



Technology Executive Committee

18 September 2018

Seventeenth meeting

Bonn, Germany, 25–28 September 2018

Draft paper on mapping barriers and enabling environments in Technology Needs Assessments, Nationally Determined Contributions, and Technical Assistance of the Climate Technology Centre and Network

Background paper

I. Background

1. The Technology Executive Committee (TEC) agreed to include in its rolling work plan 2016-2018, work stream 1, a task to map technology needs assessments (TNAs), Nationally Determined Contributions (NDCs), and technical assistance (TA) of the Climate Technology Centre and Network (CTCN) regarding enabling environments and barriers.¹

2. At the TEC-16 meeting, the task force on innovation and RD&D presented an update on its work on this activity, The TEC requested its task force on TNAs to take on the work on mapping of enabling environment and barriers by mapping barriers and enablers in NDCs and CTCN requests, presenting a concept note on a possible event on this mapping to TEC 17 for its consideration, with a view to preparing and delivering recommendations and TEC brief on this issue to COP 25.

II. Scope of the note

3. The annex I to this note contains a Draft paper on mapping barriers and enabling environments in Technology Needs Assessments, Nationally Determined Contributions, and Technical Assistance of the Climate Technology Centre and Network. The annex II to this note contains a Concept note for event, based on the draft paper.

III. Expected action by the Technology Executive Committee

4. The Technology Executive Committee will be invited to consider the draft paper on mapping, to agree on concept note on mapping event, and to agree on next steps from this work.

¹ TEC/2016/12/13–an.

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Annex I

Draft paper on mapping barriers and enabling environments in Technology Needs Assessments, Nationally Determined Contributions, and Technical Assistance of the Climate Technology Centre and Network²

I. Introduction

A. Background

1. To achieve the objectives of the Paris Agreement, implementation of climate technologies is necessary on large scale and in short time. Many climate technologies are only slowly or not implemented due to multiple barriers whether policy, legal, regulatory, economic, financial, market, technical, social and others. These barriers were reported by Parties to the Convention under the TNA, NAP and other processes. These barriers are preventing technology development, deployment and transfer. The climate technology barriers are evolving in time as the technologies and their implementation is evolving. Therefore, there is a need to look at the latest barriers reported by Parties in different technology related processes. In addition to barriers identification, there is a need to look at enabling environments that may help countries overcome the existing barriers and help them in achieving climate technology development and transfer at the speed and scale required. Only such a detailed look can assist stakeholders under the Convention to consider the existing climate technology barriers and discuss possibly effective ways to overcome them.

2. The Technology Executive Committee (TEC) at its twelfth meeting held a thematic dialogue on enablers and barriers to South–South cooperation on technologies for adaptation.

3. As part of the TEC rolling workplan 2012-2013, the TEC undertook other work on enabling environments and barriers:

(a) In 2012, the TEC held two thematic dialogues on enabling environments and barriers to technology development and transfer. The TEC also held a call for inputs on this topic.³

(b) In 2013, the TEC held a thematic dialogue on research, development and demonstration;

(c) In 2013 the TEC prepared a report on barriers and enablers contained in the TNA reports of 21 developing countries. Countries submitted these reports in 2012 and 2013.⁴

4. In the TEC's 2014-2015 rolling workplan,⁵ the TEC had noted that it would initiate consideration on further work on enablers and barriers, taking into account the outcomes of the workshop on national systems of innovation. The TEC initiated this work at TEC-11.

5. The Technology Executive Committee (TEC) agreed to include in its rolling work plan 2016-2018, work stream 1, a task to map technology needs assessments (TNAs), Nationally Determined Contributions (NDCs), and technical assistance (TA) of the Climate Technology Centre and Network (CTCN) regarding enabling environments and barriers.⁶ In addition, this activity has linkages with the TEC's work on activity 15.5 of its workplan, which is to, in relation to the GEF, "Provide policy advice on measures to create enabling environments for technology development and transfer in developing countries and an analysis of the barriers that hamper project/programme implementation".

² This paper was commissioned by the Technology Executive Committee (TEC) of the United Nations Framework Convention on Climate Change (UNFCCC) and was prepared by Sara Traerup, Lucy Ellen Gregersen and Christian Skou Knudsen.

³ TEC/2013/7/10.

⁴ TEC/2013/6/10.

⁵ TEC/2015/10/12–an.III.

⁶ TEC/2016/12/13–an.

6. The TEC-16 requested its task force on TNAs to take on the work on mapping of enabling environment and barriers. This included: beginning to map barriers and enablers in NDCs and CTCN requests in 2018; presenting a concept note on a possible event on this mapping to TEC 17 for its consideration; and mapping barriers and enablers in TNAs in the first half of 2019, with a view to preparing and delivering recommendations and a TEC brief on this issue to COP 25.

B. Objectives

7. The objectives of the paper are to:

(a) Map barriers and enablers to climate technology development and transfer in TNAs, NDCs and CTCN technical assistance;

(b) Based on the mapping, identify policies and strategies to improve enabling environments and address barriers;

(c) Assist the TEC in delivering relevant key messages and recommendations to Parties through the COP 24 and the COP-25.

II. Barriers and enablers identified in NDCs, TNAs and CTCN TAs

A. Context

8. Throughout the NDCs, TNAs and CTCN TAs that have been analysed and used for data extraction, it is recognised that engagement of stakeholders at various levels are necessary and responsible for creating enabling environments.

9. From the international level, multilateral organizations frame multilateral environmental agreements and gives directions for support, while at the regional level, enabling environments such as creation of market conditions are created through regional agreements. At the local level, the involvement of individuals from household levels to private companies and industries in raising awareness among end-users of technology, implementing awareness raising, demonstration and training programmes, as well as building capacity are identified by many developing country Parties as being crucial to technology development and transfer.

10. To identify the possible role of such stakeholders, the paper presents first an analysis of data and gives an overview of the results. Secondly, the paper goes into more details on the role of each of these actors in accelerating enabling environments and hence technology development and transfer. In the following, the approach for identifying barriers and enablers for development and transfer of technologies are presented followed by an overview of the data included in the database.

B. Methodological approach and data sources

1. Approach

11. Barriers and enablers were identified based on the methodology and categorisation as outlined in the TNA Guidebook on ‘Overcoming Barriers for the Transfer and Diffusion of Climate Technologies’.⁷ These categories have also been used as standard for previous TEC work on barriers and enablers (e.g. TEC/2013/6/10).

12. The NDCs vary greatly in their descriptions of needs or barriers. Barrier and enablers in NDCs are thus mapped with broader inclusion criteria than TNAs and CTCN TAs were. Consequently, the mapping of the barriers and enablers listed in NDCs is an investigation of the barriers and enablers that Parties report as necessary for implementing their NDC through application of technologies.

⁷ UNEP DTU Partnership (2015) Overcoming Barriers to the Transfer and Diffusion of Climate Technologies. Available at: http://www.tech-action.org/-/media/Sites/TNA_project/TNA-Guidebooks/Overcoming-Barriers-to-the-Transfer-and-Diffusion-of-Climate-Technologies-2nd-Ed_FINAL.ashx?la=da&hash=9B525D1C40FA16332143AE397F56CF0C03DD4A5B

13. In the preparation of their TNAs, Parties are encouraged to follow the specific guidelines and categories as outlined in the TNA Guidebook on ‘Overcoming Barriers for the Transfer and Diffusion of Climate Technologies, and subsequently Parties identify barriers and enablers for each priority technology included in their TNA. For all technologies in TNAs several barriers are identified by Parties, spanning from 2-9 barriers, and in average 4-5 barriers per technology.

14. The CTCN TAs in most cases cover detailed technology specific initiatives at a local level. The majority of the CTCN TAs did not identify barriers and enablers for technology development and transfer.

15. Barrier and measure categories are presented in Table 1, including descriptions and examples of what can be categorised as either category.

Table 1. Barrier and Measure Categories and Descriptions

Barrier or Enabler Category	Barrier Description	Enabler Description
Economic and financial	High cost of capital, investment in technology considered risky (e.g. due to few prior local reference examples), low expected rate on return	e.g. subsidies, Standard power purchase agreements (Feed-in-tariffs), loan guarantees, green marketing (e.g. a premium tariff on ‘green’ electricity), etc.
Market conditions	Few local suppliers of auxiliary goods and services, uneven playing field (e.g. due to subsidies on competing technologies), market control by industry incumbents	Market liberalisation (e.g. by allowing competitors to the incumbent fossil-based monopoly)
Legal and regulatory	Technology opposing incumbent actors (such as utilities), insufficient legal framework, highly controlled sector, conflicts of interest, political instability, bureaucracy, rent-seeking behaviour	Obligations to generate or purchase ‘green’ electricity, Public investment policies, Regulation of financial sector institutions
Network	Weak connectivity between actors, incumbent networks being favoured, limited distribution networks	Promotion of industry associations, networks, organisations and alliances
Institutional and organisational capacity	Few professional institutions, limited institutional capacity, limited management and organisational skills	Initiatives to enhance efficiency in government procedures and processes, Capacity-building programmes of governmental agencies and institutions
Human skills	Unskilled technical personnel and inadequate training	Education policies, Publicly funded research and development and training programmes
Social, cultural and behavioural	Consumer preferences and social biases, traditions, dispersed settlements	Involving local communities and civil society, Targeted assistance to support early adopters and technology front-runners, Promotion of public-private partnerships
Information and awareness	Inadequate information, missing feedback, lack of awareness	Research, Information dissemination, outreach and awareness-raising campaigns
Technical	Poor technology quality/performance, few local reference examples	Improved access to the grid, Support for testing and demonstration facilities (including training programs), Technical standards, certification, and codes
Other	I.e. Environmental impacts, physical infrastructure conditions	Improved infrastructure

2. Data

16. With the objective to map the barriers and enablers for technology development and transfer identified by developing country Parties, data was collected from:

- (a) 133 NDCs submitted by developing country Parties to the UNFCCC NDC registry;⁸
- (b) 51 TNAs, including 590 technologies with identified barriers and enabler, available at the TNA project website⁹, and
- (c) 50 CTCN TAs downloaded from the CTCN website¹⁰ and supplemented with information from CTCN Secretariat staff.

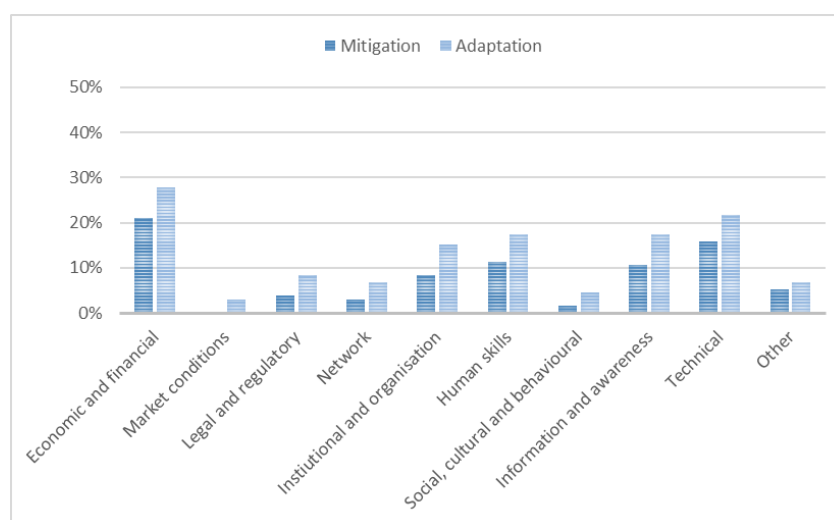
17. A complete overview of the data is provided in Annex A and an overview of the countries included in Annex B.

C. Barriers

1. Barriers listed in NDCs

18. 57 out of the 133 developing country Parties mentioned barriers related to technology development and transfer in their NDC. This corresponds to almost 43 percent of all developing country NDCs. 39 percent of the 133 NDCs list barriers for technology development and transfer in adaptation, while 32 percent list barriers for technologies in climate change mitigation.

Figure 1. Barriers identified in NDCs (percentage of all 133 NDCs)



19. For both adaptation and mitigation technologies, the economic and financial barrier stands out as the single largest barrier. Many Parties highlight that insufficient financial resources are a major obstacle for the successful implementation of their NDC, including the affordability of technologies. Following economic and financial barriers, the most frequently mentioned barriers are in the technical category. The technical barriers identified were for example weak national technical capacities or a lack of access to and availability of technologies. Following, the most common barriers are human skills, information and awareness, institutional and organisation, legal and regulatory, network, social, cultural and behaviour and market conditions.

20. Figure 1 illustrates that NDCs list barriers for adaptation technologies more frequently than for those for mitigation.

⁸ UNFCCC website at: <http://www4.unfccc.int/ndcregistry/Pages/Home.aspx>.

⁹ www.tech-action.org.

¹⁰ CTCN website at: <https://www.ctc-n.org/technical-assistance/data> www.tech-action.org.

Figure 2. Barriers to development and transfer of mitigation technologies, NDCs (percentage of all 133 NDCs)

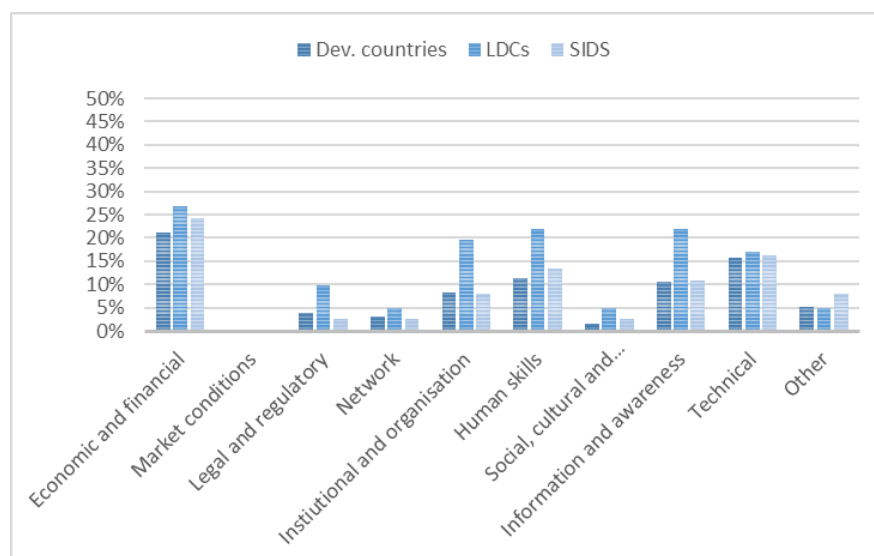
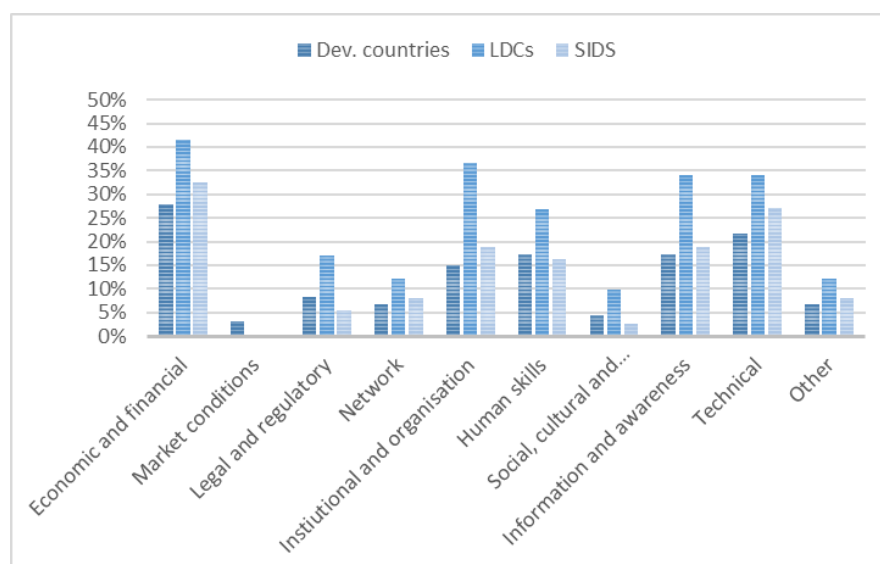


Figure 3. Barriers to development and transfer of adaptation technologies, NDCs (percentage of all 133 NDCs)



21. Across groups it is seen that SIDS and in particular LDCs identify more barriers than developing country Parties in general. This is exemplified for example in the institutional and organisation category, as well as in the information and awareness category, where the LDCs for both adaptation and mitigation identify these categories close to twice as frequent as the developing country Parties in general.

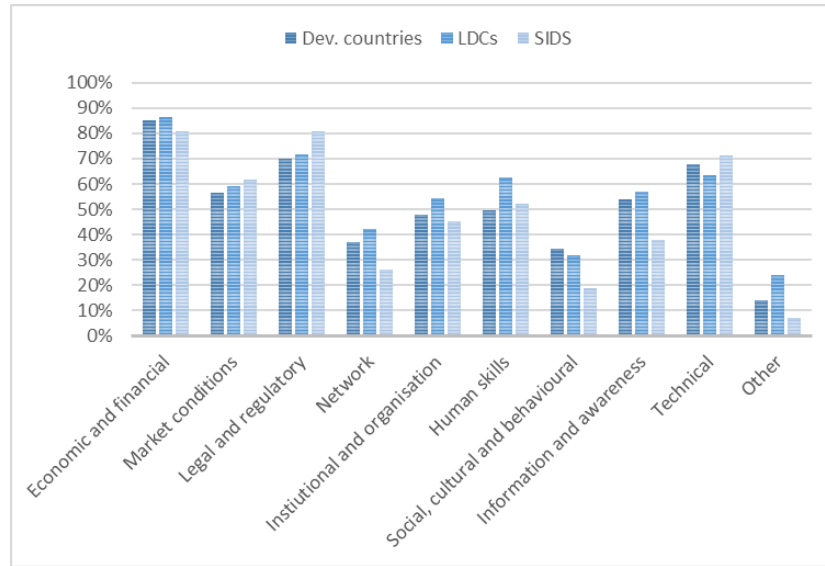
2. Overview of barriers listed in TNAs

22. For the prioritised technologies, the economic and financial barrier category is the most frequently listed barrier amongst developing country Parties in general, identified for about 85 percent of all mitigation technologies. The second most commonly identified barrier category for mitigation is legal and regulatory barriers (70-80 percent), followed by technical (64-71 percent), and human skills (50-63 percent).

23. Across developing country Parties, LDCs and SIDS, economic and financial barriers stand out as the single-most important category. This finding further emphasises that financing for climate actions in developing countries is a principal barrier, as it is pivotal to the national mitigation and adaptation efforts. When specified, economic and financial barriers are often linked to high costs of implementation, operation and maintenance, difficulty to access finance or uncertain economic

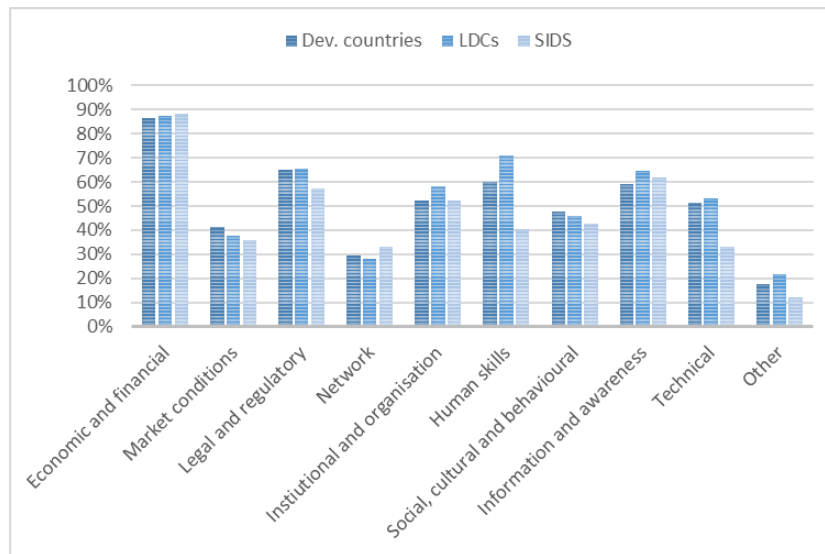
viability. Though technologies are inherently dependent or affected by national or regional conditions, specific economic and financial barriers are general to most types of technology. For instance, as a common barrier to the development of solar energy technology in a developing country, most countries, prioritising solar energy, mentioned high initial costs, interest rates or operation and maintenance costs. Despite technology improvements and decreasing prices, most Parties still identified high installation costs as a barrier. Some Parties explain how high interest rates on loans for solar technologies hinder the penetration of solar PV, while operation and maintenance costs is put forward as an additional barrier for especially small-scale, decentralized or off-grid solar PV projects.

Figure 4. Barriers to development and transfer of mitigation technologies, TNAs NDCs (percentage of mitigation technologies)



24. For none of the prioritised technologies, economic and financial barriers are listed as the only barrier, suggesting that a successful implementation of technologies is secured by not only overcoming the economic and financial barriers.

Figure 5. Barriers to development and transfer of adaptation technologies, TNAs (percentage of adaptation technologies)



3. Overview of barriers listed in CTCN TA

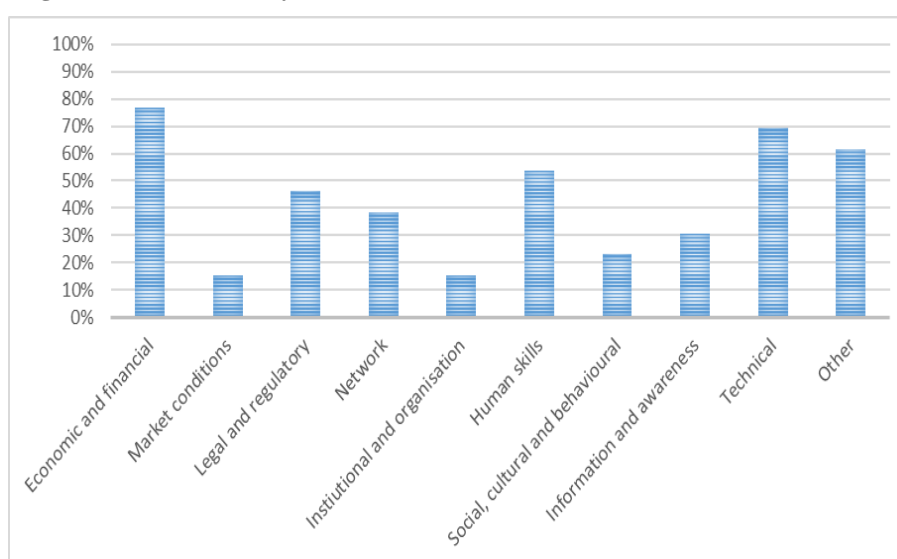
25. Out of the 50 completed CTCN TAs, which were available at the time of preparing this paper, 13 TAs identify barriers for technology development and transfer. The economic and financial category is the most frequently listed barrier being identified by 77 percent of the TAs which

identifies barriers. This is followed by the technical barriers (69 percent), human skills (54 percent), and legal and regulatory barriers (46 percent). Market conditions (15 percent) is the least common barrier identified in the TAs. Each of the 13 TAs, which identify barriers, identifies between 1 to 7 barriers with an average of 4 barriers per TA.

26. The economic and financial barriers are often described as high costs of implementation, difficulties in obtaining loans, or a general lack of access to financial resources. The second largest category, technical barriers, is often described as great difficulties in implementing and managing technologies due to a lack of technical capacities and, as exemplified by a TA for South Africa, inadequate technology designs for low carbon technologies in the cement industry.

27. Inadequate human skills, reported in 54 percent of TAs, is mentioned as limiting the implementation, maintenance and efficient operation of technologies. As an example, Thailand identifies the lack of human skills as a barrier for their ability to make use of hydraulic models to strengthen and develop their early warning systems.

Figure 5. Barriers to development and transfer of climate technologies in CTCN TAs (percentage of TAs that identify barriers)



D. Enablers

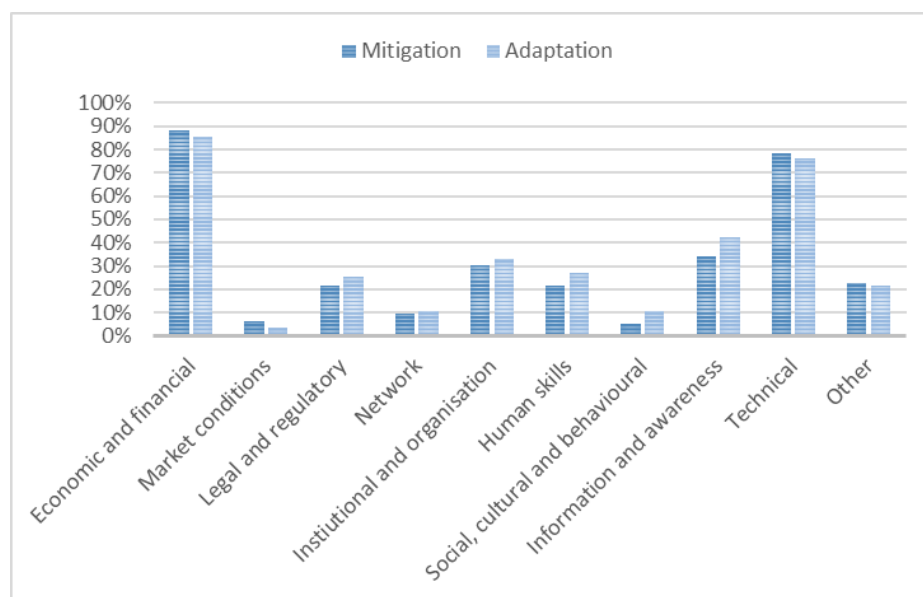
28. The enabling environment denotes the entire range of institutional, regulatory and political framework conditions that are conducive to promoting and facilitating the development and transfer of technologies. This includes the country-specific circumstances that encompass existing market and technological conditions, institutions, resources and practices, which can be subject to changes in response to government actions. Enablers may target both technology supply- and demand-side aspects of the development and transfer of technologies.

2. Overview of enablers listed in NDCs

29. For both adaptation and mitigation technologies, economic and financial enablers were listed as the most common category, being identified in over 86 percent of all the developing country NDCs. The economic and financial enablers often include the need for external financial support. The second highest ranked category of enablers was the technical category, which includes examples of publicly funded research and development, training programmes, and support for testing and demonstration facilities, including support for technology transfer in general.

30. The overview of enablers listed in NDCs (Figure 6) illustrates the commonalities in the enablers listed for mitigation and adaptation technologies respectively.

Figure 6. Enablers to technology development and transfer, listed in NDCs (percentage of NDCs)



31. Comparing enablers identified by LDCs and SIDS to all developing country Parties, both LDCs and SIDS have a higher percentage of enablers in the economic and financial group, while LDCs have the highest (90) percentage of NDCs listing enablers in the technical category, which includes capacity building.

32. For both adaptation and mitigation, a higher share of LDCs list enablers than developing country Parties as a whole.

Figure 7. Enablers listed across developing country Parties/LDCs/SIDS within Mitigation, listed in NDCs (percentage of NDCs)

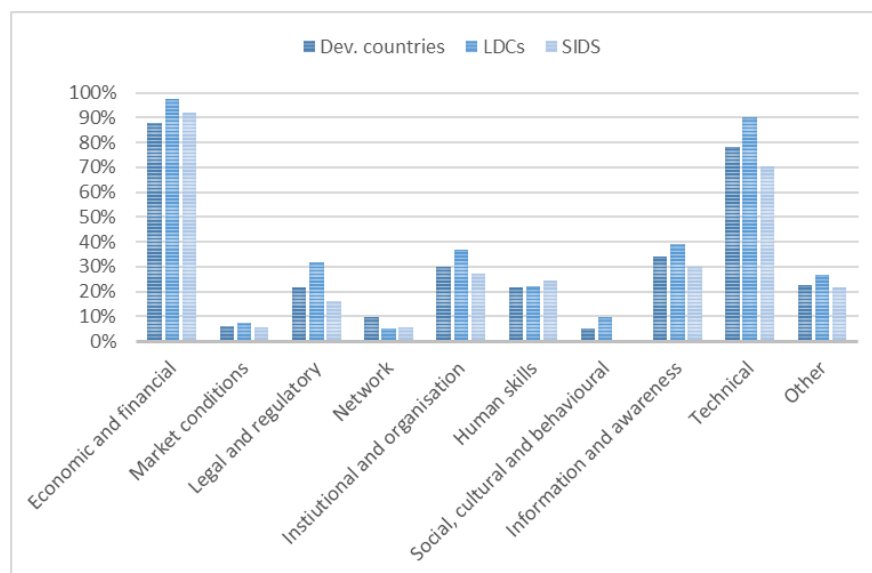
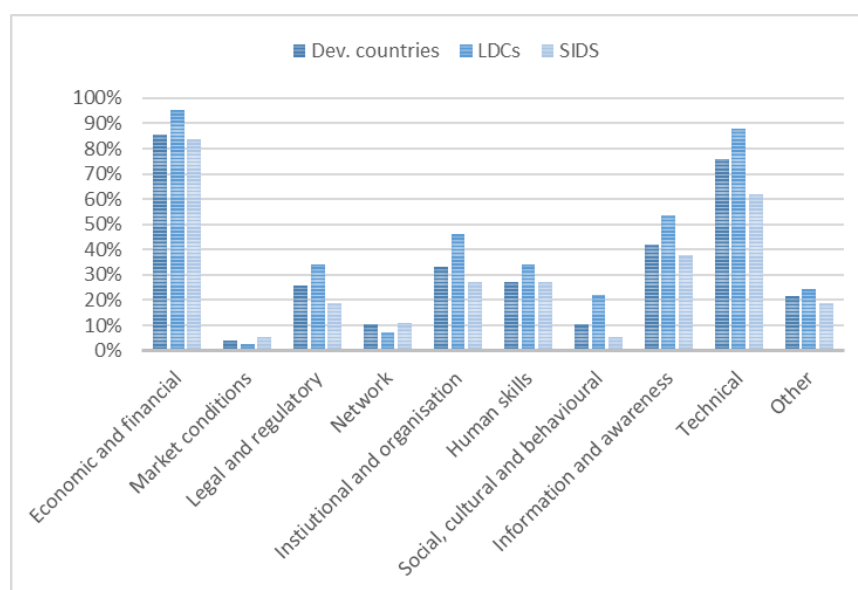


Figure 8. Enablers listed across developing country Parties/LDCs/SIDS within Adaptation in NDCs (percentage of NDCs)



3. Overview of enablers listed in TNAs

33. A total of 2831 enablers were identified in the TNA reports, with more enablers identified for technologies in climate change adaptation (54 percent) than for mitigation (46 percent).

34. The provision or expansion of financial incentives was the most commonly identified means of boosting the implementation and use of the prioritized technologies. Many Parties also specified new and improved regulations, policies and standards as a means of overcoming barriers. Other frequently mentioned enablers crossed sectors, such as establishing information and awareness programmes, providing specific skills training, as well as building capacity in institutions and organisations. For example, in order to overcome barriers to the technology development and transfer of improved drip irrigation systems, Belize suggested a wide range of enablers including economic and financial incentives, legal and regulatory strengthening, improved skills, and information and awareness raising.

Figure 9. Enablers listed in TNAs across developing country Parties/LDCs/SIDS within Mitigation (percentage of mitigation technologies)

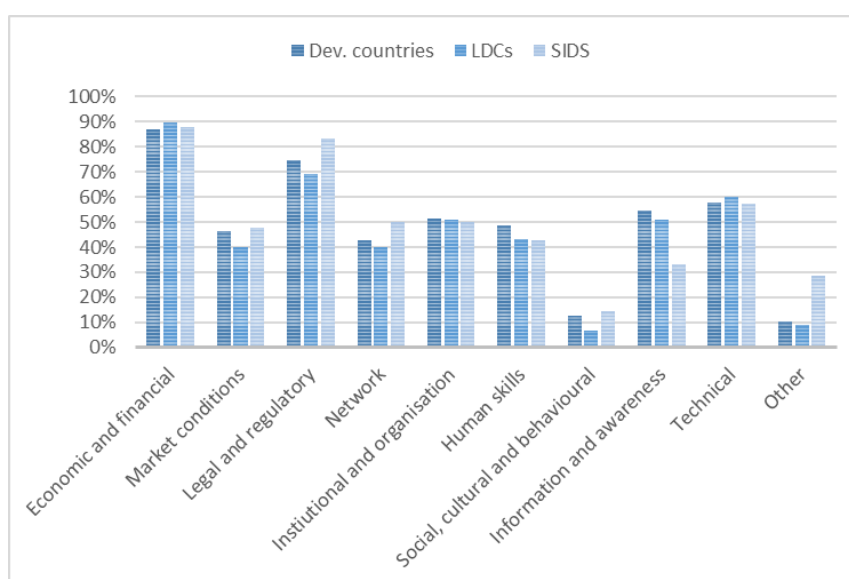
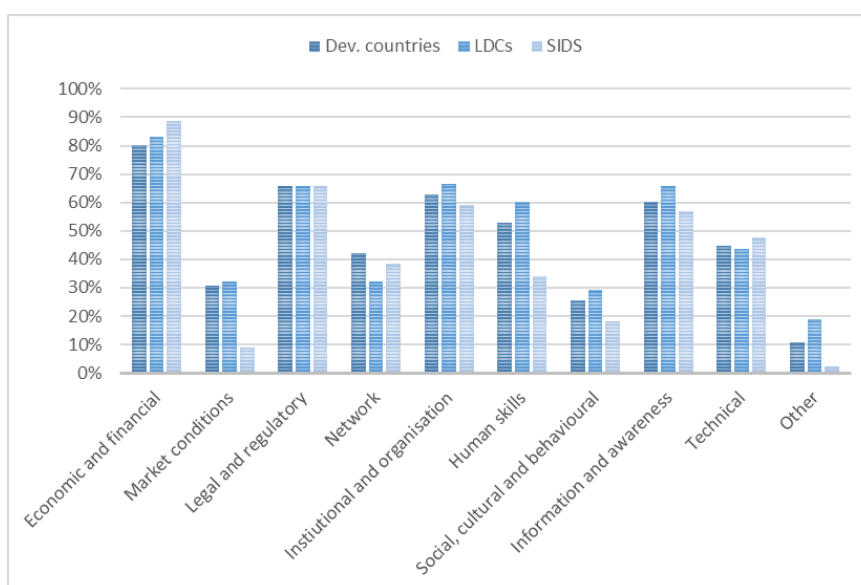


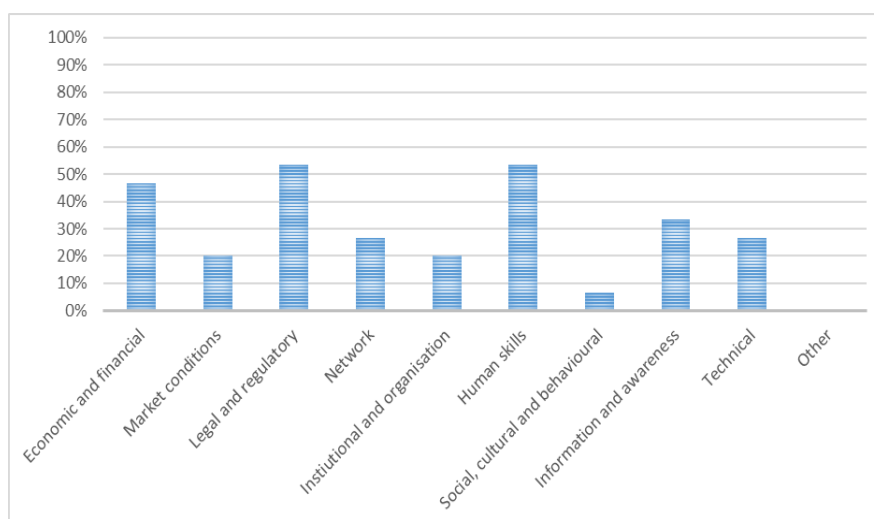
Figure 10. Enablers listed in TNAs across developing country Parties/LDCs/SIDS within Adaptation (percentage of adaptation technologies)



4. Overview of enablers listed in CTCN TAs

35. From the 50 CTCN TAs, 15 TAs list enablers to technology development and transfer. The enablers mentioned the most are in the legal and regulatory category and in the human skills category, each appearing in 53 percent of the TAs identifying enablers. Following is economic and financial (14%), information and awareness (10%), network and technical (8%), institutional and organisation (6%), social, and cultural and behavioural (2%). The 15 TAs each identify 1 to 7 enablers with an average of 2.5 enablers in each CTCN TA.

Figure 11. Enablers identified in CTCN TAs (percentage of TAs, which includes enablers)



36. The legal and regulatory enablers listed in the CTCN TAs identify needs for improved regulatory and policy frameworks, and highlight the importance of adequate policies, incentives and tax structures to facilitate the implementation of technologies. In a CTCN TA in Uganda, it is proposed to create an enabling environment for transfer of geothermal technologies through improved policy and regulatory frameworks to strengthen their position to attract finance for investments.

37. In addition, the CTCN TAs identify human capital and development of required technical capacities as key enablers to overcome the barriers of limited technical expertise which often hinders the implementation and proper management of technologies. In Columbia, a CTCN TA highlights the need for training and support programmes to efficiently monitor and evaluate climate policies and energy technologies.

38. Lastly, to overcome the barriers of limited financial resources and access to credit, the CTCN TAs express a need to attract finance and introduce new financial assistance measures. This includes i.e. improving lines of credit and introducing economic incentives. For example, the CTCN TA 'Green Cooling Africa Initiative' recommends that enablers are implemented to initialize tax reductions and appropriate subsidies.

E. Common barriers and enablers

39. The analysis of the data on barriers to technology development and transfer from the developing country NDCs, TNAs, and CTCN TAs show that most barriers experienced across all documents are listed in the economic and financial category. Similarly, the most frequently identified enablers across all documents are in the economic and financial category.

40. Common economic and financial barriers include high initial cost of technologies, difficulties in obtaining loans, uncertainties for return on investments, and a general lack of financial resources. Specifically, the barriers listed for some technologies at household level are high up-front costs, and high capital costs, also combined with high import taxes. Enablers to overcome these barriers include macro-economic policies that encourage savings, thereby increasing disposable income, though this may not lead to a guaranteed purchase and implementation of more climate technologies.

41. Technical barriers are also commonly listed across the three data sets. The technical barriers include the lack of access to technologies and insufficient technical capacities. For example, a technology, may require major changes in the existing infrastructure before it can be implemented.

42. Inadequate human skills, institutions, and organisations, as well as information and awareness are also frequently identified barriers across all developing country Parties. To overcome these barriers, Parties highlight the need to enhance capacities by strengthening the structures, competencies and resources of individuals, institutions, organisations and sectors.

43. Many developing country Parties report on legal and regulatory barriers. The lack of appropriate legal and regulatory frameworks hinders the introduction and implementation of climate technologies. This highlights a need for improved and strengthened policy frameworks to facilitate the implementation of technologies.

Figure 12. Barriers to development and transfer of climate technologies across NDCs, TNAs and CTCN TAs (percentage of each NDCs, TNAs, and CTCN TAs that identify barriers)

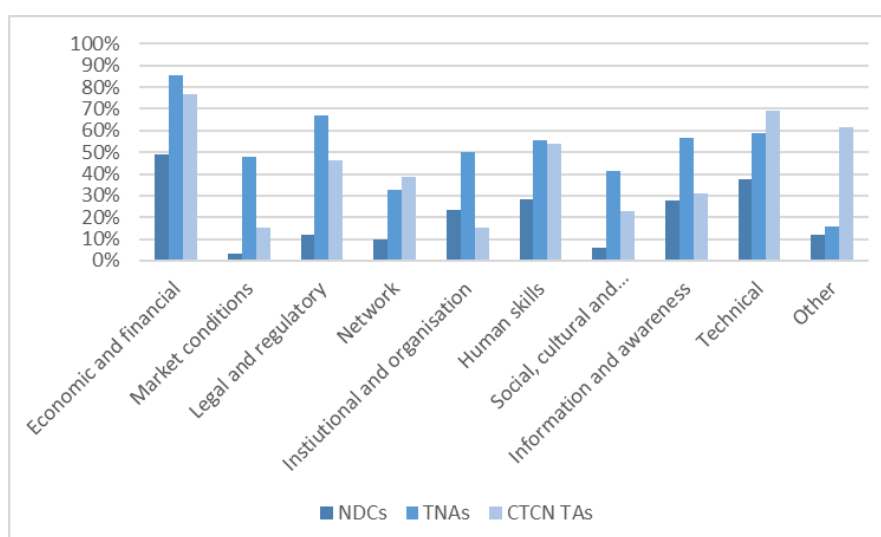
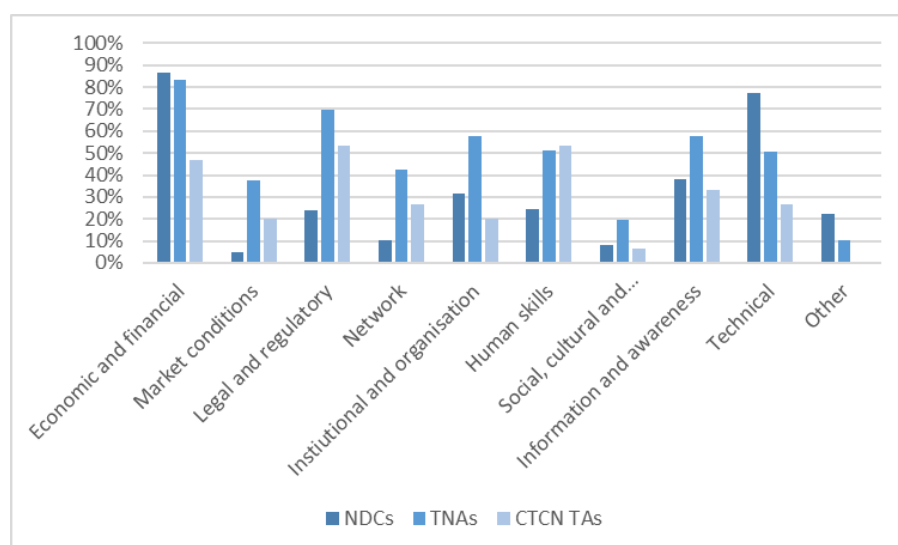


Figure 13. Enablers to development and transfer of climate technologies across NDCs, TNAs and CTCN TAs (percentage of each NDCs, TNAs, and CTCN TAs that identify enablers)



44. Across the three data sets (NDCs, TNAs, CTCN TAs), developing country Parties emphasized financial assistance as a key enabler. The recognized that financial assistance is needed and should be aimed at increasing the mobilization and transfer of financial resources drawn from public, private and alternative sources.

45. In addition to financial resources, systematic/structural changes also have to take place to facilitate the development and transfer of technologies. Subsidisation is often listed as a key main enabler of technology transfer. The creation of enabling frameworks in the economic and financial sectors through regulation and policies are by most developing country Parties identified as necessary to assist with the development and transfer of new technologies.

F. Policies, strategies and programmes to improve enabling environments and address barriers for technology transfer

46. Considering the multidimensional nature of the barriers identified for technology development and transfer, the creation of enabling environments are processes deeply imbedded in differing social, economic, and development contexts. This also implies that technology transfer should not be understood as a one-off event, but as an ongoing a process that depends upon, and influences, other ongoing national and international processes.

47. In this section, examples of policies, strategies and initiatives identified by developing country Parties as enablers for technology development and transfer are provided with a view to consider and possibly enhance existing enabling environments to tackle the commonly identified barriers listed in NDCs, TNAs and CTCN TAs.

1. Governments

48. Limited funding levels are typically listed as the main obstacle to technology transfer across NDCs, TNAs, and CTCN TAs. This is supplemented with barriers identified through missing or inadequate regulatory and institutional frameworks, market conditions, institutional and organisational capacity and with barriers in the technical category, where the latter includes capacity building. Hence, governments have a major role to play in creating enabling environments to address these barriers. Examples of enablers related to government action are listed in Table 2.

49. From the analysis, there is a clearly identified need for strengthening of legal and regulatory frameworks for international technology transfer and foreign financial flows, including introducing market based instruments for market development. Thus, macro-economic policy frameworks play a central role in creating enabling conditions for technology transfer.

Table 2: Examples of key enablers for technology transfer related to role of governments, identified by countries

Category	Role of governments, identified by countries
Economic and financial	Reform tariff regulations and remove cross subsidies; Establish incentives for the rational use of resources and good production practices;
Market conditions	Regular review and monitoring of policy; Changing of national laws and policies, including municipal laws; Make support policies for the deployment of the technology;
Legal and regulatory	Policies to enforce land utilization and avoid conflicts between farmers; Revise policy framework to improve access to and secure land property; Encourage the approval of the regulatory framework and/or laws related to technology;
Institutional and organisational capacity	Development and inclusion of a Monitoring and Evaluation mechanism into an existing system to monitor and evaluate transfer and diffusion of knowledge; Review government policy in investment activity, including activities of the banks in order to make it more attractive to invest means of adaptation; Set up an industrial association of private promoters;
Human skills	Strengthen existing institutions to promote and enhance climate technologies; Enhance knowledge base and adequate resources to the R&D departments; Promote synergy between state agencies, R&D institutes and universities;
Information and awareness	Use radio programmes and other media to inform about technologies; Elaborate and implement a policy which prepares information and databases for decision making; Promote research and development programmes National testing laboratory for new technologies;
Technical	Formulate detailed regulations and standards for the technology; Establish quality control system and facilitate certification system;

2. Operating entities of the Financial Mechanism

50. The data lists numerous enablers related to the role of the operating entities of the Financial Mechanism. An overview of key issues is provided in Table 3 and elaborated further in the following.

51. Strategic interventions to strengthen collaboration between operating entities of financial mechanism, private sector entities and local and national governments needs to be further strengthened. This can be done through cost-effective combinations of policy and financial de-risking instruments and targeted financial incentives to address market barriers and achieve a risk-return profile for technologies that can attract private investments.

52. International support, through financial means, leveraging other resources plays a crucial role in stimulating markets. A recent example, built on the needs identified in countries' TNAs, includes the creation of a new investment fund,¹¹ to drive off-grid solar power in East Africa. The fund aims to invest in 10-15 clean energy companies providing household solar technologies using equity capital from GCF to leverage investment, and grant capital to set up a technical assistance facility.

53. Support to programmes for strengthening of institutional and scientific capacities of developing country Parties, in particular for LDCs, is critical for creation of the long-term enabling frameworks required for technology transfer

¹¹ <https://www.greenclimate.fund/-/kawisawi-ventures-fund-in-east-africa>

54. For further stimulating the transition to enhance enabling framework conditions for technology transfer, a combination of market stimulation and human capacity development is identified as key by developing country Parties.

Table 3: Examples of key enablers related to the activities of operating entities of the Financial Mechanism, identified by countries

Category	Role of operating entities of the Financial Mechanism, identified by countries
Economic and financial	<p>Increase access to funds to finance adaptation measures;</p> <p>Ease access to capital through dedicated low interest credit lines from international development banks;</p> <p>Create credit risk guarantee and venture funds to enhance finance flow using public fund and international funds;</p> <p>Develop financial instruments such as credit facilities, tax concessions and subsidies;</p> <p>Use domestic and international funding sources to provide incentives for promoting public private partnerships;</p> <p>Adapt finance conditions to local context, (lower interest rates, less restrictive warranty, etc.);</p> <p>Improve access to international funds for technology pilot implementation;</p> <p>Simplify the procedures for accessing investments in the technology;</p> <p>Develop specific subsidy mechanisms to promote technology applications;</p> <p>Promote funding through private investors.</p>
Network	<p>International cooperation and support for technology project plan, design and construction;</p> <p>Develop and strengthen inter-agency coordination and work;</p> <p>Facilitate existing/establish networks of technology relevant stakeholders.</p>
Institutional and organisational capacity	<p>Provide assistance to relevant government agencies to prepare suitable management plans for technology implementation.</p>
Human skills	<p>Capacity building and strengthening for national and sub-national level.</p>
Information and awareness	<p>Support technology feasibility studies and technology data bases;</p> <p>Sharing experience (best practices) of other countries in the using of the technology.</p>

3. Non-state actors

55. To create conducive enabling frameworks for technology diffusion and transfer, governments may set the broad policy framework, or use tools such as fiscal incentives and legal instruments. However, other stakeholders including the private sector, NGOs, academia and other community actors are equally important in providing financial resources, increasing technical capacities and disseminating information. Examples of the role of these actors in creating enabling environments for technology development and transfer, as identified by countries, are provided in Table 4.

Table 4: Examples of key enablers related to the activities of Non-state actors, identified by countries

Enabler Category	Role of operating entities of the Financial Mechanism, identified by countries
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Network	Creating network of experts and generate updated knowledge
Institutional and organisational capacity	Participation of local people in the planning and designing of projects and programmes; Strengthen institutional capacity (staff training, equipment support, review of existing staff structure for engineering works, etc)
Human skills	Establish research collaboration between organizations, especially at the regional and international level
Social, cultural and behavioural	Research on background information relating to local cultural, and socio-economic dimensions; Establish what the local needs of communities are with regards to the technology; Engage community development specialists;
Information and awareness	Awareness raising at community level to show the importance of new technology; Generate a participative climate monitoring scheme which generates confidence in the community; Organize discussions on technology at local level
Technical	Community capacity building workshops;

III. Key findings

56. The findings indicate that economic and financial barriers are central to climate actions, though efforts to realize identified technologies should not target the barrier narrowly as a single-causality issue. Instead, multifaceted actions are recommended taken, ensuring that all barriers hindering successful development and transfer are targeted.

57. In summary, the data on barriers showed that:

(a) The most commonly listed barriers are in the categories of economic and financial, legal and regulatory, human skills, information and awareness, and technical barriers.

(b) Economic and financial barriers feature more predominantly for adaptation technologies than for mitigation technologies;

(c) A larger share of LDCs lists barriers for technology development and transfer than is the case for developing country Parties and SIDS. This is even more pronounced for adaptation technologies than for mitigation technologies;

(d) Inadequate human skills are more commonly listed as a barrier for LDCs than for developing country Parties and SIDS.

58. In summary, the data on enablers showed that:

(a) In NDCs, the majority of enablers for overcoming the barriers for technology development and transfer are identified in the economic and financial category, as well as in the technical category, which includes capacity building;

(b) In TNAs and CTCN TAs, the distribution of enablers is more widespread than in NDCs and includes the categories of economic and financial, legal and regulatory, human skills, information and awareness, and technical enablers;

(c) A larger share of LDCs lists enablers for technology development and transfer than is the case for developing country Parties and SIDS.

59. These findings are well along the lines of the previous work from the TEC,¹²¹³ on barriers and enabling environments to technology development and transfer, which highlighted the need to

- (a) Engage the financial and business community to enhance access for financing;
- (b) Strengthen collaboration on research and development;
- (c) Find efficient ways of developing national capacities; and
- (d) Initiate activities related to policy and regulatory frameworks.

60. Numerous barriers are identified related to missing or inadequate regulatory and institutional frameworks, market conditions, institutional and organisational capacity and with barriers in the technical category, where the latter includes capacity building. Hence, governments have a major role to play in creating enabling environments to address these barriers.

61. Furthermore, the key findings point to crucial role of the operating entities of the Financial Mechanism in establishing strategic interventions for strengthened collaboration between operating entities of financial mechanism, private sector entities and local and national governments. It also highlights the importance of the Financial Mechanism to leverage resources from the private sector in order to stimulate markets for technology transfer.

62. Lastly, developing country Parties identify a combination of enablers for market stimulation and human capacity development as key to strengthen institutional and scientific capacities, in particular for LDCs, to create long-term enabling frameworks required for technology transfer.

IV. Key messages

63. From the findings presented in this paper, following key messages are suggested:

(a) Support to capacity building programmes for strengthening institutional and scientific capacities of developing country Parties, in particular for LDCs, are critical for creation of the long-term enabling frameworks required for technology transfer.

(b) Strategic interventions to strengthen collaboration between operating entities of financial mechanism, private sector entities and local and national governments should to be further strengthened.

64. In addition, the TEC recommends that the COP encourages:

(a) the TEC, the CTCN, the GEF, the GCF and other stakeholders to collaborate in identifying effective policies, instruments and collaboration forms that support Parties, particularly developing country Parties, and other partners in their efforts to create enabling frameworks for technology development and transfer.

65. The TEC recommends that the COP:

(a) Invites the operating entities of the Financial Mechanism to consider how to more effectively support enabling activities as identified by developing country parties in their NDCs, TNAs and CTCN TAs.

V. Issues for further consideration

66. The TEC may develop a comprehensive understanding of common barriers to and enabling environments for climate technology development and transfer as identified by developing countries. This may help the TEC to identify key work areas for its future workplan. This may include as related to its work areas on, inter alia, mitigation and adaptation technologies, climate technology financing, and innovation.

In addition, the TEC may further follow up on its work on barriers and enablers as needed in order to provide inputs for implementation of climate technologies to support the Paris Agreement.

¹² TEC/2013/7/10.

¹³ TEC/2013/6/10.

Annex II

Concept note on mapping event

1. Concept note for event, based on the 'draft paper on Barriers and enabling environments in Technology Needs Assessments, Nationally Determined Contributions, and Technical Assistance of the Climate Technology Centre and Network
2. **Suggested event title: Strengthening enabling environments for technology development and transfer for implementation of the Paris Agreement**
3. The event could be organized as an in-session event of 2 hours, or it could be organized as a whole day event. Number of sessions and presentations can be adjusted accordingly.

I. Background

4. The Paris Agreement sets out a global action plan to put the world on track to avoid dangerous climate change by limiting global warming to well below 2°C. The Agreement opens up for international collaborations that brings together Governments, civil society, the private sector, the United Nations system and other actors and mobilizes all available resources for the transition of economies to low emission climate resilient development paths. In the lead up to the Paris agreement countries prepared their Nationally Determined Contributions. After the ratification of the Agreement, countries now have to deliver their contributions, which are partly voluntary and partly conditional. In going forward, developing countries have technology development and transfer as one of the key pillars to an effective international response to climate change, with requirements for support on finance and capacity building.
5. The Technology Executive Committee (TEC) agreed to include in its rolling work plan 2016-2018, work stream 1, a task to map technology needs assessments (TNAs), Nationally Determined Contributions (NDCs), and technical assistance of the Climate Technology Centre and Network (CTCN) regarding enabling environments and barriers.¹⁴
6. The findings of this mapping indicate that economic and financial barriers are central to climate actions, though efforts to realize identified technologies should not target the barrier narrowly as a single-causality issue. Instead, multifaceted actions are recommended taken, ensuring that all barriers hindering successful development and transfer are targeted. Furthermore, to stimulate technology development and transfer beyond current levels, the results of the mapping point to the necessity of articulating and presenting opportunities, beyond a discussion of technology hardware and financing, including revisions in related policy and the broader regulatory enabling frameworks. This further leads to private investors, technology suppliers and consumers being key actors that governments and state agencies must engage with to create, steer and scale up markets for technologies.
7. This event will focus on discussing experiences and identifying future activities to accelerate enablers for technology development and transfer, including the role of the operating entities of the Financial Mechanism, Governments, the private sector and other non-state actors.

¹⁴ TEC/2016/12/13-an.

II. Agenda

A. Opening and rationale

- (a) Including an overview of barriers and enablers identified in NDCs, TNAs and Technical Assistance of the CTCN (presentation by the TEC)

1. Session I: Support

- (a) This session discusses how current support relate to the enablers identified by Parties and presented in the draft paper on barriers and enablers, as necessary for technology development and transfer. The session further elaborates on what the opportunities are for accessing further support to accelerate enablers.
- (b) Presentations by the operating entities of the Financial Mechanism, donors, the Technology Bank for LDCs,¹⁵ other development banks.

2. Session II: Experience sharing

- (a) Senegal: Government has taken proactive steps to a wider uptake of climate technologies such as establishing a feed-in tariff system for renewable energy technologies.
- (b) Ghana, Kenya, Mauritius and Namibia: The CTCN Technical Assistance 'Green Cooling Africa Initiative' identify the most suitable green refrigeration and air conditioning technologies, and develop supportive policy measures for technology transfer.
- (c) Private sector representatives (e.g. Thyssenkrupp): examples of how it operates in developing countries and what the needed actions are to a) create enabling policy and regulatory environments that help facilitate private climate investments in developing countries, and b) ensure implementation of working solutions and not just building plants and equipment.
- (d) Civil society, NGOs: provides examples from micro loan programme, capacity building initiatives etc.

3. Session III: Break out groups, incl. reporting back

- (a) Participants gathered in small groups will share experiences, discuss and consider how to accelerate enablers for climate technology development and transfer in developing countries for achieving the goals of the Paris Agreement. Specific questions for each group will be distributed.
- (b) The breakout groups will report back to the plenary and there will be an open discussion with all participants to identify means to accelerate creation of enabling framework conditions for climate technology development and transfer in developing countries.

B. Closing

¹⁵ <https://unohrlls.org/technologybank/>

Annex III

I. Overview of data

A. NDCs

Overview of barriers identified in developing country NDCs (133 NDCs)			
Category	Barriers		
	Total	Mitigation	Adaptation
Economic and financial	65	28	37
Market conditions	4	0	4
Legal and regulatory	16	5	11
Network	13	4	9
Institutional and organisation	31	11	20
Human skills	38	15	23
Social, cultural and behavioural	8	2	6
Information and awareness	37	14	23
Technical	50	21	29
Other	16	7	9
Total	278	107	171

Overview of enablers identified in developing country NDCs (133 NDCs)			
Category	Enablers		
	Total	Mitigation	Adaptation
Economic and financial	231	117	114
Market conditions	13	8	5
Legal and regulatory	63	29	34
Network	27	13	14
Institutional and organisation	84	40	44
Human skills	65	29	36
Social, cultural and behavioural	21	7	14
Information and awareness	101	45	56
Technical	205	104	101
Other	59	30	29
Total	869	422	447

B. TNAs

1. 51 developing country countries' TNAs were included in the data set. In the TNAs, barriers and enablers were identified for 590 technologies. From these 590 technologies, 268 technologies were in the category of mitigation and 321 in the category for adaptation.

Overview of barriers identified in TNAs						
(51 TNAs)						
Category	Developing country Parties		SIDS		LDCs	
	Mitigation	Adaptation	Mitigation	Adaptation	Mitigation	Adaptation
Economic and financial	228	277	34	37	76	84
Market conditions	151	132	26	15	52	36
Legal and regulatory	187	209	34	24	63	63
Network	99	94	11	14	37	27
Institutional and organisation	128	168	19	22	48	56
Human skills	133	193	22	17	55	68
Social, cultural and behavioural	92	153	8	18	28	44
Information and awareness	145	190	16	26	50	62
Technical	182	165	30	14	56	51
Other	38	56	3	5	21	21
Total	1383	1637	203	192	486	512

Overview of enablers identified in TNAs						
(51 TNAs)						
Category	Developing country Parties		LDCs		SIDS	
	Mitigation	Adaptation	Mitigation	Adaptation	Mitigation	Adaptation
Economic and financial	233	258	79	80	37	39
Market conditions	124	98	35	31	20	4
Legal and regulatory	200	211	61	63	35	29
Network	115	135	35	31	21	17
Institutional and organisational	138	202	45	64	21	26
Human skills	130	170	38	58	18	15
Social, cultural and behavioural	34	82	6	28	6	8
Information and awareness	146	194	45	63	14	25
Technical	155	144	53	42	24	21
Other	28	34	8	18	12	1
Total	1303	1528	405	478	208	185

C. CTCN TAs

Overview of barriers and enablers identified in CTCN Technical Assistances (50 CTCN TAs)		
Category	Barriers	Enablers
Economic and financial	10	7
Market conditions	2	3
Legal and regulatory	6	8
Network	5	4
Institutional and organisation	2	3
Human skills	7	8
Social, cultural and behavioural	3	1
Information and awareness	4	5
Technical	9	4
Other	8	0
Total	56	43

D. Overview of countries included in the analysis

Country	NDC	TNA	CTCN
Afghanistan	x		x
Albania	x		x
Algeria	x		x
Andorra	x		
Antigua and Barbuda	x		x
Argentina	x	x	
Armenia	x	x	
Azerbaijan	x	x	
Bahamas	x		
Bahrain	x		
Bangladesh	x	x	
Barbados	x		
Belize	x	x	
Benin	x		
Bhutan	x	x	x
Bolivia	x		

Country	NDC	TNA	CTCN
Bosnia and Herzegovina	x		x
Botswana	x		
Brazil	x		
Burkina Faso	x	x	
Burundi	x	x	
Cabo Verde	x		
Cambodia	x	x	
Cameroon	x		
Central African Republic	x		
Chad	x		
Chile	x		x
China	x		
Colombia	x	x	
Comoros	x		
Congo	x		
Cook Islands	x		
Costa Rica	x	x	x
Cote D'Ivoire	x	x	x
Cuba	x		
Democratic People's Republic of Korea	x		
Democratic Republic of the Congo	x		
Djibouti	x		
Dominica	x		
Dominican Republic	x	x	x
Ecuador		x	x
Egypt	x		
El Salvador	x	x	
Eritrea	x		
Eswatini	x		
Ethiopia	x		
Fiji	x		
Gabon	x		

Country	NDC	TNA	CTCN
Gambia	X		
Georgia	X	X	
Ghana	X	X	X
Grenada	X	X	
Guatemala	X	X	
Guinea	X		X
Guyana	X	X	
Haiti	X		
Honduras	X	X	X
India	X		
Indonesia	X	X	X
Iran			X
Israel	X		
Jamaica	X		
Jordan	X	X	X
Kazakhstan	X	X	
Kenya	X	X	X
Kiribati	X		
Kuwait	X		
Lao People's Democratic Republic	X	X	X
Lebanon		X	
Lesotho	X		
Madagascar	X	X	X
Malawi	X		
Malaysia	X		
Maldives	X		
Mali	X	X	X
Marshall Islands	X		
Mauritania	X	X	X
Mauritius	X	X	
Mexico	X		
Micronesia	X		

Country	NDC	TNA	CTCN
Mongolia	X	X	
Montenegro	X		
Morocco	X	X	
Mozambique	X	X	X
Myanmar	X		
Namibia	X		X
Nauru	X		
Nepal	X		
Niger	X		
Nigeria	X		
Niue	X		
Pakistan	X	X	X
Palau	X		
Panama	X	X	
Papua New Guinea	X		
Paraguay	X		
Peru	X	X	
Qatar	X		
Republic of Korea	X		
Republic of Moldova	X	X	
Rwanda	X	X	
Saint Kitts and Nevis	X		
Saint Lucia	X		
Saint Vincent and Grenadines	X		
Samoa	X		
Sao Tome and Principe	X		
Saudi Arabia	X		
Senegal		X	X
Serbia	X		
Seychelles	X	X	X
Sierra Leone	X		
Singapore	X		

Country	NDC	TNA	CTCN
Solomon Islands	x		
Somalia	x		
South Africa	x		x
Sri Lanka	x	x	
State of Palestine	x		
Sudan	x	x	
Syrian Arab Republic		x	
Swaziland		x	x
Tajikistan	x		
Thailand	x	x	x
The Former Yugoslav Republic of Macedonia	x		
Timor-Leste	x		
Togo	x	x	
Tonga	x		
Trinidad and Tobago	x		
Tunisia	x	x	
Turkmenistan	x		
Tuvalu	x		
Uganda	x		x
United Arab Emirates	x		
United Republic of Tanzania	x	x	
Uruguay	x	x	
Vanuatu	x		
Venezuela	x		
Vietnam	x	x	x
Zambia	x	x	
Zimbabwe	x		x