Tracing Technology Assessment Internationally—TA Activities in 12 Countries Across the Globe

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1 Introduction

This chapter describes and highlights current and relevant developments of technology assessment (TA) across 12 countries within the globalTA network[1] and clusters these according to their main areas of activity. Overall, we understand TA as 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, 14). This involves various approaches and methods, including scientific assessments, policy analysis, and participatory processes, which are used to understand the societal implications of technology and innovation in a multitude of dimensions, thereby taking into account the different cultural contexts in which technology development unfolds. TA as a term is not necessarily used alike in different national contexts. Instead, other approaches such as ELSA/ELSI (ethical, legal, and social aspects/implications), Responsible Innovation (RI) or Responsible Research and Innovation (RRI), sustainability studies, societal effects of science and

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

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technology (S&T), etc., may be more common (Hahn & Ladikas, 2019). Looking at different national contexts allows for a detailed view of these activities regarding the interrelation of S&T and public/political/societal settings, and to frame these as TA or "TA-like". By tracing current TA or "TA-like" activities in selected countries across the globe, this chapter highlights several developments, initiatives, or methods, which are relevant for a global perspective on TA. In order to remain in the scope of this volume, the focus of this chapter is mainly on non-European countries, especially because the European TA landscape has been extensively described and analyzed elsewhere (e.g., Hennen & Ladikas, 2019). Since the globalTA network unites researchers and institutions from around the world working in the area of TA, members of the network were invited to share practical insights into their activities. This provides a unique impression of TA-like activities in Australia, Brazil, Chile, China, Czechia, India, Poland, Russia, South Africa, South Korea, Slovakia, and the USA.

The starting point for this chapter was to conduct interviews (JH, NH) with globalTA network members in each of the 12 countries, which enabled discussions about current activities and developments. The interview partners then provided brief reports outlining the situation of TA in their respective national settings (see Country Reports, in the supplement of this volume). The Country Reports all follow the same structure including, (i) the country-specific context, (ii) specific highlights of TA activities (e.g., projects, technologies, and methods), and (iii) outlook and challenges regarding TA in the national setting, and the potential for a global level of TA. Based on these Country Reports, this chapter clusters and localizes the country-specific TA activities (Sect. 2) and reflects on what can be learned from this global analysis (Sect. 3).

2 Mapping of Country-Specific TA Activities

The Country Reports were analyzed and clustered with regard to the various modes of institutionalization of TA. We build on the three main areas of parliamentary TA that have been identified in the European TA landscape (Hennen & Ladikas, 2019, 62): politics (committee model of TA), science (office model of TA), and the public (interactive model of TA). These areas show various manifestations of TA practices, strongly characterized by specific political cultures, yet TA institutions are often active in all three areas. For the global context, we expanded the TA activities to be considered, focusing not only on parliamentary TA. This expands the original TA landscape from the European context to consider TA activities in an international context that are not necessarily termed as "TA" and are embedded in different institutional settings. In addition, in a context in which TA is emerging there may not be an institutionalized form (yet). Corresponding with the definition of TA as an interactive and communicative process, this broader view enables a range of different actors and activities to be considered. We used the three areas (politics, science, and public) as

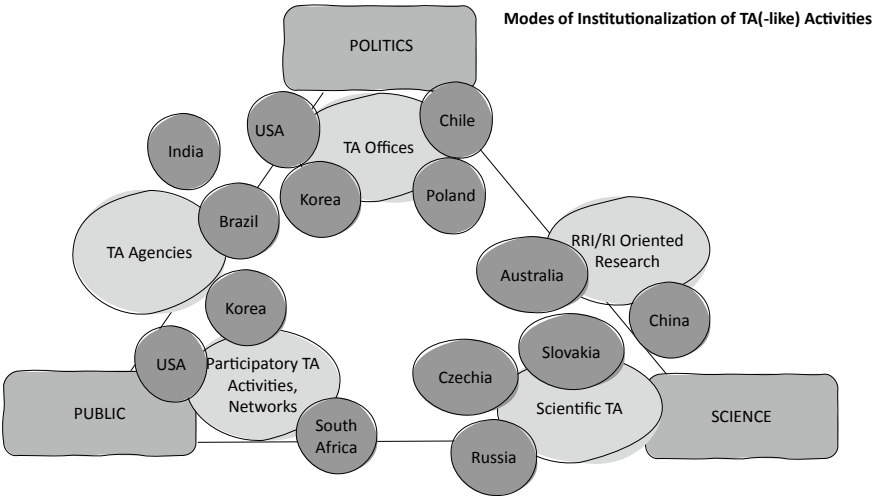

Fig. 1 Modes of institutionalization of TA (-like) activities in the 12 countries

a starting point, but considered wider areas of TA activities and application, such as research programs, networks, or government ministries.

Based on the expert interviews and Country Reports, we identified five main areas of TA activities—or five modes of institutionalization of TA—in the 12 countries (see Fig. 1):

(a) A distinct TA office, which is the institutionalization mode closest to Politics, whether in the form of government ministries or the parliament;
(b) Research funding programs of government ministries that are oriented toward responsible (research and) innovation (RRI or RI), localized between politics and science;
(c) Scientific institutions conducting TA, which is the institutionalization mode closest to science with its main function in research and education;
(d) Participatory TA activities and networks, which often include NGOs, think tanks or other civil society actors, therefore, being close to public; and
(e) TA agencies or government ministries that are oriented toward the public and can, therefore, be located between politics and public.

Figure 1 shows where the country-specific TA activities described in this chapter can be located in terms of institutionalization. In some countries, a variety of TA activities take place, thus these countries are located in more than one area of institutionalization. This is a first account of clustering TA across different national contexts, and deeper analysis of the specific socio-political contexts, institutional settings and formation of TA in each country would be a necessary next step in order to gain a more in-depth picture. Yet, this first clustering can provide some insights into the aspects that are important for TA to emerge and then institutionalize, and provides first indications of which actors may be important in these processes. In the following,

we present some of these insights and provide more details on the localization of the country-specific TA activities, drawing on the Country Reports (Fig. 1).

Politics

TA's origins at the Office of Technology Assessment (OTA) as part of the US Congress in the 1970s, together with current networks such as the European Parliamentary Technology Assessment (EPTA) understand TA as an integral part of scientific policy advice and democratic parliamentary decision-making. This "Parliamentary TA" can be found in several countries examined here.

In the *USA* (cf. Guston, in this volume), for instance, there is a group of experts at the Government Accountability Office (GAO), which mainly serves the US Congress and is led by the US Comptroller General, with responsibility for auditing and evaluation. Some connections to TA can be found, even though this is mostly attached to the expert mode of practice, in the tradition of OTA. As described in the US Country Report, GAO has emerged as a small but well-regarded TA capacity which has provided reports on various technologies (recently 5G, CRISPR, climate tech, and health), as well as reports focused on more concise and decision-centered information and communication at the parliamentary and government level.

In *South Korea* (cf. Choi, in this volume), parliamentary TA activities have also been taking place in a formalized way for some time. The Ministry of Science is responsible for TA, and within the Korea Institute of Science and Technology Evaluation and Planning (KISTEP), studies and reports on specific technologies are published each year, with the results reported to the Presidential Advisory Council on Science and Technology (PACST). In this way, TA findings are potentially incorporated into policymaking and budget planning. Experts carry out TA analyses on the effects and issues of emerging technologies, and a Citizen Forum discusses implications and impacts (see "public" paragraph below). According to the analysis in the South Korean Country Report, the future of TA development should focus on simplifying the TA process in order to be able to evaluate more technologies per year, and on raising general awareness of TA through new media. The opening up and diversifying of methods such as the Citizen Forum can be seen as an important development in South Korea to widen the perspectives of parliamentary advice.

We also find a clear location of parliamentary TA within the political system in *Chile* (cf. Weidenslaufer and Roberts, in this volume). The Parliamentary Technical Advisory Service (*Asesoría Técnica Parlamentaria*, ATP-BCN) was created in 2007, and is made up of forty researchers and advisors from various fields. They support legislative committees on a permanent basis and provide assessment of comparative law, comparisons of public policies, and assessments of technical aspects subject to regulation and their societal relevance. As described in the Country Report, in Chile, there is a renewed interest toward science in the public debate (e.g., due to COVID-19). In turn, ATP-BCN has established networks and protocols with scientific experts and parliamentary decision-makers. In 2020, a new task force was created to promote TA methodologies and products among ATP-BCN researchers and advisors ("Scientific Legislative Advisory", ACL), showing an increase in TA as a scientific activity.

In *Poland* (cf. Soler et al., in this volume), the Bureau of Research of the Polish Parliament (*Biuro Analiz Sejmowych*, BAS) was established in 1991, and is the leading national institution specializing in legislative aspects of TA. The Polish Association for Technology Assessment (PTOT) works on the development of new TA concepts and the improvement of research methods and tools. The various activities of TA, mainly in academic fields, are brought together through PTOT.

Besides this clear location within the parliamentary system, there are TA (-like) activities in agencies and think tanks with close proximity to ministries and government. In *India* (cf. Srinivas, in this volume), the Technology Information, Forecasting and Assessment Council (TIFAC) is an organization under the Department of Science & Technology. It has developed the "Technology Vision 2035" (a strategy paper describing S&T focus areas) and has supported innovation-related programs dealing with intellectual property rights, technology development, and commercialization. Yet overall, according to the Country Report, activities in India cannot necessarily be classified as "Technology Assessment". "Technology evaluation", "impact assessment", and "techno-economic study/assessment" are some of the terms used in various documents and in the mandates of various institutions and programs. The government has supported Health Technology Assessment (HTA), but in general, there is a lack of a specific agency to coordinate, standardize methods and help with capacity building efforts.

Monteiro and Matenhauer Urbinatti describe an overall crisis in the positioning of science and technology within society in *Brazil* (cf. this volume), which in turn has effects on the opportunities for TA activities. The Country Report mainly describes HTA activities, which are a specific form of assessment focused on health products, clinical aspects, and cost-benefit analyses of drugs or health applications, and as such represent a very different community than TA. The current situation with COVID-19 vaccines is an example of HTA which shows challenges. Chinese Coronavac vaccine has become an issue of dispute between the Federal Government and the State Government of São Paulo. This argument has centered around issues of the origin of the vaccine, its efficacy, and conspiracy theories, anti-vaccine movements, and misinformation. The Russian vaccine Sputnik V was also controversial in Brazil regarding the regulatory process, and featured in political disputes between government agencies. This focus on HTA activities also indicates a more restricted understanding of TA and the activities taking place. Overall, in Brazil, interrelated developments have had severe effects, also regarding TA (-like) activities. Large budget cuts to research and an increase in denialism and critique of scientific expertise have led to a division of science and society, while calls for opening up science and technology policy aim to increase legitimacy. The analysis by our Brazilian experts shows how hugely problematic it is to establish TA-like activities in Brazil, due to highly contested socio-political disputes.

Science

Another important area for TA (-like) activities across the 12 countries is science and research in the respective institutional settings. It seems that this is the main area of interest for emerging TA activities, where these are not institutionalized (yet).

Academia can be a key player when initiating TA activities in countries without established (parliamentary) forms of TA. Within several Country Reports, we find activities which are relevant for TA in academic education and in network building and research.

According to the *Russia* Country Report (cf. Kazakova and Gavrilina, in this volume), TA initiatives can be found in the largest technical universities, such as the Bauman University (BMSTU) in Moscow. Here, TA education is integrated into the pilot master program, "Social Analysis of Technological Innovations and Risks", which aims to provide practice-oriented training and knowledge on sociotechnical processes. Also, courses on sociology of technology or engineering ethics are implemented into the engineering curriculum. BMSTU and the technical universities of Moscow, Saint Petersburg, Tomsk, and Perm have initiated the "TA and STS in Russia Association", which brings together institutions, enterprises, and government analytical centers. Overall, a main challenge for TA in Russia is a missing balance between the development of economies and technology across the Russian regions. This raises issues of lack of access to basic infrastructure and information on environmental effects. Further, the cultural and ethnic diversity of the country is a challenge regarding the understanding of public perceptions of technologies. A lack of transparency regarding decision-making in the technical processes creates uneven distribution of knowledge and responsibilities in society. This requires comparative and contextualized views of technologies and their potential benefits and risks.

In the Country Report from *Czechia* (cf. Soler et al., in this volume), we learn that there are no real established TA institutions, but that research activities are of importance, especially in European TA-related projects. The Technology Centre of the Czech Academy of Science (TC CAS) has been involved in several European projects, which in turn have changed public and policy-makers' views due to more representation of TA, and public engagement in S&T or research and development policy strategies. Similarly, in *Slovakia* (cf. Soler et al., in this volume), there is no clear TA institution, yet the Slovak Academy of Sciences (SAV) can be considered as an aspiring TA institution. Past TA activities on nuclear energy and human enhancement technologies were conducted by SAV, which lacks resources and capacities, yet is advocating for TA in the country. In general, in the three described Central European countries (Poland, Czechia, and Slovakia), there are institutions that conduct TA-like activities, but these remain mainly uncoordinated.

Another area of relevance to TA is RRI activities, which can be found as part of funding programs in research organizations, or as governance frameworks. For example, the Chinese Academy of Science and Technology for Development (CASTED) participated in the Horizon 2020 European research project "Responsible Research & Innovation in practice"[2] and introduced RRI as a governance research concept to case studies in *China* (cf. Huang, in this volume). Overall, TA, RRI, and sustainable development have been included in research, especially regarding areas such as research ethics, open science, artificial intelligence (AI), or the digital economy. According to the China Country Report, the fast development of S&T in

[2] www.rri-practice.eu.

China has put issues of research ethics and integrity at the center of attention for many stakeholders, such as scientists, businesses, the government, and the wider public. Therefore, approaches such as RRI or TA, as well as Open Science, are regarded as useful tools for researchers and policy-makers in China.

According to the *Australia* Country Report (cf. Lacey and Fielke, in this volume), Responsible Innovation (RI) is also an important approach. The country's national science agency, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), has adopted RI as one of its future science platforms, which represent new research programs and funding. This was based on previous work on R(R)I in European contexts and projects, and has developed a ten-year impact pathway for delivering RI for Australian S&T development. Applied research capacities in RI and its application are advancing, yet the outcomes of applying RI approaches especially through "blue sky" research investments are still open. Its seems that bringing together findings from a wide array of projects to better understand what has worked and what can be taken up by different stakeholders remains a challenge.

Public

The localization of TA in a more public sphere can be found in several of the 12 countries in the form of participatory activities, and wider networks that include different TA-like or adjacent institutions. In *South Korea* (cf. Choi, in this volume), participatory elements are included in parliamentary TA processes. A Citizen Forum is implemented to discuss the impacts of technologies and provide recommendations. Before finalizing TA reports, the Korea Institute of Science and Technology Evaluation and Planning (KISTEP) holds an open forum, during which the results, and TA in general, are communicated.

In *South Africa* (cf. Mugabe, in this volume), both expert-led more top-down activities as well as multi-stakeholder participatory biotechnology assessment can be observed. The South African Agency of Science and Technology Advancement (SAASTA) launched a program in 2003 named South Africa's Public Understanding of Biotechnology (PUB), which aimed to increase public awareness and understanding, and promote public dialogue on the socio-economic and environmental impacts. Overall, TA seems to be in its early beginnings in Africa, but according to the South Africa Country Report there is a demand to include it in STI policy processes. It seems that in African countries there is an increasing body of scientific knowledge and technological innovation, which in turn shows the need for TA. To improve awareness, capacity building, and sharing of information and experiences, it is necessary to establish an African TA network, strengthen institutional coordination, and improve policy frameworks.

Participatory and network activities can both be found in the *USA* (cf. Guston, in this volume). For instance, Expert and Citizen Assessment of Science and Technology (ECAST) is an initiative which aims to revive more participatory forms of TA. Further, an emerging field of "Public Interest Technology" can be observed, which sees TA as an important part of its potential contributions. The Public Interest Technology University Network plays an important role here, with more than 40 members, and small grants that support TA-like projects.

As observed in the *Australia* Country Report (cf. Lacey and Fielke, in this volume), we also find participatory activities within the framework of RI, which are aimed at risk/benefit assessment as well as the uncertainties of S&T in light of advancements for society. For instance, there has been research to combine Indigenous Knowledge and AI for the improvement of environmental management in Northern Australia, which shows a specific example of participation and TA at a regional and community level.

3 Reflections

Reviewing the country-specific descriptions of TA activities across the globe illustrates the high heterogeneity of socio-political systems, modes of institutionalization of TA, and TA practices in the 12 countries discussed. Overall, it appears as if approaches aiming at the "public" are more dispersed and fluid and less institutionalized when compared to TA manifestations in "science" and "politics". In an attempt to further identify similarities, differences and patterns between TA institutionalization across the analyzed country cases, we first look at the topical substance and the intended impact of TA and TA-like activities. Subsequently, a more bird's eye perspective is taken on the broader structural conditions within which TA institutionalizes and is performed.

In all 12 Country Reports, the TA core is clearly visible: researchers in different settings are addressing the potentials and risks of emerging technologies, exploring ways to perform RRI, analyzing issues of trust and acceptance by the public and different stakeholders, investigating science and technology governance, etc. Another communality lies in the technologies with which the socio-political systems are confronted, whether this is AI, digitalization, health, or biotechnologies. In all 12 Country Reports, we find descriptions of challenges associated with sociotechnical issues and different ways and levels of approaching them.

In terms of the mission of TA activities and their intended impact, it is interesting to see that a main focus of TA activities, both in Europe and globally, seems to lie on impacts. These include a) improving knowledge about the technological or scientific aspects of the subject in focus, b) forming attitudes and opinions with respect to agenda-setting in research or politics, or c) with respect to self-reflection and bridge building between different stakeholders. This becomes apparent when applying the typology of impacts developed in the TAMI project (Decker & Ladikas, 2004). In this chapter, three impact dimensions have been cross-tabulated with three issue dimensions of TA (Hennen et al., 2004, 63). The TAMI impacts can also be understood as intended impacts, or the mission of TA activities and institutions. The impact dimensions include raising knowledge (through scientific assessment, social mapping, and policy analysis), forming attitudes and opinions of actors (through agenda-setting, mediation, and re-structuring the policy debate), and initializing actions (through reframing debates, new decision-making processes, and decisions taken); the issue dimensions include technological and scientific, societal, and policy aspects. Table 1

Table 1 Types of impact of TA in 12 different countries

Issue/impact dimension	Raising knowledge	Forming attitudes/opinions	Initialising actions
Technological-scientific aspects	Chile (TA office) South Korea (TA office) India (HTA) Poland (TA office) Czechia (TA institution) Slovakia (TA institution) USA (TA office) South Africa (Academia)	Australia (RI program) China (RI orientation) Czechia (TA institution) Slovakia (TA institution) South Africa (Academia)	Australia (RI program)
Societal aspects	South Korea (TA office) Australia (RI program) India (TA agencies) South Africa (Academia)	Russia (TA education) Poland (TA office) Czechia (TA institution) Slovakia (TA institution) USA (TA network)	
Policy aspects	Chile (TA office) South Korea (TA office)	Chile (TA office)	

shows the classification of the country-specific TA activities into the resulting TAMI table. As is the case for the European TA landscape (Decker & Ladikas, 2004), most TA activities seem to address the upper left area of the TAMI table. This is not surprising, since raising knowledge and forming attitudes/opinions represent the key impact dimensions of both classical and participatory TA (Hennen et al., 2004).

In sum, the great heterogeneity of different country-specific settings in which TA takes place and is performed globally, cannot hide the fact that on a substantive and methodological level TA faces similar challenges.

The Country Reports also briefly describe the individual country backgrounds and political settings, which in turn are relevant for TA activities. This can be understood as the "habitat" in which TA takes place (Hennen & Nierling, 2015), which is structured by aspects such as the political system, S&T decision-making systems, socio-economic development stage or values (Hahn & Ladikas, 2019). Drawing conclusions from the comparative analysis of the cases has to be done with caution due to both the limited number of cases analyzed and the information provided in the Country Reports, as these are only a brief highlight of TA relevant activities and structures. However, while taking this limitation into account, a closer look allows us to point to a number of noteworthy observations and preliminary insights with regard to the relationship between TA manifestations and the broader institutional and structural contexts.

Table 2 Liberal democracy score of 12 selected country cases

Score on V-Dem liberal democracy index	Country
Top 50% countries	
Top 20%	Australia, Czechia, Slovakia, Chile, South Korea, and USA
Top 30–50%	Brazil, Poland, and South Africa
Bottom 50% countries	
Bottom 40–50%	India
Bottom 10–20%	China and Russia

Source Based on V-Dem liberal democracy index 2021 (Boese et al., 2022; pp. 10–11)

The following interrelated factors have been identified that begin to explain similarities and differences between TA manifestations between the 12 countries:

- The key characteristics of the polity, including the degree and quality of democratic decision-making and basic structural features;
- The types and intensities of political conflicts about scientific-technological issues, including the role of science in society and in policy-related decision-making;
- The developmental levels of and opportunity structures for science, technology, and innovation in the respective political economies and the socio-economic make-up of the countries, including the steering capacities of the state with regard to techno-scientific developments and innovation.

With regard to the characteristics of the polity, the question of the democratic quality of the political system and the rule of law seems to be a potentially useful predictor of the degree of TA institutionalization, understood as the existence of fairly stable and formalized organizational structures and procedures within which TA is conducted. If the liberal democracy index of the V-Dem Institute is applied (Boese et al., 2022),[3] our 12 selected countries cover nearly the whole spectrum of the index score: six countries are among the top 20%, three are in the top 30–50%, one is in the bottom 40–50%, and another two are located in the bottom 10–20% (see Table 2).

While any correlation between TA manifestations and scoring on the liberal democracy index should be treated with caution, we can observe that low scores on the index correlate with low degrees of TA institutionalization, as is the case for India, China, and Russia. However, the opposite relationship is not supported by our selected cases: a high rating on the liberal democracy index is not uniformly reflected by high degrees of TA institutionalization. Instead, among the top 50% of

[3] The V-Dem liberal democracy index rates over 180 countries based on 71 indicators, covering aspects such as quality of the electoral process, freedom of expression, protection of civil liberties, and checks and balances between governmental institutions (http://www.v-dem.net).

the countries included in our study, significant differences in terms of TA institutionalization are evident. While South Korea, Chile, the USA, and Poland have established specialized offices or services generating TA-related knowledge for policy, TA remains largely informal and limited to academia in other countries of this high rated group.

Another potentially useful structural factor in understanding different pathways toward TA institutionalization refers to the general structure of the polity of the democratic systems among our 12 selected cases. It can be expected that particularly presidential systems are more inclined to establish parliamentary TA offices due to the stronger separation of legislative and executive powers, thus increasing the need of the legislature to have access to its own scientific advice infrastructure. This relationship seems to be supported by the example of the USA, where the first parliamentary TA office—the OTA—was established in 1972 (but was also defunded roughly twenty years later). Other presidential systems with institutionalized TA offices or services are Chile and Poland. In South Korea's presidential system, however, the TA facilities are part of the executive branch. These observations, together with the fact that a number of parliamentary democracies have established TA offices connected to the legislature, such as Austria or Germany, indicate that macro-institutional factors of the polity are a rather weak predictor of specific country pathways toward institutionalization.

While establishing relationships between basic structural features of the polity and TA has rather limited explanatory strength, linking TA to political and societal patterns of conflict over techno-scientific issues and socio-economic conditions related to science, technology, and innovation is likely to be more promising. Although significantly more in-depth knowledge is needed to arrive at generalizable insights in this regard, the Country Reports provide valuable evidence on the interplay of these complex framework conditions on the different trajectories of TA developments. For instance, the report from Brazil can be seen as an example of the challenges in any attempt to develop TA under the rule of an outright anti-scientific federal government. In Russia, the prospects for academic freedom and thus TA are considerably worse in view of the far-reaching and recently amplified infringements of freedom of speech, civil rights, and the rule of law.

In terms of possible pathways toward the institutionalization of TA, the Country Reports provide useful insights. A first, though not overly surprising observation, is that academia seems to be the "birthplace" of TA across all 12 countries. Thus, the realm of science and research develops and provides the foundational expertise needed for further uptake and institutionalization of TA. And in those instances where TA thus far has not reached beyond the science system, academia serves as an important reservoir of expertise needed for institutionalization at later stages. Moreover, even in those countries that are unlikely to establish formal TA institutions in the near future, conducting academic TA studies and offering training can provide important contributions to TA capacity building, and sensitizing actors about critical perspectives on the complex interplay between technology and society. Second, a number of Country Reports showing currently low levels of TA institutionalization, such as Australia, China, Czechia, Slovakia, and South Africa, all stress the important

role of international exchanges with TA actors, and particularly the conduct of joint TA or RRI projects. While this observation clearly suggests maintaining and even increasing efforts for international cooperation, it also indicates a rather precarious situation for TA in these countries, as sustained funding is scarce or even non-existent. Third, in some of the countries with very low levels of TA institutionalization, specific variants of TA or neighboring approaches to assessment, such as HTA and Environmental Impact Assessment (EIA), are comparatively well-developed and highly institutionalized. This is the case, for instance, in Brazil, Australia, South Africa, and India. It remains to be seen if the existence of such related approaches might provide entry points for the institutionalization of TA at a later stage. For this to materialize, however, explicit connections to the STI policy field will have to be established. Similarly, some of the country cases report a stronger focus on RRI than conventional TA. While this might be an expression of deliberate emphasis on influencing research and innovation practices rather than generating orientation via TA-based policy advice, embedding RRI in STI policy might nonetheless help to pave the way toward TA, due to the many conceptual and epistemic commonalities between the two approaches.

The discussion of the interplay between structural context factors and TA institutionalization was a first step in improving our understanding of the different pathways toward TA. Undoubtedly, more comparative research on these issues will be required in order to provide answers on conducive and hindering factors of TA institutionalization across the globe. The emerging globalTA network could provide valuable contributions in such a collective research process.

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