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Deutsches Institut für
Entwicklungspolitik



German Development
Institute



Institute for
Technology Assessment
and Systems Analysis



Assessing new technologies for sustainable development

A step-by-step approach to Technology Assessment (TA) in the context of developing countries

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Some conceptual clarifications



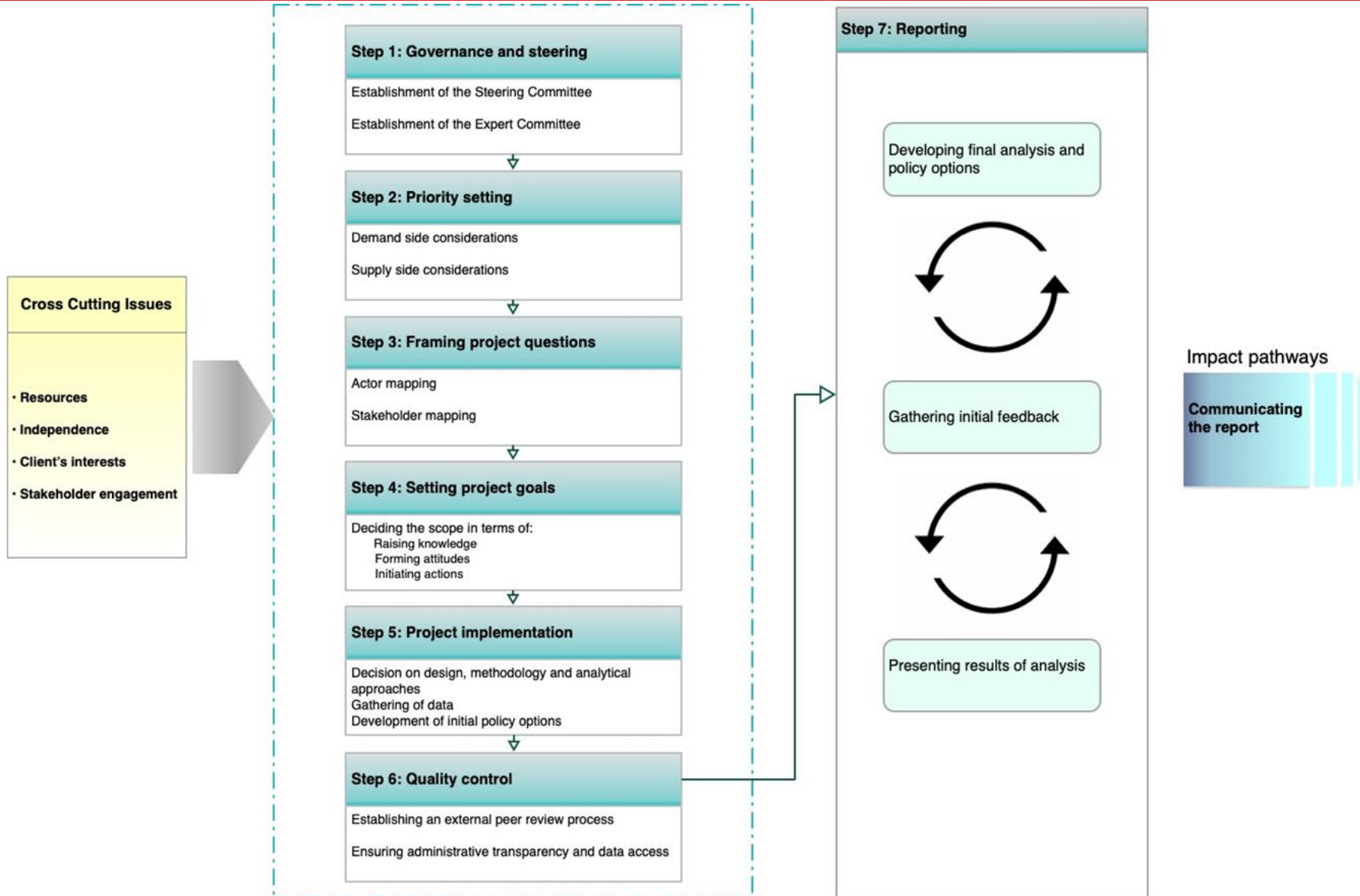
- **Technology Assessment (TA)** *is a scientific, interactive and communicative process which aims to contribute to the formation of public and political opinion on societal aspects of science and technology.” It is a form of policy research that examines short- and long-term consequences (for example, societal, economic, ethical, legal) of the application of technology”.* Impacts of TA are expected to be threefold: raising knowledge and forming opinion among policy makers and initializing actions by them.
- **Technology forecasting** can be seen as attempting to predict the future characteristics of useful technological machines, procedures or techniques. Its aim is mainly to inform decision makers at the level of companies and other organizations, thus, not concentrating on the broader societal effects of technological advancements and innovation.
- **Technology Foresight** combines creative thinking, expert views and alternative scenarios to make a contribution to strategic planning. It looks into the longer-term future of science technology and innovation (STI) in order to make better-informed policy decisions. Thus, Foresight is a long-term strategic, not an assessment tool.
- **Technology Needs Assessment (TNA)** originates in the process UNFCCC in 2001. TNAs are a set of country-driven activities that identify the climate change mitigation and adaptation technology priorities of partner countries, and work towards producing a pipeline of investment projects.
- **Responsible research and innovation (RRI)** is an approach that anticipates and assesses potential implications and societal expectations with regard to research and innovation, with the aim to foster the design of inclusive and sustainable research and innovation.

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TA – Step by step: Overview





Step 1: Governance and steering of the TA process

“As a first step, two bodies are created: The Steering Committee (SC) which oversees the process and is entitled to take discussions. An Expert Group (EG) advises the SC by providing timely and high-quality information and knowledge. Both bodies together assure an effective and efficient governance of the TA Process.”

➤ **Steering Committee (SC)**

- The SC should consist of representatives from the sponsor of the project (e.g. relevant line ministry or Prime Minister’s Office) along with independent, external TA experts, to take decisions, deal with administrative issues and ensure a smooth and timely process.
- Adequate representation of women in the SC should be assured.
- One member could be responsible for ensuring that the interests of women, girls and possibly other groups are adequately taken into account.

➤ **Expert Group (EG)**

- The EG would be an interdisciplinary team of knowledgeable experts, who will prepare and accompany the analytical process. It is important to assure, as far as possible, a variety of perspectives and avoid a narrow approach to evidence-seeking.
 - University and non-university researchers, active and retired
 - Members of the knowledge diaspora
 - Private sector experts
 - Non-national International researchers with long-standing cooperation relations
 - Experts from international agencies
 - Experts from other countries facing similar challenges



Step 2: Priority Setting

“TA ties up considerable human and financial resources. Thus, decisions are taken by the SC with advice by the EG about which technologies will be in the focus of the TA process. These decisions can be based on demand-side or supply-side considerations.”

➤ **Demand-side decision making**

- Which social, economic or environmental challenges call for technological solutions?
- These challenges are often written down in national or sector development plans (poverty reduction, food security, rural development, electrification)
- Nationally Determined Contributions (NDCs) – Outcomes of TNA processes (>60 developing countries)
- Rapid changes (global warming, digitalization, *COVID-19 pandemic*) might call for an update of development priorities

➤ **Supply-side considerations)**

- Which technologies / innovations are emerging in other parts of the world, which may affect, positively or negatively, the efforts of the respective country to achieve the SDGs?
 - Disruptive innovations may provide completely new opportunities to satisfy given societal needs, either because solutions become technically feasible or because of radical cost reductions.
 - They may also challenge given development patterns.
 - They are often not introduced in a planned way in the national context, but are brought into the country, for example, through FDI or integration into global value chains.
 - Knowing these developments early on helps to take flanking measures



TECHNOLOGY READINESS LEVEL (TRL)

RESEARCH	9	ACTUAL SYSTEM PROVEN IN OPERATIONAL ENVIRONMENT
	8	SYSTEM COMPLETE AND QUALIFIED
	7	SYSTEM PROTOTYPE DEMONSTRATION IN OPERATIONAL ENVIRONMENT
DEVELOPMENT	6	TECHNOLOGY DEMONSTRATED IN RELEVANT ENVIRONMENT
	5	TECHNOLOGY VALIDATED IN RELEVANT ENVIRONMENT
	4	TECHNOLOGY VALIDATED IN LAB
	3	EXPERIMENTAL PROOF OF CONCEPT
DEVELOPMENT	2	TECHNOLOGY CONCEPT FORMULATED
	1	BASIC PRINCIPLES OBSERVED



Step 3: Framing the TA questions based on a mapping exercise

“Once the priorities are defined, the context will be assessed, in which the technology develops in the national context. Actor and stakeholder mapping will lead to in-depth knowledge about the individuals and organizations which will have to be involved in the subsequent phases of the project. Knowledge is gathered which allows taking informed decisions about the project design and avoid irrelevant analyses or employ ineffective methods. The role of national innovation system will also be analyzed.”

➤ **Mapping of...**

- *actors* directly involved in the development, regulation and governance of a specific technology: ministries and state agencies, universities and research centres, international cooperation agencies.
- *stakeholders*, who are affected by the implementation of a new technology or lobby for common goods, e.g. business groups (producers, processors, traders, exporters), trade unions, farmers' organisation (in the case of agricultural technologies), etc. Also consumer protection organizations might be relevant in certain technology fields.

➤ **Analysis of...**

- discourses and debates around the focus technologies within the society. It is important to understand, at an early stage, which main arguments and which conflicts of interests and opinions have been formulated and whether consensus or agreements are possible and in which topics. Sometimes there is the need to draw on analogies, e.g. previous discourses and debates about innovations in a specific sector.



Step 4: Setting realistic project goals

“TA can pursue various goals and in step 4 the concrete goals are defined. The three pillars of this step are “Raising Knowledge”, “Forming Attitudes” and “Initializing Action”. The relative weight of the three goals and how they will be combined is decided by the SC, with advice from the EG.”

Pillar 1: Raising Knowledge: Knowledge gaps about new technologies and their risks and potentials will usually be more significant in developing countries, compared to developed countries with well-developed NIS. The term may refer to the scientific/technological, the social or the policy dimensions of the technology in question. Such gaps can be filled through analysis of scientific knowledge on paths of technology development, risks, chances, and unintended consequences (risk assessment), analysis of interests or perspectives of relevant actors (social mapping) and analysis of policy making options (policy analysis).

Pillar 2: Forming Attitudes or Opinions: TA goes beyond scientific assessment to fill knowledge gaps but aims at also transforming attitudes and opinions. Contributes to agenda setting, mediation or conflict resolution, restructuring the policy debate.

Pillar 3: Initializing Action: “Initializing Actions” reflects the most tangible goal and impact perspective in TA. It describes the means by which the TA process influences the outcome of the policy making process.



Roles of TA:

ISSUE DIMENSION	IMPACT DIMENSION		
	I. RAISING KNOWLEDGE	II. FORMING ATTITUDES / OPINIONS	III. INITIALISING ACTIONS
TECH-NOLOGICAL SCIENTIFIC ASPECTS	SCIENTIFIC ASSESSMENT <ul style="list-style-type: none">▪ Technical options assessed & made visible▪ Comprehensive overview on consequences given	AGENDA SETTING <ul style="list-style-type: none">▪ Setting the agenda in the political debate▪ Stimulating public debate▪ Introducing visions or scenarios	REFRAMING OF DEBATE <ul style="list-style-type: none">▪ New action plan or initiative to further scrutinise the problem decided▪ New orientation in policies established
SOCIETAL ASPECTS	SOCIAL MAPPING <ul style="list-style-type: none">▪ Structure of conflicts made transparent	MEDIATION <ul style="list-style-type: none">▪ Self-reflecting among actors▪ Blockade running▪ Bridge building	NEW DECISION MAKING PROCESSES <ul style="list-style-type: none">▪ New ways of governance introduced▪ Initiative to intensify public debate taken
POLICY ASPECTS	POLICY ANALYSIS <ul style="list-style-type: none">▪ Policy objectives explored▪ Existing policies assessed	RE-STRUCTURING THE POLICY DEBATE <ul style="list-style-type: none">▪ Comprehensiveness in policies increased▪ Policies evaluated through debate▪ Democratic legitimisation perceived	DECISION TAKEN <ul style="list-style-type: none">▪ Policy alternatives filtered▪ Innovations implemented▪ New legislation is passed



Step 5: Project implementation

“Step 5 is the core element of the TA process and the most significant in terms of time and resources. Two are the sub-steps: *First*, gathering and synthesizing evidence. *Second*: Stakeholder involvement based on interactive methods, to ensure wide participation.”

➤ **Gathering and synthesizing evidence...**

- Interdisciplinary evaluation of core scientific and technical literature;
- drawing on international knowledge and experience and embedding it into the specific social, political, economic and environmental conditions of the country;
- Variety of proven methods (interviews, surveys, focus groups, Delphi surveys, scenarios)

➤ **Stakeholder involvement ...**

- Interactive methods involve exchanges between stakeholders in a structured setting. The type and number of stakeholders that are invited is of outmost importance in the choice of the method, e.g.
 - Citizens' dialogue (large scale, highly structure debate with lay persons to identify future STI challenges and policy agendas);
 - Citizens' jury (panel of lay persons that hear expert arguments and judge technology qualities
 - STI café (informal, non-academic setting to discuss the merits of particular developments);
 - Future workshops (participation of local people, designed to deal with local challenges and solutions);
 - Fishbowl planning



Step 6: Quality control

“Quality control should be part of every single step in the TA process. Still a Step 6 is recommended to systematically check the scientific and the process quality. **The scientific quality of the process is verified following procedures close to what peer-reviewing is in academic research, but has to be trans-disciplinary due to the very character of the TA process. Process quality must ensure the achievement of its main goals from every stakeholder’s perspective.**

➤ **Scientific quality...**

- similar to the standard academic review process; but
- TA is an interdisciplinary process, any review arrangement must take this into consideration in its design.

➤ **Process quality...**

- the TA process must ensure the achievement of its main goals from every stakeholder’s perspective. It should not only be based on solid evidence but it must also be transparent, balanced and fair in its practice



Step 7: Reporting

“The TA report is important to inform policy makers and implementing agencies about the process, the outcomes and the recommendations of the TA process. In addition, it assures core information is safeguarded and stored for the future. It should include the rationale for decisions taken by the SC, e.g. the priorities set in Step 2. The main findings that led to the policy recommendations and the recommendations themselves are also part of the report.”

For a country which has not a long experience in TA, the reports should be shorter and summarize the core information necessary for an informed decision making. It has to include the rationale behind the priority setting (step 2) and the main findings that led to the policy recommendations. It should be drafted by the EG, which might wish to elect one or two key authors representing two different disciplines (e.g. biotechnology and economy), who prepare the first draft versions. These will be reviewed by the whole EG and the submitted to the SC for their approval.



After Reporting: impact assessment

“ Once the TA report is submitted to the policy making community, its handling and ultimately its impact, will depend on a number of factors, such: institutional location of TA, regulatory needs, technology trajectory, etc. ”

Impact assessment can include:

- Direct client feedback
- Analysis of policy debates
- Analysis of media coverage
- Analysis of academic literature



Thanks for your attention !

