfalls of the IPCC process and comparing these with TA theory and practice, they investigate whether such an institutionalised process of co-design between governments and researchers could serve as a potential global TA model. They identify central challenges of the IPCC process related to questions of political impact, pursuit of consensus, trust and accessibility of information. The authors argue that there is potential for each of these problems to be addressed using existing analytical TA frameworks, resulting in more authentic and accepted outcomes from a global governance perspective.

Biotechnology involves the use and manipulation of living organisms such as plants, animals, humans and biological systems or parts of this, to modify their characteristics in order to create desired organisms or products. Biotechnology is a field that touches on many aspects that are central to TA and have been in its focus since the 1980s. By presenting three key topics in biotechnology—genetically modified food and crops (GMO), synthetic biology and human genome germline editing (HGGE)—*Sophie van Baalen, Ravi Srinivas* and *Guangxi He* show that a central feature of biotechnology is that the science is evolving globally and the products it brings forth are traded across the globe. But as is typically the case for modern technologies nowadays, there are major differences between the regulation and governance of the academic and industrial sectors across countries. These stem from different needs and interest per country, as well as differences in traditions, cultural differences and public perceptions. As global governance is fragmented, with little scope for harmonisation, global TA of biotechnology can bring clarity, better understanding and enable better governance. In order to do so, an integrated global TA framework should consider international trade, differences in risk assessment, cultural variation and different value-systems between countries, as well as differences in countries' capacities in R&D and coordination of public engagement efforts.

Based on a large scale of technology application scenarios, *artificial intelligence* (AI) is expected to have disruptive impact on economies and societies. *Lei Huang* and *Walter Peissl* argue that breakthroughs have been made recently in basic research on the fundamental technologies, so that AI is showing greater potential to become a general-purpose technology. In the domain of TA, research on AI and its potential impacts has been considered early. The research questions, which include impacts on the workforce as well as on societal communication and democracy, and fundamental issues such as responsibility, transparency and ethics have drawn widespread attention from TA studies. The chapter presents a scholarly discussion of AI topics in the

context of TA, based on a qualitative analysis of AI policy databases from the Organisation for Economic Co-operation and Development (OECD) and the European Parliamentary Technology Assessment (EPTA) network. The analysis concludes that enhancing global cooperation in TA will contribute to addressing fundamental ethical and societal issues of AI, which in turn broadens the knowledge base and helps to pave the way for more inclusive and just use of AI.

A recent case showing the need for concerted global governance to increase social resilience to crisis is the COVID-19 pandemic. *Marko Monteiro*, *Florian Roth* and *Clare Shelley Egan* examine the governance of health technologies during the COVID-19 pandemic. They reflect on three interrelated challenges that need to be addressed in future assessment approaches for achieving systemic resilience: problems of *scale*, *trust* and *politics*. The chapter focuses on digital surveillance technologies and vaccines; two cornerstones in the efforts to mitigate the spread of SARS-CoV-2 around the globe. Tracing apps were introduced in many countries, but their effectiveness has been constrained by issues of data privacy, insufficient interoperability and digital inequalities. In parallel, a global research race enabled the development of different vaccines with unprecedented speed, building on innovative biotechnologies. However, vaccination worldwide was marked by disparities in access and controversy. The authors conclude that governance and assessment should be built around strong international coordination and cooperation, without limiting local experimental learning and innovation. Further, public trust should be considered as a necessary condition for the success of any technological innovation in the health context. As trust in policymakers, academia and industry is strongly context-specific, global governance should also be sensitive to the diversity of social and cultural contexts. Finally, to improve overall systemic resilience, global power imbalances should be addressed in all phases of the innovation process.

The concluding chapter (**Outlook**) draws tentative conclusions from the findings of these contributions with regard to possible future ways to organise TA on a global scale. These considerations comprise a discussion of possible organisational shapes that can support the global interchange and sharing of TA capacities and increase its political relevance and operability on a global level. Beyond such medium- and long-term aspirations, the outlook reflects on more short-term practical steps that could be taken within the globalTA Network to improve interchange of knowledge and expertise, engage in joint projects and mutually foster analytical and methodological capacities.

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