United Nations
Framework Convention on
Climate Change

TECHNOLOGY
EXECUTIVE
COMMITTEE

BUILDING CAPACITIES IN CLIMATE TECHNOLOGIES

Understanding gaps, needs, challenges and enabling measures to promote endogenous capacities and technologies

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LIST OF ACRONYMS

CMA	Conference of the Parties serving as the meeting of the Parties to the Paris Agreement
COP	Conference of the Parties
CTCN	Climate Technology Centre and Network
NDC	nationally determined contribution
NDE	national designated entity
PCCB	Paris Committee on Capacity-building
TEC	Technology Executive Committee
TNA	technology needs assessment
TT:CLEAR	technology information clearing house

EXECUTIVE SUMMARY

In response to the guidance of the COP and the CMA, the TEC has been working to develop and enhance countries' endogenous capacities and technologies.

Building on previous work to promote a shared understanding of the concept of endogenous capacities and technologies, the TEC conducted surveys in 2020–2021 to ascertain stakeholders' perceptions of needs, gaps, challenges, enabling environments and measures to promote endogenous capacities and technologies. The three stakeholder groups targeted were national authorities working on climate technologies; members and observers of the TEC, the CTCN and the PCCB; and practitioners with experience working on projects involving climate-related technologies.

This report presents the findings from these surveys. In addition to presenting results related to needs, gaps, enablers, challenges and measures to promote endogenous capacities and technologies, the report also discusses cross-cutting issues such as research and innovation systems, stakeholder engagement, financial and economic issues, gender, local communities and indigenous people, collaboration, governance and legal and regulatory frameworks. It also compares these findings with other relevant work, such as the work of the TEC on enablers and challenges, as well as collaborative research, development and demonstration, and the work of the PCCB on needs and gaps.

To date, the work of the TEC on endogenous capacities and technologies has underlined the complexity of the issues involved, including with regard to ensuring a shared understanding of the concept of endogenous capacities and technologies, dealing with differences in countries' capacities to develop and use climate technologies for mitigation, adaptation and cross-cutting purposes and addressing the need for context-specific skills and knowledge. A wide range of strategies can be used to create enabling environments for enhancing countries' capacities to develop endogenous technologies, with strategies relating to collaboration, financing and building technical skills perceived as some of the most significant factors. Further, the work has also revealed that engagement by multiple stakeholders is crucial to building endogenous capacities.

Parties and stakeholders may wish to take into account the conclusions and recommendations arising from this report when considering countries' needs in relation to building endogenous capacities and technologies. Likewise, the report may be useful for informing the work of other constituted bodies and processes under the UNFCCC on matters relating to capacity-building, local communities and indigenous people, gender, finance and national reporting.

While the work of the TEC to date has improved the understanding of many aspects of endogenous capacities and technologies, other questions remain. The TEC looks forward to working with the CTCN and other UNFCCC bodies, Parties and stakeholders to conduct further work on this topic.

1. INTRODUCTION

1.1 Background mandates

In decision 1/CP.21 on the adoption of the Paris Agreement, Parties agreed to strengthen the Technology Mechanism and requested the TEC and the CTCN, in supporting the implementation of the Agreement, to undertake further work relating to, inter alia:

The development and enhancement of **endogenous capacities and technologies** (para. 66 (b))

Article 10, paragraph 4, of the Paris Agreement established a technology framework to guide the work of the Technology Mechanism in promoting and facilitating enhanced action on technology development and transfer in order to support the implementation of the Agreement.

The technology framework was elaborated on and adopted in the annex to decision 15/CMA.1 as part of a package of decisions to operationalize provisions of the Paris Agreement. The technology framework consists of five thematic areas: innovation, implementation, enabling environments and capacity-building, collaboration and stakeholder engagement, and support.

The aim of actions under the thematic area of enabling environments and capacity-building is to create and enhance an enabling environment, including policy and regulatory frameworks, for technology development and transfer and to strengthen the capacity of countries to effectively address various challenges. These actions include:

Facilitating countries in enhancing an enabling environment to **promote endogenous and gender-responsive technologies** for mitigation and adaptation actions (para. 16 (c))

Catalysing the **development and enhancement of endogenous capacities** for climate-related technologies and harnessing indigenous knowledge (para. 16 (h))

1.2 Work of the Technology Executive Committee on endogenous capacities and technologies

The TEC has already undertaken work relating to developing and enhancing endogenous capacities and technologies in response to the mandate in paragraph 66 (b) of decision 1/CP.21:

(a) Preliminary study by the secretariat in 2016–2017;1[1]

(b) TEC survey of stakeholders' perspectives on the understanding of the concept of endogenous capacities and technologies in 2018;2[2]

(c) Inputs obtained from other UNFCCC constituted bodies and operating entities of the Financial Mechanism in 2018;

(d) Dialogue, in collaboration with the PCCB, to promote a shared understanding of the concept of endogenous capacities and technologies among stakeholders in 2019;[3]

(e) Key messages conveyed to COP 25 and CMA 2 on endogenous capacities and technologies, as contained in the joint annual report of the TEC and the CTCN for 2019.[4]

1 https://unfccc.int/ttclear/tec/endogenous
2 See https://unfccc.int/ttclear/endogenous/index.html and document TEC/2018/17/14.
3 See https://unfccc.int/ttclear/events/2019_event9.
4 Available at https://unfccc.int/documents/200725.

In response to the mandate in the technology framework, the TEC in its rolling workplan for 2019–2022 agreed to continue its work on the topic by identifying and analysing measures that assist countries in enhancing enabling environments to promote endogenous capacities and technologies.

1.3 Understanding the concept of endogenous capacities and technologies

In a preliminary study by the secretariat, the TEC observed a lack of common understanding among various stakeholders on what endogenous capacities and endogenous technologies are and what developing and enhancing them might mean. It also noted that the terms 'endogenous' and 'indigenous' are sometimes used interchangeably, despite their different meanings. The TEC therefore considered it important to first address this issue by identifying elements and features that could be used to describe endogenous capacities and technologies. Based on its work in 2017–2018, the TEC recommended the following understanding of endogenous capacities and technologies in the joint annual report of the TEC and the CTCN for 2019:

(a) Endogenous technologies are those that have been:

(i) Developed within the country or by a team of in-country and external people, or

(ii) Developed elsewhere but modified and adapted within the country or by a team of in country and external people to meet the country's needs and conditions;

(b) Endogenous capacities include the capacities to:

(i) Assess climate-related technology needs from the individual to the national level;

(ii) Identify appropriate technologies to assist in meeting identified needs, and;

(iii) Adapt technologies to local needs and conditions.

The TEC further elaborated on what "in country" entails: "In-country" skills, knowledge, and practices include those contributed by people from all levels of government, local communities and indigenous groups with traditional knowledge, academia and businesses.

2. SURVEYS ON ENDOGENOUS CAPACITIES AND TECHNOLOGIES

2.1 Methodology and targeted stakeholders

At TEC 20 the TEC decided to conduct surveys targeting three groups thought to be knowledgeable in order to identify needs, gaps, enabling environments, challenges and other issues relating to promoting endogenous capacities and technologies. The surveys for the three groups were similar but customized somewhat to match the presumed knowledge and experience of the different groups.

a) **Survey 1** covers issues relating to the national management of technologies and related capacity-building. Those targeted are responsible for national-level policies and programmes involving climate technologies, namely NDEs and TNA focal points.

b) **Survey 2** covers general knowledge of what is required to support issues relating to endogenous capacities and technologies. Those targeted have knowledge of technology and capacity-building issues in the context of the UNFCCC process and include current and former members of the TEC, the Advisory Board of the CTCN and the PCCB, and observers of these constituted bodies.

c) **Survey 3** focuses on what works in practice. Those targeted have first-hand knowledge of gaps, needs, enablers and challenges relating to programmes involving endogenous capacities and technologies, obtained from climate technology projects in which they or their organization have been involved. Respondents include CTCN Network members who have previously implemented technical assistance projects, partner organizations of Nairobi work programme on impacts, vulnerability and adaptation to climate change, practitioners identified by the nine constituencies in the UNFCCC process as having expertise in climate technologies, and technology stakeholders who expressed an interest in engaging in TEC work on endogenous issues during the launch of an expression of interest period in November 2019.

The SurveyMonkey platform was used to design the surveys and analyse the results. The surveys were conducted in English, contained a combination of closed-ended questions (based on rating scales) and open-ended (more qualitative) questions and took into account the fact that issues relating to needs, gaps, challenges and enabling environments may be specific to a given country or the respondent's own experience.[5] The three surveys were opened between May and August 2020.

At the end of the survey period, the responses were collected and analysed. Owing to the large volume of statistical data and detailed analysis of the results of the three surveys, this information is provided in a separate document titled "Statistical data and detailed analysis of surveys on needs, gaps, challenges, enablers and measures to develop and enhance endogenous capacities and technologies" (hereinafter referred to as the statistical data and detailed analysis document) and is available on the TEC 22 meeting page in TT:CLEAR.[6] Selected findings are elaborated on in the following sections.

2.2 Respondent characteristics

Table 1 shows the number of respondents and countries they are located, while figure 1 shows the distribution of those countries across the five regional groups recognized by the United Nations. The regions where practitioners were working mostly align with the regions where they were living.

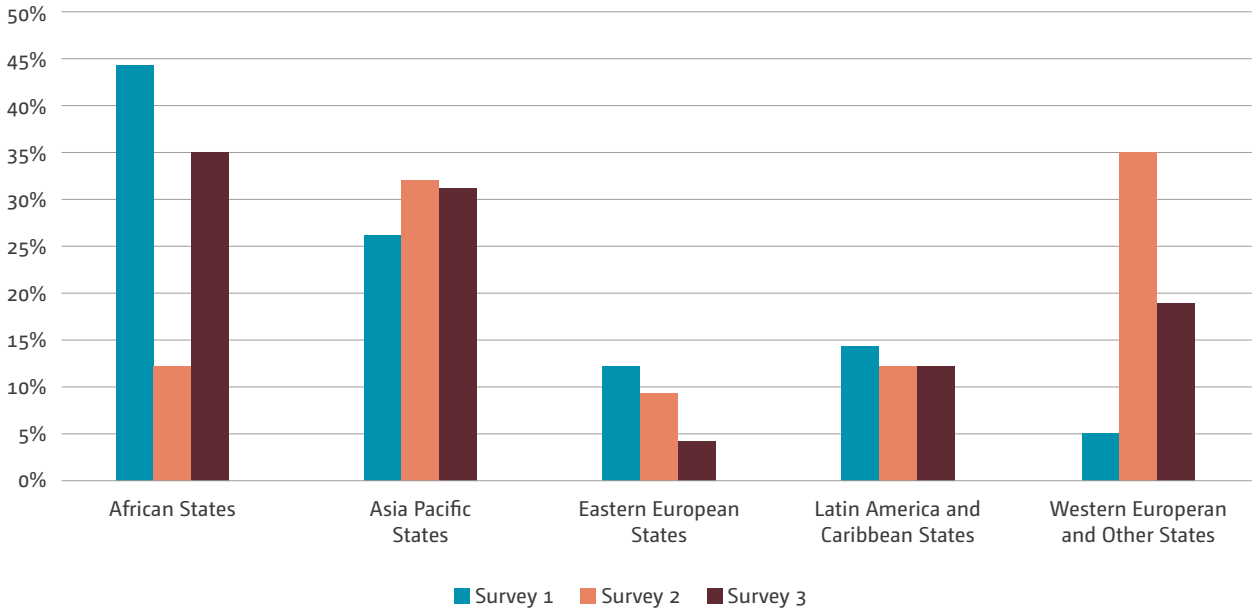
5 The questions asked in the three surveys can be viewed in document TEC/2020/21/8, available https://unfccc.int/ttclear/misc_/StaticFiles/gnwoerk_static/tn_meetings/2e8db72eaee04c928011637df1bbf62d/fe33a2c470a448dd9e23884920b6d0dc.pdf

6 The statistical and detailed analysis document can be viewed https://unfccc.int/ttclear/misc_/StaticFiles/gnwoerk_static/tn_meetings/91b9c6ccc5af4e57bb99a1dbcef0128e/fa99fe1e09054f19b9482b1bce86751a.pdf

Table 1: Number of respondents and countries locations

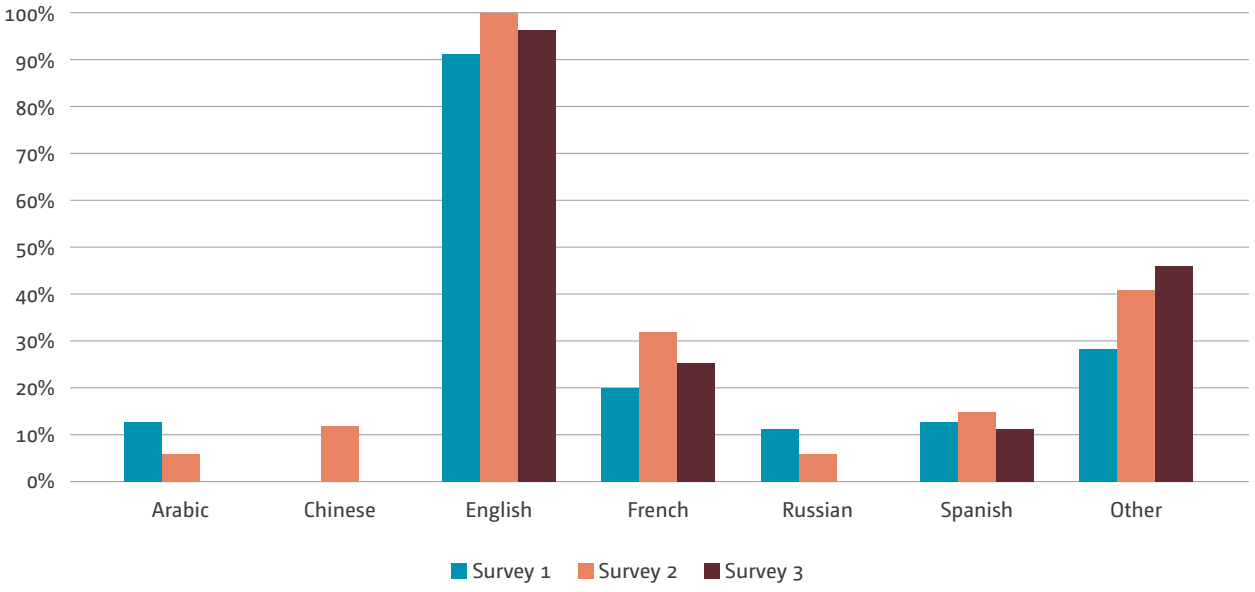
	Survey 1	Survey 2	Survey 3
Number of respondents	46	31	27
Number of countries	39	25	19

Figure 1: Distribution of countries represented across the five United Nations regional groups



With regard to the language spoken by the survey respondents, 9 out of 10 respondents reported that they speak English (see figure 2).

Figure 2: Languages spoken



With regard to the roles of the respondents, 80% of the respondents taking part in survey 1 are currently NDEs, 38% are TNA focal points, and 31% fall under both categories. For survey 2, most respondents are TEC members (39%) or TEC observers (36%), while 15% are members of the CTCN Advisory Board, 15% observers of the CTCN Advisory Board and 12% PCCB members. A total of 36% of survey 2 respondents reported that they are currently country negotiators. As for survey 3, 46% work for non-governmental organizations, 18% in academia and 11% for intergovernmental organizations.

Further information on the respondents' language preferences and primary employment can be found in the statistical data and detailed analysis document.

3. FINDINGS ON NEEDS AND GAPS RELATING TO ENDOGENOUS CAPACITIES

3.1 Current endogenous capacities and identified gaps

To identify needs and gaps, information about areas of weakness is required. The surveys asked respondents to rate (from "very weak" to "very strong") national capacities in 22 climate technology areas identified as falling under mitigation, adaptation or cross-cutting. The responses from the three surveys were fairly diverse, as shown in figures 3 on mitigation, 4 on adaptation and 5 on cross-cutting issues.

All groups reported relatively high levels of weakness in national capacities relating to climate technologies for mitigation, adaptation and cross-cutting issues, with national entities reporting the highest levels of weakness and practitioners the lowest.

Figure 3: Percentage of respondents who reported weaknesses in capacities to address mitigation issues

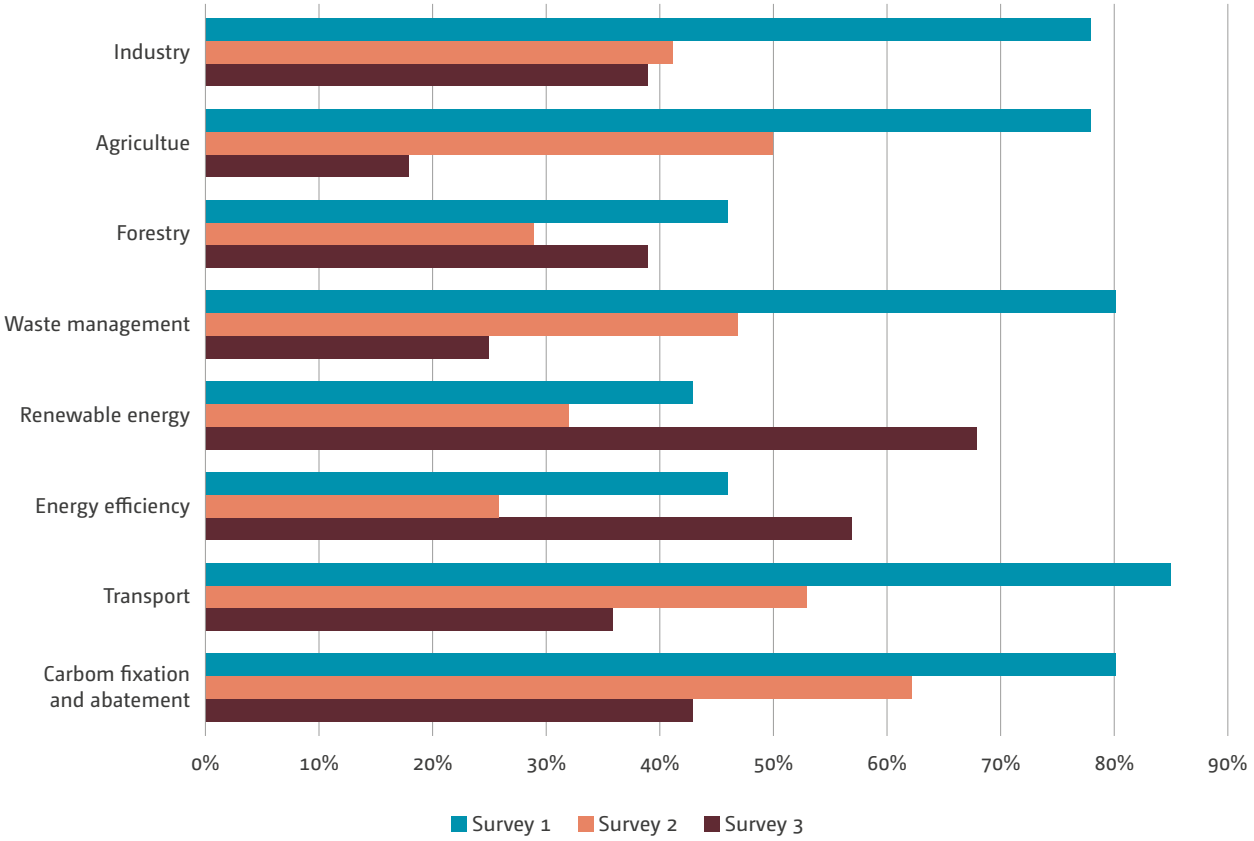


Figure 4: Percentage of respondents who reported weaknesses in capacities to address adaptation issues

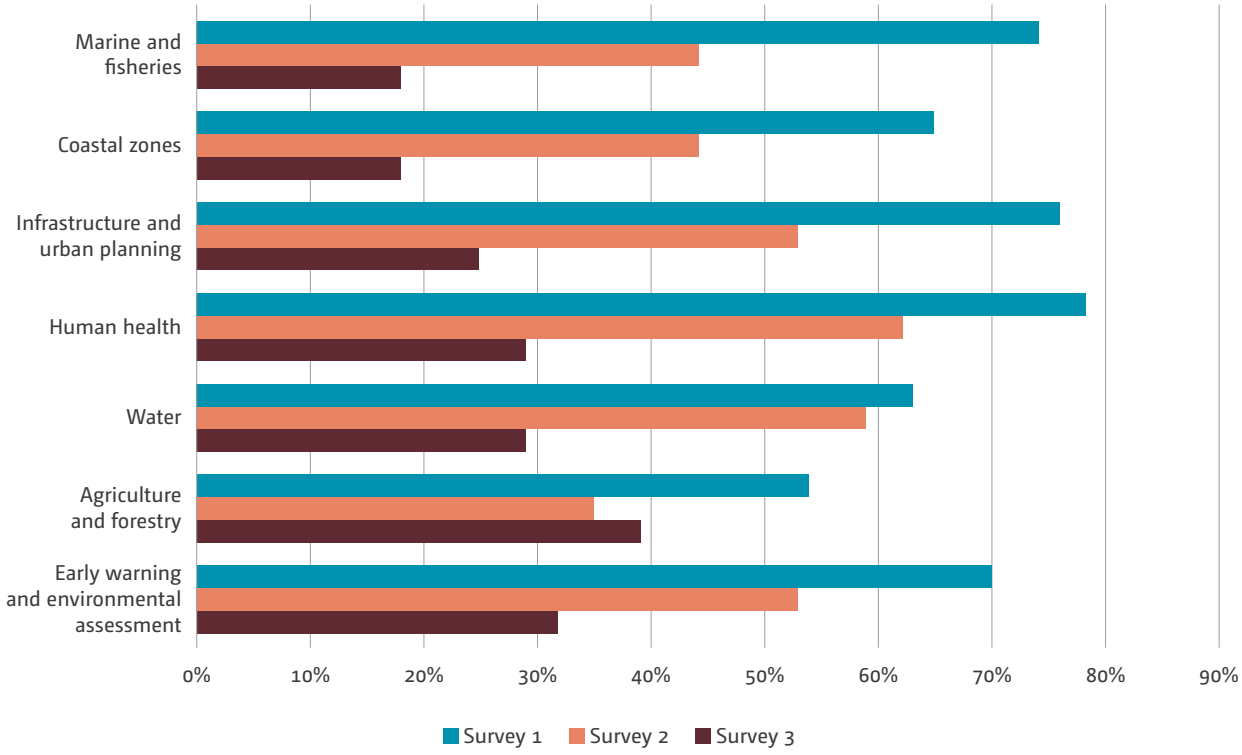
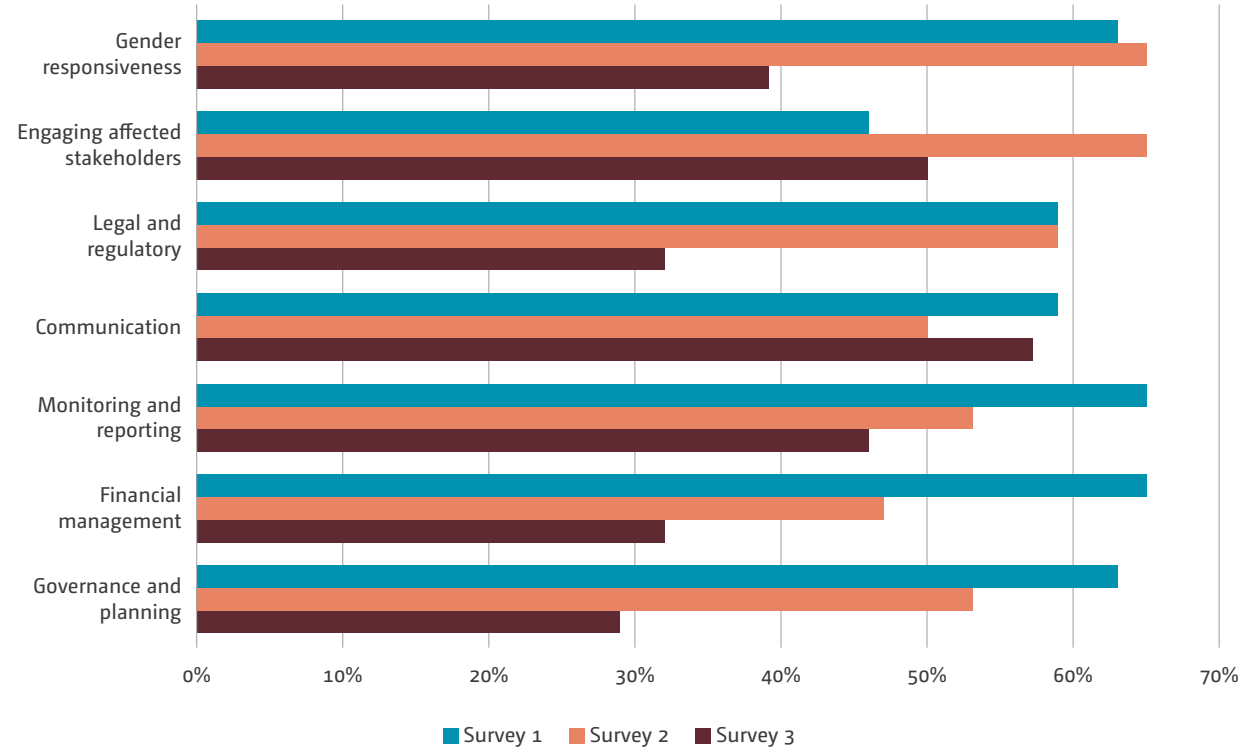


Figure 5: Percentage of respondents who reported weaknesses in capacities to address cross-cutting issues



NDE capacities: Survey 1 also asked about NDEs' individual needs to build capacities. This question was included because in previous work NDEs had indicated that they had personal capacity-building needs. The 38 NDEs and TNA focal points who responded to this question described more than 60 personal capacity-building needs ranging from adaptation, mitigation and data collection and management to monitoring and evaluation, financing, gender and support for UNFCCC negotiations.

3.2 Skill and knowledge needs

The surveys asked respondents to rate the need for 24 skills and knowledge relating to endogenous capacities and technologies, from "no need" to "very strong need". Table 2 shows the percentage of those responding to this section who chose either "Strong needs" or "Very strong needs. As with capacity needs, different groups have different views on which needs relating to skills and knowledge should be prioritized.

Table 2: Skill and knowledge needs and percentage of respondents who rated them as strong and very strong needs

Skills and knowledge	Survey 1	Survey 2	Survey 3
Assessing local community needs for climate technology	78%	62%	68%
Selecting appropriate technologies	78%	62%	68%
Importing technologies	60%	35%	18%
Installing technologies	80%	50%	61%
Maintaining technologies	82%	65%	57%
Adapting technologies to local needs and conditions	87%	71%	71%
Operating technologies safely and efficiently	76%	62%	64%
Recycling technologies at end of use	91%	79%	57%
Improving supply chains	84%	62%	54%
Making development more sustainable	87%	76%	79%
Drafting legal and regulatory approaches to technology	76%	53%	71%
Dealing with intellectual property issues	67%	44%	46%
Evaluating social/economic/environmental impacts of technologies	71%	62%	75%
Managing interdisciplinary teams	51%	56%	71%
Working with external industries and consultants	58%	35%	39%
Managing finances relating to technologies	71%	59%	50%
Encouraging development/adaptation for local needs	82%	71%	64%
Avoiding unintended consequences	56%	62%	50%
Estimating useful lives of technologies	58%	41%	46%
Engaging various stakeholders	58%	68%	46%
Utilizing local and indigenous knowledge	80%	68%	61%
Empowering social capital	73%	62%	68%
Assessing gender impacts of technologies	71%	62%	64%
Boosting national and community ownership	71%	62%	71%
Number of responses to this section	45	34	28
Range of percentages	51%–91%	35%–79%	18%–79%
Median percentage	76%	62%	64%

4. FINDINGS ON ENABLERS, CHALLENGES AND MEASURES TO ENHANCE ENDOGENOUS CAPACITIES AND PROMOTE ENDOGENOUS TECHNOLOGIES

Promoting the endogenous development of new technologies and the adaptation of existing technologies requires enabling environments and the ability to deal with challenges facing such work. The three surveys included questions designed to assess the importance of various enabling factors and identify significant challenges. Previous work of the TEC has found that similar factors are sometimes cited as both enablers and challenges. To facilitate comparisons, responses to the open-ended question about challenges were classified under the same categories as those used for questions about enabling environments. The surveys also contained questions about measures – more specific than enabling strategies – to determine whether developing new climate technologies and adapting existing technologies might require different types of measures.

4.1 Enabling strategies

Respondents were asked to rate 17 enabling factors from "does not enable" to "enables significantly" (closed-ended question). Figures 6–9 show the percentage of respondents who indicated that a factor is "Enables moderately" or "Enables significantly", broadly grouped in four enabling strategies: collaboration, communication, information; financial and economic issues; education and human resources; and governance, institutions and legal and regulatory structures. Findings on specific issues are discussed in the section on cross-cutting issues below.

Figure 6: Percentage of respondents indicating that collaboration, communication and information factors are moderately or significantly enabling

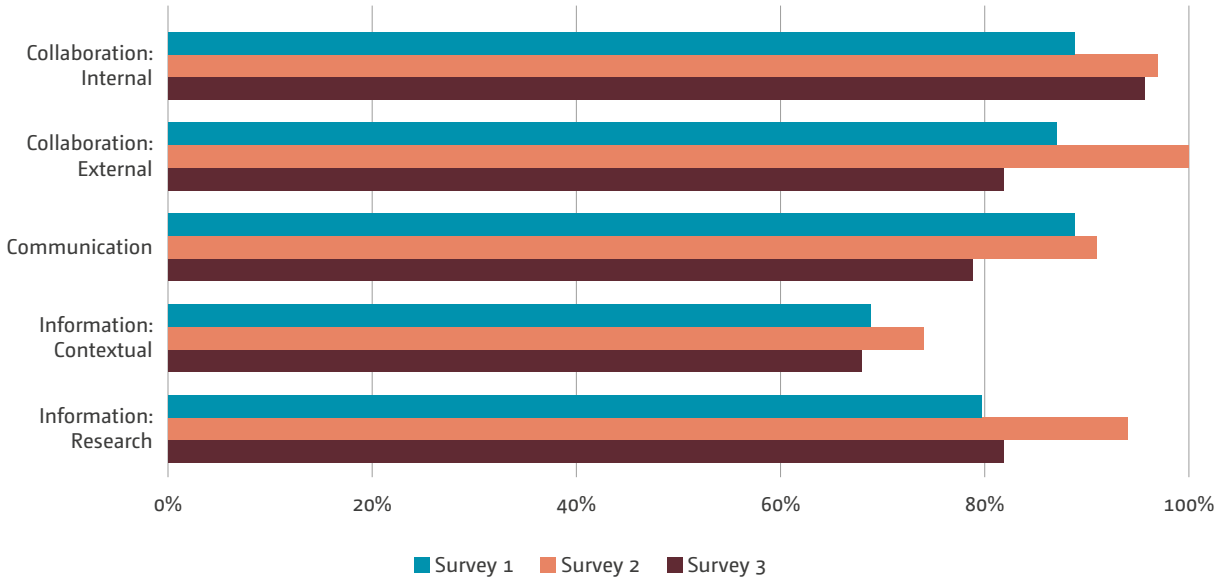


Figure 7: Percentage of respondents indicating that factors relating to financial and economic issues are moderately or significantly enabling

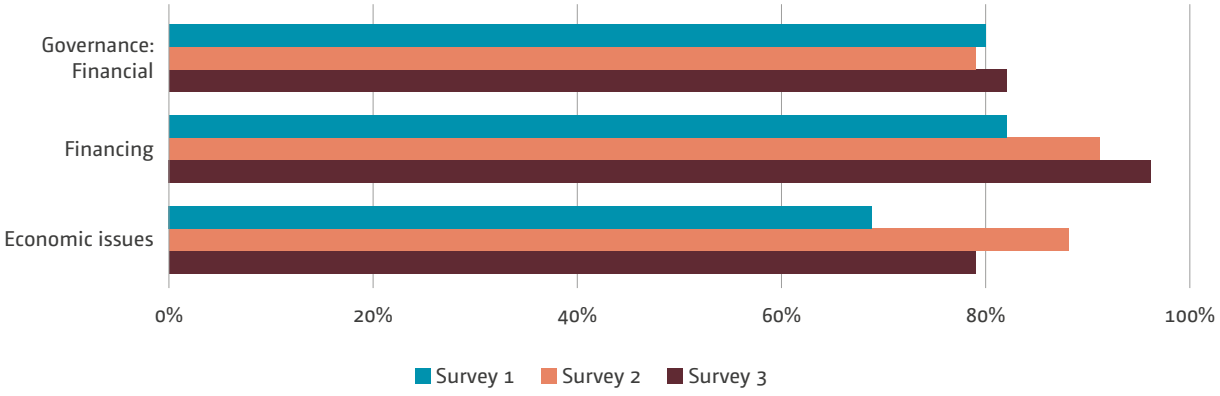


Figure 8: Percentage of respondents indicating that factors relating to education and human resources are moderately or significantly enabling

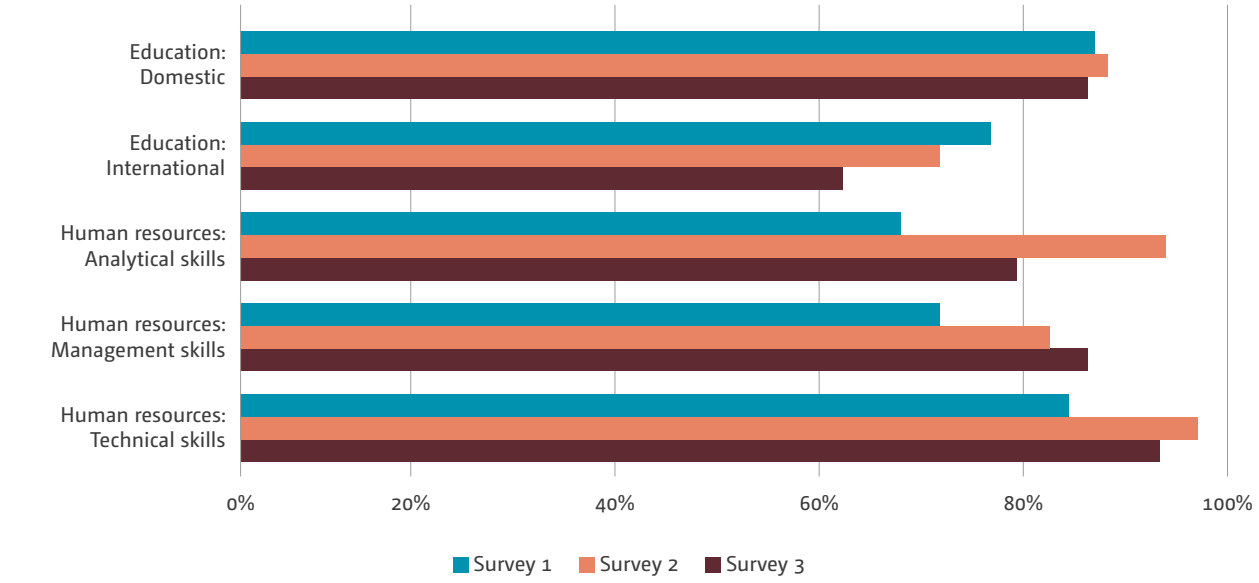
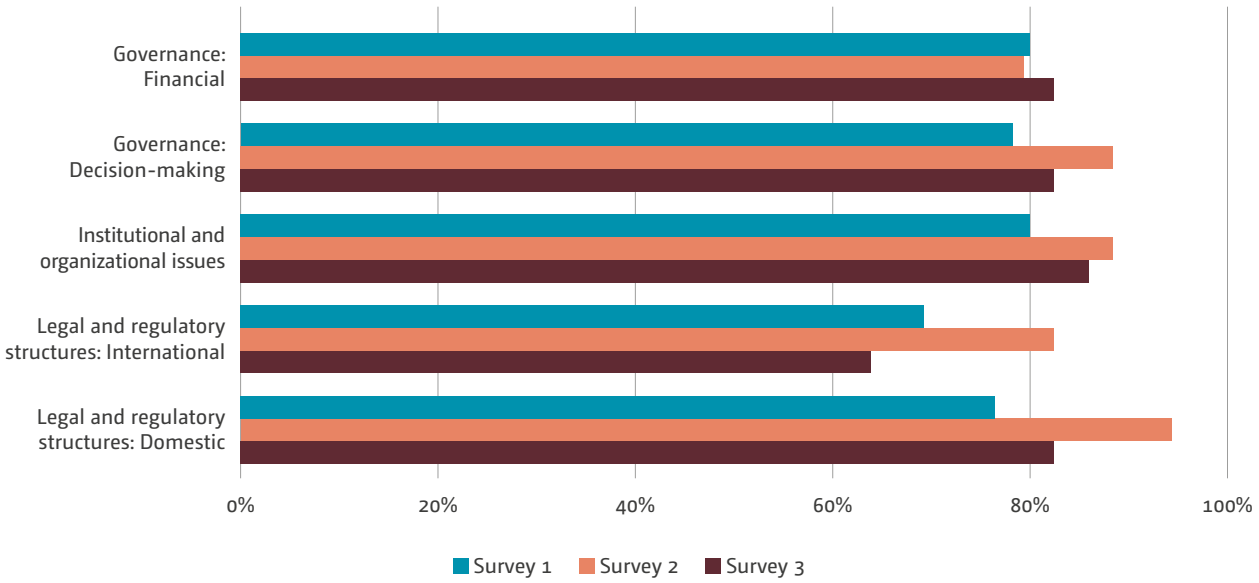


Figure 9: Percentage of respondents indicating that factors relating to governance, institutions and legal and regulatory structures are moderately or significantly enabling



To complement and expand on the results of the ratings, all three surveys asked respondents to describe the enabling factors in their own words (open-ended question). A total of 90 respondents provided 386 comments. Samples of these comments (verbatim) are presented in table 3.

Table 3: Examples of responses to the open-ended question about enabling factors

Survey 1
• Integrated collaboration among stakeholders
• Collaboration with researchers, funders or practitioners from outside
• Active communication with CEO's and awareness-raising campaigns, like workshops, networking events, websites (like for instance: www.ecotechnology.at, cleaner-production.eu, LinkedIn etc.
Survey 2
• Collaboration is very important, so that not different people work to try the same problem themselves. I really think that it's important to collaborate since climate change is a global problem and we need to tackle it together
• Collaboration with external researchers, including academia and students
• Interdisciplinary development, deployment and monitoring of technologies
• Technical education and training – data analysis, technological
Survey 3
• Collaboration with users/communities
• All stakeholders at every level
• Private oil and gas sector

4.2 Challenges

The three surveys only used an open-ended type of question to gather perceptions of challenges to the development of new technologies or modification of existing technologies. Respondents were asked to list up to five challenges. A total of 95 respondents provided 402 challenges in their responses.

The same categories of enabling strategies were used to group responses to the open-ended question on challenges to facilitate comparisons. Three new categories were added for challenge responses that did not fit well into the categories for enabling environments, namely "technologies," "research and innovation," and "other." Table 4 shows the percentage of challenges that fell into different categories for each of the three surveys. Percentages were determined by dividing the number of challenges listed in a category by the total number of challenges provided by respondents to that survey.

In general, the challenges were evenly distributed among the categories. No one challenge stands out as significant.

Table 4: Percentages of challenges to the development of new technologies or modification of existing technologies in different categories

Challenges	Survey 1	Survey 2	Survey 3	Total
Collaboration (internal and external)	6%	11%	7%	8%
Economic issues	4%	3%	1%	3%
Financing and other resources	17%	13%	11%	14%
Legal and regulatory structures (domestic and international)	7%	5%	4%	6%
Institutional and organizational (policy and other)	3%	3%	11%	5%
Information (research, contextual, including political)	15%	9%	12%	12%
Human resources (general, technical, management, analytical skills)	18%	9%	11%	14%
Governance (decision-making, planning, financial)	7%	10%	10%	9%
Education	0%	3%	1%	1%
Communication	4%	3%	5%	4%
Technologies (general, assessing and adapting to local needs, evaluation of impacts, specific technologies)	9%	19%	14%	13%
Research and innovation	10%	10%	11%	10%
Other	1%	0%	2%	1%
Number of respondents	42	28	25	95
Total comments	186	116	100	402

4.3 Measures to enhance capacities to develop new technologies and adapt technologies to meet local needs

Respondents were asked to rate (from "not important" to "very important") specific measures to enhance capacities to develop new technologies within the country and specific measures to adapt existing technologies to meet local needs. Responses relating to "moderately important" and "very important" are presented in tables 5 and 6 below. All three groups rated all the measures listed as moderately or very important. Respondents tended to give slightly higher importance ratings for developing new technologies than for modifying existing technologies.

Table 5: Percentage of respondents who rated measures to enhance capacities to develop new technologies within the country as moderately or very important

	Survey 1	Survey 2	Survey 3
Access to additional funding	100%	88%	96%
Training in research, development, innovation	100%	91%	93%
Educational programmes	100%	100%	89%
Collaboration with external researchers	93%	97%	89%
Collaboration with external industries	91%	97%	85%
Public/private partnerships	91%	85%	85%
Participation in international teams	89%	91%	81%
Access to peer-reviewed literature	76%	85%	78%
Access to existing databases	89%	88%	81%
Exchange programmes	84%	74%	74%
Fellowships	89%	71%	78%
Travel to international conferences	89%	56%	74%
Ability to deal with intellectual property	87%	82%	81%
Number of respondents	45	34	27
Range of percentages	76%–100%	56%–100%	74%–96%
Median percentage	89%	88%	81%

Table 6: Percentage of respondents who rated measures to enhance capacities to adapt existing technologies to local needs and conditions as moderately or very important

	Survey 1	Survey 2	Survey 3
Access to additional funding	98%	88%	100%
Training in research, development, innovation	98%	85%	93%
Educational programmes	95%	97%	82%
Collaboration with external researchers	84%	88%	86%
Collaboration with external industries	84%	88%	82%
Public/private partnerships	93%	91%	75%
Participation in international teams	86%	74%	82%
Access to peer-reviewed literature	70%	71%	68%
Access to existing databases	82%	74%	75%
Exchange programmes	82%	62%	64%
Fellowships	84%	59%	75%
Travel to international conferences	84%	47%	61%
Ability to deal with intellectual property	86%	65%	79%
Number of respondents	44	34	28
Range of percentages	70%–98%	47%–97%	61%–100%
Median percentage	84%	74%	79%

5. FINDINGS ON CROSS-CUTTING ISSUES

This study also looks at prominent cross-cutting issues and follows them throughout the survey results, including both the ratings and responses to open-ended questions. In this section, selected findings on these cross-cutting issues are discussed. A more detailed analysis of the finding is included in the statistical data and detailed analysis document.

5.1 Research and innovation systems

Challenges

The open-ended question about challenges produced the largest number of responses relating to research and innovation systems. About 1 in 10 respondents in each group cited a challenge in this area. A few examples of responses are included in table 7.

Table 7: Sample responses relating to research and innovation challenges

Survey 1 (11 of 186 responses)
• Technical capabilities of innovators
• Inefficient research and development institutes and their disconnect from needs of industry
• Low budget allocation by the State towards technology advancement in the country
• Lack of country-tailored studies, impact assessment
Survey 2 (11 of 116 responses)
• Weak national innovation system, low information sharing
• Lack of an innovative environment to develop new and improve existing climate technologies
• Lack of research or (financial) support for research, development and demonstration of climate technologies
Survey 3 (11 of 100 responses)
• Lack of a venture capital sector
• Limited finances to support development, modification and dissemination of endogenous development technologies
• Innovation capabilities and technology readiness

Measures to enhance capacities related to endogenous technologies

Training on the research, development and innovation process was one of the highest-rated measures for enhancing country capacities to develop new or modify existing technologies (see tables 5 and 6).

5.2 Financial and economic issues

Respondents to all three surveys perceived finance to be a major issue in relation to endogenous capacities and technologies, although financial and related economic issues did not always receive top three ratings within particular survey sections.

Capacity needs and gaps

Respondents were asked to rate current capacity needs and gaps related to financial management (such as accessing funding and managing budgets). Overall, 65% of survey 1 respondents (NDEs and TNA focal points) rated financial management capacities in their countries as weak or very weak, although they rated nine other capacities as even weaker (out of 22 capacities in total). A total of 47% of survey 2 respondents (members and observers) saw this capacity as weak, but rated 13 other areas as even weaker, while 32% of survey 3 respondents (practitioners) rated the capacity as weak or very weak in a country where they had worked and ranked it as the 12th weakest capacity.

Skills and knowledge

Respondents were asked to rate the need for skills and knowledge relating to managing finances related to technologies. This revealed a similar trend to that observed with capacity needs: while survey respondents (71% in survey 1, 59% in survey 2, 51% in survey 3) rated the skill as a strong need, none of the groups placed it in the top two thirds of skill and knowledge needs.

Enabling strategies

The enabling strategies related to financing and economic issues were financing (such as access to funding for capacity-building, planning and technologies), Governance: Financial (such as where funds are deposited, procedures for budgeting and spending), and economic issues (such as market conditions the high cost of capital). The summary of the ratings for these three enabling strategies for the three surveys are presented in table 8.

Survey 1 respondents regarded financial and economic factors as enabling factors but did not rate these among the top five possible enabling factors. The same was true for survey 2 respondents. Survey 3 respondents working with projects on the ground pointed to financing as the top enabling factor, tied with internal collaboration.

Table 8: Percentage of respondents indicating that factors relating to financial and economic issues are moderately or significantly enabling

Strategy	Survey 1	Survey 2	Survey 3
Financing	82%	91%	96%
Governance: financial	80%	79%	82%
Economic issues	69%	88%	79%

Challenges

Of the responses to the open-ended questions about challenges, 58 out of 460 responses relate to financing and related resources (see table 9). These types of challenges were included by at least 1 in 10 respondents across all three groups (see table 4).

Table 9: Sample responses relating to finance and resources as challenges

Survey 1 (32 of 186 responses)
• Financial scarcity
• Lack of funding for technology monitoring and maintenance
• Investments costs in technology
Survey 2 (15 of 116 responses)
• Unstable and small financial support
• Expensiveness of advanced technologies
Survey 3 (11 of 100 responses)
• Lack of financial resources

Measures to enhance capacities related to endogenous technologies

Respondents to all three surveys rated access to funding as very or somewhat important in the context of developing new technologies in the country and adapting technologies to meet local needs (see tables 5 and 6).

Overall, all three respondent groups consistently rated access to finance and financial management as important and in need of attention, while economic issues such as market conditions received slightly lower ratings. It is important to note that the surveys were not designed to gather information about successful attempts to raise or manage funds. 5.3. Stakeholder engagement

5.3 Stakeholder engagement

Findings from previous TEC work outlined in section 1 indicated that a participatory approach could enhance endogenous capacities and technologies. The surveys consequently included numerous questions to explore perceptions of various aspects of engagement in climate-related activities. In general, all three respondent groups expressed strong support for participation and inclusion, but the level of support perceived as necessary varied among the different stakeholders.

Capacity needs and gaps

Respondents were asked to rate the capacity relating to cross-cutting: engaging affected stakeholders (such as involving local communities, indigenous peoples and the most vulnerable in project planning). As highlighted in figure 5, the results showed different perceptions across the three groups. A total of 46% of survey 1 respondents (NDEs and TNA focal points) rated the capacity to engage stakeholders as weak or very weak but ranked it as the 18th weakest capacity out of 22. Overall, 65% of survey 2 respondents (observers) and 50% of survey 3 respondents (practitioners) viewed this capacity as weak or very weak but ranked it as the top weakness.

The reasons for these discrepancies are not clear. They may be related to the fact that respondents to surveys 1 and 3 were rating capacities in specific countries, while survey 2 respondents were rating capacities in general.

Participation of different groups

The surveys included a section to determine the extent to which various groups have actually been involved in the planning, development and deployment of climate-related technologies in a given country. Survey 1 asked **who has been involved** in such activities in their country. The other two surveys asked respondents **who should be involved** in such activities. Ratings ranged from "not at all involved" to "significantly involved". Figure 10 shows the stakeholders who the respondents said have been or should be somewhat and significantly involved.

The responses indicate that aspirations for involvement are very high. Members and observers thought that virtually all the 11 groups listed should be at least somewhat involved in climate technology related activities. Practitioners most supported the involvement of women and financial institutions.

For every single stakeholder group, the survey 1 respondents reported lower levels of involvement in their country than the respondents to the other two surveys had reported. In other words, the actual levels of stakeholder participation do not match aspirations.

The results also indicate that some of the groups most likely to be affected by climate change, including vulnerable populations and local communities, may be the least engaged in climate technology related activities. An additional study could uncover the reasons why these groups are less involved.

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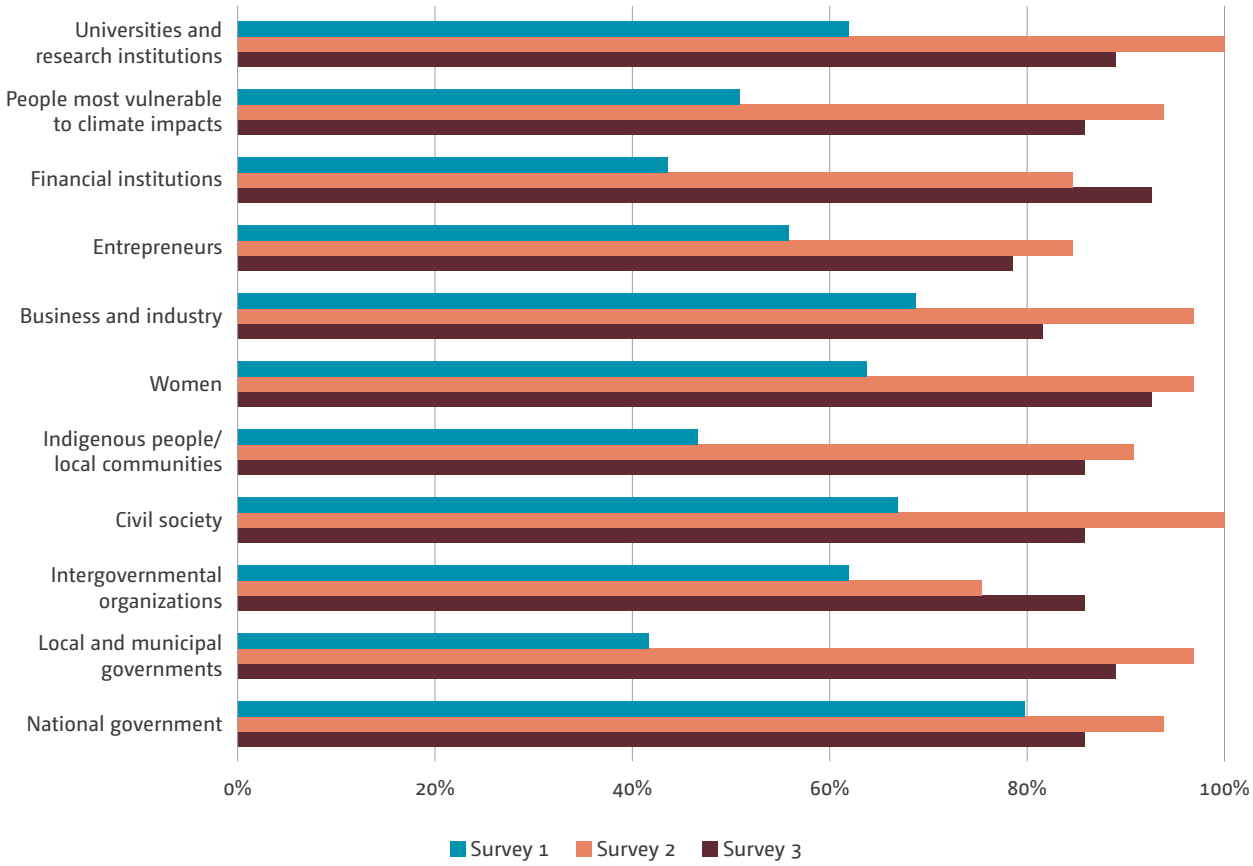
Figure 10: Percentage of respondents indicating various stakeholders as somewhat or significantly involved in planning, developing and deploying climate-related technologies



Enabling strategies

In the responses to the open-ended question about enabling factors, the NDEs and TNA focal points described more than 20 enablers, which involved collaboration, engagement and/or partnerships. Members and observers described 24 enablers relating to collaboration and participation, putting more emphasis on engaging academia and the private sector than the other groups. Practitioners listed 14 enablers involving engagement and another 3 involving collaboration, placing emphasis on local involvement. One response noted that people most impacted by climate change contributed to enabling environments.

5.4 Gender

The COP through decision 21/CP.22 requested that all constituted bodies include in their regular reports progress made towards the integration of gender perspectives in their respective processes. The technology framework under Article 10, paragraph 4, of the Paris Agreement sets out numerous ways in which gender should be considered in work relating to climate technologies (see document FCCC/PA/CMA/2018/3/Add.2). In its rolling workplan for 2019–2022, the TEC committed to incorporating gender considerations into its work.

Capacity needs and gaps

Gender responsiveness was included in the list of 22 endogenous capacities. A total of 63% of survey 1 (NDEs and TNA focal points) and 65% of survey 2 respondents (members and observers) said that the capacity in this area was weak or very weak (see figure 5). Whereas survey 2 respondents ranked it as the weakest capacity, survey 1 respondents ranked it as the 13th weakest capacity out of 22. Overall, 39% of survey 3 respondents (practitioners) saw it as a weak capacity and ranked it as the 17th weakest.

Skills and knowledge

At least 6 out of 10 of the ratings from each group expressed a strong or very strong need for skills and knowledge related to assessing the gender impacts of technologies.

Participation of women

Both survey 2 and survey 3 respondents expressed very strong support for participation by women, placing them in the top three groups that should be involved (see figure 10). For survey 1 respondents, just under two out of three respondents reported that women have previously been involved in climate technology related activities in their country, meaning that women were ranked fourth in terms of actual participation.

Enabling strategies

The survey section on strategies for creating enabling environments did not include an item on gender issues, but respondents were given an opportunity to describe enabling strategies in their own words. None of the 188 survey 1 responses referred to gender issues. Survey 2 produced 115 comments, none of which referred to gender. Three of the survey 3 responses cited gender out of 89 comments submitted. While the responses to other questions indicated that all three respondent groups believe that gender issues are important, respondents to surveys 1 and 2 do not appear to see gender issues as one of the factors most likely to create enable environments for climate technologies. Practitioners were the only group to list gender among the top five enablers.

Challenges

The NDEs and TNA focal points listed two challenges relating to gender, while members and observers on the one hand and practitioners on the other each cited one. The responses referred to gender impacts, equality and integration, with the response by the practitioner also describing social constraints that restrict involvement by women.

Overall, respondents in all three groups expressed strong support for the participation of women in activities related to climate technologies. Respondents also showed awareness of various aspects of gender issues, such as disparate treatment, impacts of technologies, attitudes and participation. A further study would be needed to provide details about these issues.

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5.5 Local communities and indigenous people

The creation of the Local Communities and Indigenous Peoples Platform in 2015 demonstrates the commitment of the UNFCCC to the inclusion of these traditional groups and their traditional knowledge in climate-related activities. The surveys collected relevant information by referring to these groups in numerous questions and reporting on the results. Several responses to the open-ended questions address indigenous peoples. Other responses mentioned local communities, but it was not clear whether they meant traditional communities or anyone who currently lives in a local area.

Capacity needs and gaps

Responses to open-ended questions about current capacity needs included three references to local communities and indigenous peoples. The comments addressed participation, including participation in decision-making, and the use of traditional knowledge.

Skills and knowledge

At least three out of five respondents in each group rated the need for utilizing local and indigenous knowledge as strong or very strong.

Participation by local communities and indigenous peoples

More than four out of five participants in the survey 1 and 2 groups indicated that indigenous peoples and local communities should be somewhat or significantly involved in climate technology programmes (see figure 10). Survey 1 respondents indicated that participation by local communities and indigenous groups has not reached the levels they would like to see.

Enabling strategies

Participation by indigenous peoples and local communities was not listed as a separate enabling strategy, but indigenous peoples were listed as an example of a group that could collaborate on efforts within a country to develop and enhance endogenous capacities and technologies. This category was rated as one of the top two enabling strategies across all three surveys. Almost none of the responses to the open-ended question about enablers involved indigenous peoples and local communities.

Challenges

Numerous respondents mentioned challenges relating to meeting local needs and conditions. In addition, seven comments related to indigenous peoples and local communities, five of which focused on local and indigenous knowledge. The remaining response mentioned social empowerment as a challenge.

Other

Respondents were given the chance to provide additional feedback at the end of the surveys. One of the national representatives wrote "Reforzar técnicas de cultivos ancestrales en las comunidades" (Reinforce ancestral farming techniques in the communities).

Overall, respondents were in favour of participation by local communities and indigenous peoples, as well as of the use of traditional knowledge, in conducting climate technology activities.

5.6 Collaboration and partnerships

With regard to experience of collaboration and partnerships, the respondents' profiles suggest that just over one third (36%) of practitioners – the group most likely to have been involved in on-the-ground action – have previously collaborated in public/private partnerships involving climate technologies. The same number (36%) reported experience with South–South or triangular cooperation.

Skills and knowledge

More than half of all three groups rated managing interdisciplinary teams as a strong or very strong need for countries' skills and knowledge. Survey 1 respondents also view working with external industries and consultants as an important factor.

Enabling strategies

As shown in figure 6, collaboration and cooperation – both internal and external – were rated among the most important strategies for supporting enabling environments for enhancing climate capacities and technologies.

Challenges

Only 8% of the many challenges listed involved internal or external collaboration. Some examples include conflicts between sectors on how to deal with an issue, partnership coordination at the national level (survey 1), inter-agency and interdisciplinary cooperation, lack of cooperation with academia and companies (survey 2) and how to create synergies between government, oil and gas companies, power sectors and heavy industries with a view to reducing and monetizing greenhouse gas emissions together (survey 3).

Measures to enhance capacities related to endogenous technologies

With regard to developing new technologies, almost all respondents rated collaborative projects with researchers in other countries as moderately or very important. The importance of collaborative projects with industries in other countries also received high ratings from all three groups, in particular with regard to the development of new technologies.

Overall, all three respondent groups recognized the importance of and need for collaboration and cooperation. They were less likely to see a strong need for skills and knowledge, but more likely to recognize the importance of collaboration and partnerships in creating enabling environments.

5.7 Governance

Governance takes on many substantive forms, including policies, institutions, laws and regulations. It also involves many process issues such as transparency and planning. All of these issues were either presented in the survey questions or mentioned in response to open-ended questions. Governance is treated as the overall concept in this section. Legal and regulatory issues are addressed separately because they often appeared in specific questions and were frequently mentioned in responses to open-ended questions.

Capacity needs and gaps

Respondents to surveys 1 (NDE and TNA focal points) and 2 (members and observers) rated the capacity governance and planning (such as assignments of responsibility and oversight) as weaker than the respondents to survey 3 (practitioners) as shown in figure 5. However, members and observers ranked it higher in terms of weakness than the other two groups. Table 10 presents examples of the governance-related needs identified by respondents.

Table 10: Sample responses relating to governance-related capacity needs

Survey 1 (8 of 196 responses)
• Developing project proposals
• Promoting and mobilizing resources for the implementation of national adaptation plans
• Assessing and upgrading technical institutions
Survey 2 (10 of 127 responses)
• Coordination among related ministries and agencies
• Urban planning and governance, implementation and monitoring is the problem
• Support beyond project cycle
Survey 3 (9 of 107 responses)
• Policy development at a country level
• Installed capacity at the government level
• Resource access for strategy and policy development

Participation by national and local governments

As shown in figure 10, close to 9 out of 10 survey 2 and 3 respondents said that national governments should be at least somewhat involved in activities relating to climate technologies. Both groups placed national governments in the top half of groups that should be involved. The survey 1 respondents reported that national governments were more involved in such activities than any other stakeholders.

There was a different pattern for local and municipal governments. Both survey 2 and 3 respondents thought that local and municipal governments should be even more involved than national governments. This differed from the pattern observed in survey 1 responses, where local and municipal governments were ranked last on the list in terms of actual participation.

Enabling strategies

The section on enabling environments included three items directly related to governance: institutional and organizational issues (such as policies, programmes and organizational structures); governance-related decision-making (such as assignment of responsibility, lines of authority); and financial governance (such as where funds are deposited, procedures for budgeting and spending).

Figure 9 shows that all three groups generally thought of these governance functions as moderate or significant enablers. Each group gave similar ratings to the three functions, although members and observers saw the financial governance function as less of an enabler than the other two groups. While this may seem inconsistent with the perception of the importance of finance noted elsewhere, this item referred specifically to the way in which budgets and finances were handled and not how funding was obtained.

Responses to the open-ended question about enablers provided further hints of why governance is an important enabler. NDEs and TNA focal points mentioned government involvement, decision-making and policies, while members and observers were more concerned with clarity. Practitioners mentioned the role of government and policy and the need to keep systems simple. See the statistical data and detailed analysis document for further sample responses.

Challenges

In response to open-ended questions about challenges, more than 10% of the challenges listed in each survey related to governance. Samples of these responses are presented in table 11.

Table 11: Sample responses relating to governance-related challenges

Survey 1 (24 of 186 responses)
• Instability
• Military occupation
• Poor governance and planning
• Administrative barriers
• Absence of adequate infrastructure (legislation, tax incentives, training, availability of funds, etc.)
• Policy of the country
• Political backing or lack off
Survey 2 (18 of 116 responses)
• Corruption
• Lack of State support in developing or modifying technologies, even when the areas are announced as being high priority
• Lack of strategical and tactical plans and firm steps how to implement them on State and regional level
• Coordination between central and local governments' assessment and selection of technologies
• Use of external consultants instead of doing it themselves
• Political instability
Survey 3 (23 of 100 responses)
• Perception of executive responsible for governance
• Lack of coordination
• Policy formulation dominated by central government
• Continuous changes in government and national goals
• Short-term policy evaluation and framing
• Lack of political motivation

Overall, the three groups had somewhat diverse views on the different levels of government, possibly owing to their own experience. NDEs and TNA focal points are national representatives who continuously work for and with national governments. Members and observers may be most familiar with intergovernmental organizations. Practitioners, who work on more local issues, may be the group most likely to be in contact with local and municipal governments.

5.8 Legal and regulatory framework

Capacity needs and gaps

The pattern of responses was similar to the pattern observed for the capacity related to governance and planning. Almost 6 out of 10 survey 1 and survey respondents (NDEs, TNA focal points and members and observers) rated the capacity related to legal and regulatory structures (such as revising regulatory structures and protecting intellectual property) as somewhat or very weak. Again, survey 3 respondents (practitioners) saw this area as less weak. The rankings also showed a similar pattern, with members and observers ranking legal and regulatory capacities as one of the four weakest current capacities.

Responses to open-ended questions about capacity needs referred to technical barriers (mainly taxes at the customs level), implementing formulated policies and by-laws on climate change mitigation and improving regulatory compliance of existing provisions, as well as formulating a legal and regulatory framework for energy technologies and resources.

Skills and knowledge

As shown in table 2, skill and knowledge needs related to legal and regulatory issues included both drafting skills and issues relating to intellectual property. More than 7 out of 10 NDEs and TNA focal points, as well as practitioners, saw a strong or very strong need for drafting skills. Only about half of members and observers saw drafting as a strong need. Dealing with intellectual property issues in the context of climate technology was seen as a less strong need. While two out of three NDEs and TNA focal points rated this as a strong need, intellectual property issues were ranked just 18th out of 24 on the list of skills and knowledge. Less than half of the other two groups saw a strong need for skills in dealing with intellectual property.

Enabling strategies

Figure 9 includes both domestic and international legal and regulatory structures as possible enabling factors. International structures were low on the list of enabling strategies for all three groups. Views were more divided when it came to domestic frameworks. Members and observers viewed only three other issues as more enabling than domestic legal and regulatory structures. Practitioners also ranked this factor in the top half, while NDEs and TNA focal points provided a lower ranking.

Challenges

Only a few of the listed challenges referred to legal and regulatory issues (see table 12). A few respondents mentioned weak laws in specific areas, such as land tenure, start-ups and renewable energy, while others referred to generally weak legal and regulatory systems. Intellectual property issues were listed as challenges at least once in surveys 1 and 2.

Table 12: Sample responses relating to legal and regulatory challenges

Survey 1 (13 of 186 responses)
• Inhibiting policies, laws and instruments
• Land tenure
• Poor legislation and rules for innovations and start-ups
• Legal and regulatory constraints
• Dealing with intellectual property issues
Survey 2 (6 of 116 responses)
• Weak regulatory framework
• Poor or absent legal and regulatory frameworks
• Lack of regulation to exclude not appropriate technology
• IPR and barriers
• Managing intellectual property rights for it not to be a barrier
Survey 3 (4 of 100 responses)
• Developing legal and regulatory processes
• Law enforcement
• The regulatory process for renewable energy project development is overly long and complex, involving several government bodies, permits and licences

Measures to enhance capacities

As shown in tables 5 and 6, respondents to surveys 1 and 3 had almost identical perceptions of the importance of developing new technologies and modifying existing technologies, but there were differences in rankings. NDEs and TNA focal points placed intellectual property rights for modifying existing technologies in the top half of the most important measures to enhance capacities, while intellectual property rights for developing new technologies were ranked much lower. Members and observers saw intellectual property rights for existing technologies as less important than for new technologies, but the rankings for the two were identical, falling in the bottom half in terms of importance. Practitioners gave almost identical ratings and rankings to both developing new technologies and modifying existing technologies.

Overall, the respondents to all three surveys saw legal and regulatory issues as important, but generally not as a top area of concern, with a few exceptions. Members and observers ranked legal and regulatory capacities as much weaker than the other two groups. Practitioners saw a strong need for legal and regulatory drafting skills. Respondents to surveys 1 and 3 ranked intellectual property rights relating to the modification of existing technologies among the top half of measures of importance; practitioners gave the same ranking to intellectual property rights for developing new technologies.

6. COMPARISON WITH OTHER WORK

Three recent pieces of UNFCCC work have addressed issues which are common or relevant to those considered in this study. Comparisons and implications are discussed below.

6.1 Work of the Technology Executive Committee on mapping enabling environments and challenges

As per its rolling workplan for 2019–2022, the TEC is undertaking a study to examine enabling environments and challenges to technology development and transfer identified in TNAs, NDCs, CTCN technical assistance and relevant TEC Briefs.[7]

The study covered by this report addressed somewhat different questions and employed different methodologies. For example, its scope focused on needs, gaps, challenges and enablers relating to endogenous capacities and technologies, while the study on enabling environments mentioned in the paragraph above is focusing on enablers and challenges to technology development and transfer. Further, the data in the study covered by this report were based on the individual responses of three different groups involved in climate technologies, while the data used in the study on enabling environments were collected from reports on the outcomes of national processes, some of which, such as TNAs, have been available for many years.

Despite the differences in methodologies, the findings of the two studies were remarkably consistent. Financing issues were identified as the top enablers and challenges in both surveys. Technical skills were viewed as highly important, as were information, awareness and communication issues. Legal and regulatory issues were of high concern in the study on enabling environments. Table 13 shows the top enablers and challenges identified in the two studies.

Table 13: Top enablers and challenges identified in the Endogenous report and Enabling environment and challenges report

	Study on endogenous needs, gaps and enablers	Study on enabling environments and challenges
Top four enablers	Collaboration	Economic and financial
	Technical skills (human resources)	Legal and regulatory
	Financing	Technical
	Communication	Information and awareness
Top four challenges	Financing and other resources	Economic and financial
	Human resources	Legal and regulatory
	Technology issues	Technical
	Information	Information and awareness

The findings of the two studies are complementary. The surveys forming part of this study compared the perceptions of national representatives, members and observers of various constituted bodies, and practitioners working with technologies on the ground. The study on enabling environments, which analysed national reports, compared findings across technologies, sectors and types of reports.

7 See document TEC/2020/21/9.

6.2 National-level pilot exercise on capacity gaps and needs related to the implementation of nationally determined contributions

In 2019 the PCCB undertook a study[8] of the NDCs of six countries to determine the capacity gaps and needs revealed therein and the processes that produced them. Some of the results from that study were incorporated into the surveys developed for this report. This section compares some of the findings relating to gaps and needs in the two studies.

The methodologies applied to the studies differed in several significant ways, as described in table 14. Nevertheless, the two studies provide information about gaps and needs relating to the same types of climate capacities, and some of the major findings in the PCCB study were confirmed by the surveys conducted for the study covered by this report.

Table 14: Comparison of approaches used in the Endogenous report and PCCB gaps and needs report

	Study on endogenous needs, gaps and enablers	PCCB gaps and needs study
Purposes	Identify needs, gaps, enabling environments, challenges and other issues relating to the promotion of endogenous capacities and technologies	National-level pilot exercise to assess capacity gaps and needs related to the implementation of NDCs
Data sources	Surveys to gather perceptions of different issues from three groups: NDEs and TNA focal points; members and observers of the TEC, the PCCB and other groups; and practitioners	Six PCCB members consulted with key stakeholders in their countries who were involved in implementing NDCs; semi-structured interviews and document reviews were used
Types of capacities studied	22 areas of current capacities and 24 skills and knowledge, in part taken from work by the TEC, the CTCN, the PCCB and other groups	Gaps and needs for specific capacities in the areas of mitigation, adaptation and cross-cutting issues were developed on the basis of case studies
Technologies	Questions were asked in relation to endogenous technologies but included many issues relating to endogenous capacities	Gaps and needs relating to institutional, technical, relational and strategic capacities were addressed
Countries	Many countries, both developed and developing, from all regions of the world	Six developing countries

8 https://unfccc.int/sites/default/files/resource/PCCB_TP_capacity%20gaps%20and%20needs_NDCs_final.pdf

The study on endogenous needs, gaps and enablers covered by this report gathered perceptions of needs and gaps related to capacity-building from respondents in a wide variety of countries. No specific projects were investigated, although respondents were asked to base their answers on projects or countries with which they were familiar. The PCCB study provided in-depth information on climate-related efforts in six developing countries.

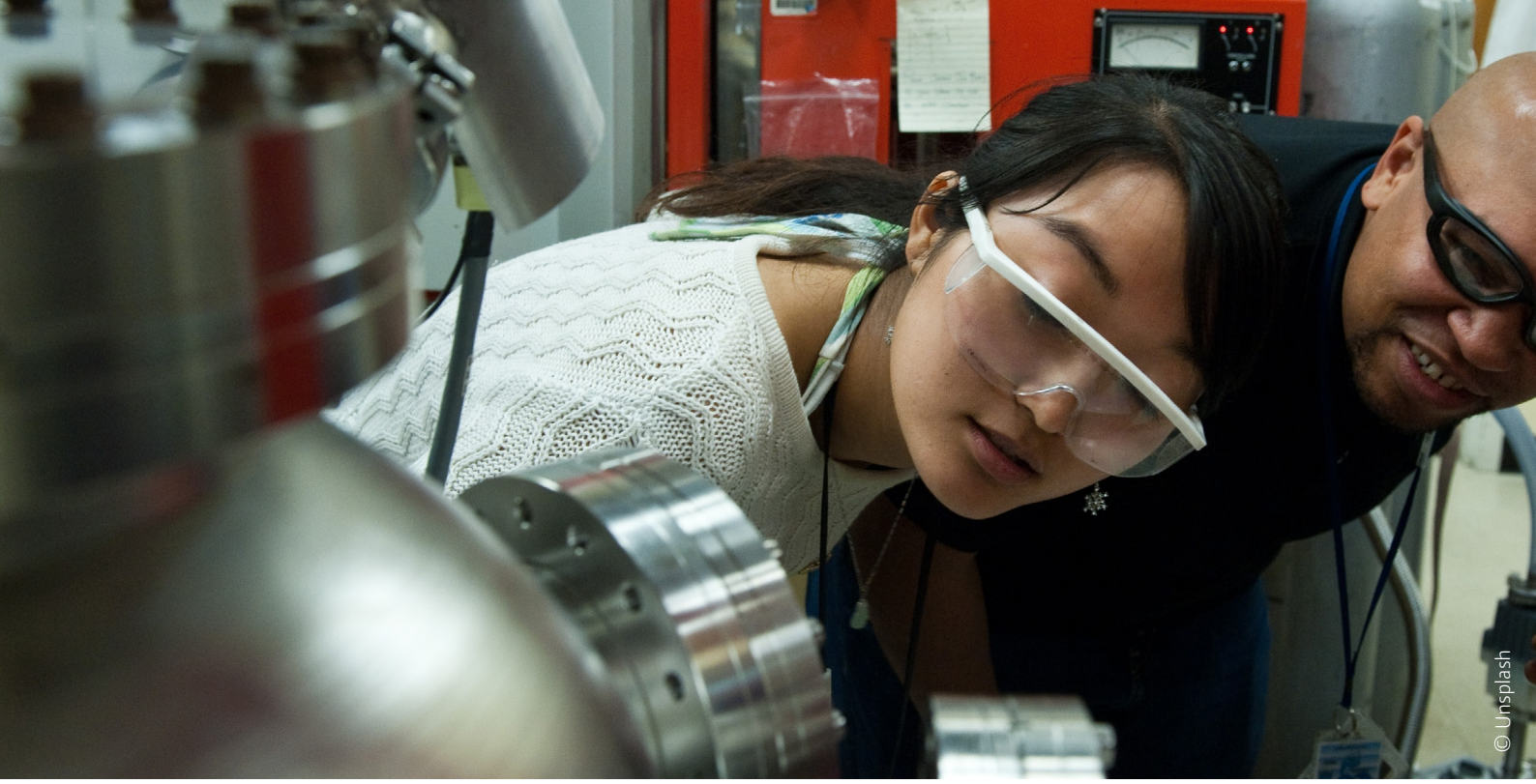
Both studies confirmed that countries continue to experience many different gaps and needs in their capacities to deal with climate-related challenges. The PCCB study identified gaps and needs in five mitigation areas, seven adaptation areas and six cross-cutting areas. All of these areas were addressed in the surveys covered by this report, which asked for perceptions of the strength of current capacities in 22 areas.

Both studies emphasized the importance of stakeholder participation in capacity-building. Previous TEC work on endogenous capacities and technologies had confirmed the value of a participatory approach, and the surveys sought to obtain information about the levels at which different groups should be and have already been involved in the planning, development and deployment of climate-related technologies. The PCCB study determined that "addressing capacity gaps and needs at the national level must go hand-in-hand with addressing similar gaps and needs at the local level, both for public sector entities as well as for non-State actors such as the private sector, civil society, academia, media, religious leaders and young people".

Later in the report the PCCB study discusses the importance of coordination across and within levels of governance. "The implementation of an NDC requires entails [sic] its integration into various sectoral policies, programmes and budgeting, and therefore requires strong coordination efforts between and within relevant ministries and other government entities at both the national and local levels." The PCCB study also notes how hard it is for countries to achieve such coordination.

The study covered by this report confirms the presence of such problems in national and local coordination. Of the 11 stakeholder groups listed, national governments were rated by NDEs and TNA focal points as the group most involved in technology-related activities and local and municipal governments as the least involved. Coordination across governmental levels is difficult if one level is not present at the table. More information is needed about the actual types of participation by local and municipal governments in climate technology issues, and which factors affect their involvement.

The PCCB study emphasizes the importance of developing endogenous capacities, which is the purpose of the study covered by this report, which provides examples of the kinds of gaps and needs assessments that the PCCB is trying to promote.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6.3 Compilation of collaborative research, development and demonstration

The TEC has been engaged in innovation and research development since 2013. Recently, the TEC published a compilation of good practices and lessons learned with regard to international collaborative research, development and demonstration of climate technologies.[9] The compilation mapped information from several studies, planning documents, websites and other material relating to international collaborative research, development and demonstration and selected eight initiatives to present as case studies. The compilation of good practices and lessons learned presented five core recommendations that covered:

- The need for regular project evaluations, reported transparently, to facilitate learning;
- Evolving participation by countries, based on national needs and capacities;
- How the private sector and other actors should become engaged, including timing;
- The need to increase hardware research, development and demonstration, in addition to ongoing software and orgware work;
- The need to enhance local engagement and capacity-building in developing countries.

Following these recommendations, the compilation addresses the importance of designing collaborative research, development and demonstration initiatives that are systemic and support capacity-building globally. Equal participation by actors from all countries requires enhancement of local capacities, among other factors.

The compilation emphasizes the importance of broad participation and stakeholder engagement from the outset of a project. The desire for extensive stakeholder involvement is consistent with findings obtained from this study.

An additional investigation into the roles and responsibilities of stakeholders at different planning and implementation stages could help to enhance the effectiveness of engagement in future projects involving climate technologies.

9 https://unfccc.int/ttclear/tec/rdandr

7. CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations presented in this section build on the results of the surveys covered in this report as well as previous TEC work on this topic and other relevant topics.

7.1 Conclusions

Capacity needs and gaps

Countries have many weaknesses in their capacities to deal with climate technologies for mitigation, adaptation and cross-cutting issues. Perceptions of the strength of various capacity needs sometimes vary depending on the type of respondent. The personal capacity needs of NDEs differ according to the individual. Perceptions of skill and knowledge needs relating to endogenous capacities and technologies differ by subject area and the role of the respondent.

Assessing local community needs for climate technologies and making development more sustainable are considered high needs. Different perceptions across areas and groups suggest that capacity, skill and knowledge needs and gaps are highly context-specific. Gaps and needs are likely to vary depending on the nature of the problem and the communities involved.

Enabling strategies and challenges

Many different strategies contribute to enabling environments for enhancing climate capacities and technologies. Some strategies serve as both enablers and challenges. Strategies relating to collaboration, financing and building technical skills are perceived to be among the most significant enablers, while stakeholder participation, collaboration and sharing information improve outcomes. Collaboration across sectors and disciplines, including the sharing of knowledge, best practices and resources, enhances planning and action.

Adequate financing and other resources are required to support the development and modification of technologies within countries. Capacity-building at all levels enhances participation, expertise and informed decisions. National education is more of an enabler than international education.

Good governance is essential at all levels, including effective leadership, transparency, integrity, stability and other factors. Legal, regulatory and policy frameworks need to support endogenous technology innovation and adaptation. Coordination between national and local authorities enhances the ability of communities to develop and modify technologies to meet local needs and conditions.

Measures to develop and enhance endogenous capacities

Priorities are similar when it comes to measures to develop new technologies and measures to adapt technologies to meet local needs. Funding, cooperative efforts and training and education are considered to be among the most important measures.

Financing

Virtually everything related to enhancing endogenous capacities and technologies requires adequate financing. Access to financing is of greater concern than financial management. Financial institutions are not adequately engaged in planning related to climate technologies.

Stakeholder engagement

A participatory approach is essential to effectively working on endogenous capacities and technologies. Multiple stakeholders can help to identify local environmental, social and economic needs; evaluate the possible impacts of suggested solutions; empower local stakeholders; and improve acceptance of and support for decisions. Actual participation is lower than desired for all stakeholder groups considered in the surveys. The largest gap between desired and actual participation lies with local and municipal governments, while large gaps are also the case for financial institutions, indigenous peoples and local communities and people most vulnerable to climate impacts.

Gender

There is strong support for the participation of women in work involving endogenous capacities and technologies. Views differ on the strength of current capacities, skills and knowledge needed to deal with gender issues.

Local communities and indigenous peoples

There is support for the participation of local communities and indigenous peoples, but engagement levels are lower than desired. Utilizing local and indigenous knowledge is viewed as a strong need, but little is known about what exactly is involved.

Communications

Effective engagement requires information to be extensively communicated in order to raise awareness among affected citizens, encourage recruitment of participants, keep people informed about the processes that affect them, enhance trust in the decision-making process and provide evidence to facilitate informed decisions. Different groups have different information needs and different levels of understanding.

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Collaboration

Collaboration across interests and sectors is seen as crucial to successful working with endogenous capacities and technologies. Both internal and external collaboration is important. Collaboration and cooperation are among the most important strategies for creating enabling environments. Essential players may differ according to the nature of each project.

Research and innovation systems

Developing effective technology research and innovation systems is essential to enhancing endogenous capacities and technologies. Many stakeholders play important roles, including national and local governments, researchers and academics, financial institutions, and business and industry. Multiple disciplines, including the sciences and social sciences, law and management, along with types of knowledge, including indigenous knowledge, help to inform planning and decisions. Stakeholders may require capacity-building in multiple areas to help them to participate effectively. Training in research, development and the innovation process is important to support both the endogenous development of new technologies and the modification of existing technologies.

Governance

Many aspects of governance affect issues relating to climate technologies, including leadership, financial and other support, transparency, stability, lines of authority, policy formulation and politics. All levels of government can enable or constrain action. National governments are heavily involved in planning that involves climate technologies. Coordination between and across government levels is critical but hard to achieve.

Legal and regulatory frameworks

Policies and legal and regulatory frameworks can both enable and constrain climate technology related actions. Specific enabling and constraining components vary depending on the situation. The importance of intellectual property rights depends on the nature of the technologies involved.

7.2 Recommendations

The recommendations below are intended to facilitate country efforts to enhance enabling environments for promoting endogenous capacities and technologies. Naturally, these strategies need to be adapted to specific in-country capacity-building needs and opportunities.

With regard to stakeholder engagement:

- Develop strategies to communicate with and encourage the participation of every group likely affected by a particular issue and actions taken to address the issue to become involved in all stages of technology planning and implementation projects.
- Assess and address gaps and needs relating to capacities needed for stakeholders to participate in planning involving climate technologies.
- Take gender issues, in particular participation of women, into account in work involving endogenous technologies.
- Incorporate best practices relating to the use of local and indigenous knowledge in developing new technologies and adapting existing technologies to local needs and conditions.

With regard to governance:

- Create and promote good governance[10] at different levels, including legal, regulatory and policy frameworks that support endogenous innovation.
- Encourage close engagement from local and municipal authorities.
- Enhance communication and coordination within and between government levels.

With regard to capacity-building:

- Ensure that NDEs and TNA focal points have the necessary capacities to assess technology needs, identify appropriate technologies, develop endogenous technologies, understand the demands and implications of existing processes and engage stakeholders.
- Customize capacity-building projects based on local needs and levels of skills and knowledge.
- Promote educational opportunities to enhance technical and other capacities, skills and knowledge.
- Consider targeting groups such as young people and workers for local capacity-building projects, training and educational programmes.

10 See https://www.unescap.org/resources/what-good-governance.

With regard to financing:

- Identify innovative, effective and flexible ways of acquiring and managing funding to support the development and modification of technologies within a country.
- Enhance engagement of financial institutions in the early stages of planning for endogenous technologies to improve access to funding.

With regard to research and innovation systems and collaboration:

- Develop and implement strategies to enhance the effectiveness of research and innovation systems relating to climate technologies.
- Facilitate training on research, development and the innovation process.
- Promote domestic and international collaboration to enhance endogenous capacities and technologies.

8. USE OF THE STUDY AND POSSIBLE FURTHER WORK

8.1 Use of this study

The previous TEC study on endogenous mentioned in section 1 indicated that no entities had undertaken work specifically on endogenous capacities and technologies. Therefore, the results from the study covered in this report may be useful for the work of other constituted bodies and processes under the UNFCCC:

(a) **Technical assistance requests submitted to the CTCN:** The study results can be used by the CTCN in considering requests for technical assistance submitted by countries, in particular with respect to how the request would support the development and enhancement of endogenous capacities and technologies, as described in the CTCN guiding principles and prioritization criteria;

(b) **Research and innovation:** The findings of this study should feed into the future work of the TEC on national systems of innovation since endogenous capacities are crucial building block to creating an effective national system of innovation;

(c) **Capacity-building:** Identified needs and gaps related to developing and promoting in-country capacities relating to climate technologies may be relevant to the PCCB and other groups working in the specific areas addressed, such as the Nairobi work programme (Lima Adaptation Knowledge Initiative);

(d) **Finance:** Information on the needs, enablers and challenges related to finance, as well as other information on measures to promote and enhance endogenous capacities and technologies, may be relevant to the work of the Green Climate Fund and the Global Environment Facility to further strengthen their frameworks;

(e) **Local communities and indigenous peoples:** The findings on this topic may be useful for informing the work of the Local Communities and Indigenous Peoples Platform on addressing capacity needs, skills and knowledge to ensure the equitable and effective participation of local stakeholders in developing new technologies or adapting existing technologies to meet local needs and in devising strategies for enhancing the use of traditional knowledge;

(f) **Gender work:** The findings on gender may provide information on how the TEC can further mainstream gender consideration into its work, as well as inform the work on gender and technology conducted jointly by the TEC and the CTCN, and the work of the UNFCCC gender team;

(g) **National reporting:** Reporting on endogenous capacities and technologies has been a feature of national reporting for all countries in the UNFCCC process. Since the TEC is the only body that works on this topic, the results of this study, together with the previous study on the concept of endogenous capacities and technologies, may be helpful for illustrating enabling strategies and specific measures that can be considered in enhancing endogenous capacities and technologies. Recently, the understanding of endogenous capacities and technologies recommended by the TEC to COP 24 has been incorporated in the review practice guidance for the review of national communications and biennial reports;

(h) **Stakeholder engagement:** The findings on gaps between desired and actual levels of engagement by different stakeholder groups may be of use to the UNFCCC in considering ways to enhance participation in UNFCCC processes and other areas of climate action.

8.2 Possible further work by the Technology Executive Committee

As the TEC continues to respond to the mandates of the COP and the CMA to develop and enhance endogenous capacities and technologies, possible further work by the TEC on this topic may include:

(1) Examining the roles of different stakeholders in planning and developing a national innovation system that will systematically build capacities and promote development of endogenous climate technologies at different levels;

(2) Exploring collaboration with the CTCN to further enhance the work on endogenous capacities and technologies, for example in the relevant areas highlighted in the section above.

ACKNOWLEDGEMENTS

The TEC would like to express its appreciation to Marilyn Averill, University of Colorado Boulder, and the representatives of non-governmental organizations of the TEC task force on enabling environments and capacity-building, who supported and contributed to the development of this report, and all respondents who participated in the surveys used in this report.

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About the Technology Executive Committee

The Technology Executive Committee is the policy component of the Technology Mechanism, which was established by the Conference of the Parties in 2010 to facilitate the implementation of enhanced action on climate technology development and transfer. Along with the other component of the Technology Mechanism, the Climate Technology Centre and Network, the committee is mandated to facilitate the effective implementation of the Technology Mechanism.

Contact Details

The Technology Executive Committee may be contacted through the United Nations Climate Change Secretariat

Platz der Vereinten Nationen 1, 53113 Bonn, Germany
Email: tec@unfccc.int

Website: www.unfccc.int/ttclear/tec

A digital copy of this report can be downloaded from:
https://unfccc.int/ttclear/endogenous/

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