

国連主導の技術ニーズ評価（TNA）の分析と低炭素技術移転に向けた 課題と提言

Can United Nations lead low-carbon technology transfer? Analysis of the technology needs
assessment (TNA) and recommendations for improvements

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要旨

1. はじめに

2001年の国連気候変動枠組条約（UNFCCC）第7回締約国会議（COP7）にて、途上国において技術ニーズ評価（TNA）を行うことが決定した。2009年から開始した「第一期グローバルTNA」では、地球環境ファシリティ（GEF）の資金提供により国連環境計画（UNEP）が主導し、2013年までに36カ国におけるTNAが実施された。2012年COP18では、途上国の技術ニーズに応えるため、気候技術センター・ネットワーク（CTCN）と呼ばれる仕組みが設立された。CTCNはUNFCCCの下で気候変動対策に資する技術移転を促進するための国際メカニズムであり、国連環境計画（UNEP）を中心に13の機関によって運営されている。一方、気候変動における技術移転の必要性は以前から指摘されているものの、国際的な低炭素技術移転は必ずしも成功しているとは言えない。そこで、本稿ではUNEPによるTNAのプロセスにおける課題を分析し、今後実施されるTNAの改善点を示すと共に、CTCNとの連携を強化し、低炭素技術移転の促進に向けた課題を検討する。

2. 分析方法

本稿では国連環境計画が主導して行った技術ニーズ評価（TNA）のプロセスに関して、アジアの途上国8カ国を対象としてインタビュー調査を行い、その結果を基に、TNAのプロセスおよび各国における課題や成功要因、その後の技術移転に関する対応について分析した。特に、TNAの実施の際のトレーニングや方法論の理解、関係者間の協議の実施に関する課題、TNA結果やその後の技術行動計画（TAP）の策定後に、国内でどのような対応がとられたかを調査した。インタビュー調査は、2014年にバングラデシュ、カンボジア、インドネシア、モンゴル、ネパール、スリランカ、タイ、ベトナムにて実施し、主にTNAに関わった政府関係者やステークホルダーに対して、対面・質問紙によるインタビューを実施した。

また、CTCNの制度がどのように低炭素技術移転に資することが可能かという観点から

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分析を行った。なお、本稿は「技術移転」の定義を気候変動に関する政府間パネルによる「政府、民間部門主体、金融機関、NGO、研究／教育機関などのさまざまな利害関係者」の間の、気候変動の緩和と適応のための知識、経験、設備の流れを対象とする幅広いプロセス（IPCC 2000）として論じる。これには、ハードウェアとして技術を他国に導入するにとどまらず、技術を学習し、現地の状況に合わせて修正を行うプロセスや政策作り、能力開発も含まれる。

3. 分析結果

インタビュー調査の結果、各国は示されたガイドラインに沿ってプロセスを進める努力をし、関係者協議を行った上で技術ニーズを評価したことが示唆された。また、対象とした8カ国のうち7カ国にてTNAを基に技術行動計画（TAP）の策定も行われていた。一方で、TNAに関わった関係者からは、TNA報告書の完成やTAPの策定状況について不案内であり、十分な国内フォローアップが行われていないことも明らかになった。

また、TNAプロセスの共通課題として以下の点が挙げられた。1)TNAハンドブックの読解が困難でプロセスの実施が容易でなかった。2)マルチ・クライテリア分析の方法論が複雑で実施が困難であった。3)TNAプロセス（ワークショップや協議）への関係者の出席が継続的でなく、見解の継続性にも影響が出た。4)技術の選択や優先順位付けが主観的に行われた。5)各セクターにおける準備や協議の時間が限定的であった。6)民間セクターおよび金融機関からの参加が限定的であった。

4. 結論

分析の結果、TNAのガイドラインに関するトレーニング不足および情報提供のあり方が課題であることが示唆された。TNAおよびTAP策定が実施されたものの、プロセスに参加する関係者の選択方法、民間セクターや技術移転の際に重要となる資金提供に係る金融機関などからの参加が限定的であったため、当該国の選択した技術が必ずしも実態に沿っていない状況も示された。一方、技術ニーズが明らかになったものの、その後のフォローアップがなされていない例が多く、CTCNなどを活用することで技術の導入及び運用等に関する能力構築を行い、技術移転につなげられる可能性が示唆された。

TNAプロセスの改善点として、まず、方法論のトレーニング受講者をプロセスに参加する全員に拡大することが挙げられる。また、初期段階から民間セクターや金融関係者を巻き込むことで特定された技術の導入に向けた対応がスムーズに行われることが求められる。これには、TNAおよびTAPを活用する意義が示されること、政治的な認知度が高められることが重要であり、TNAを基にCTCNへの技術移転要請が行われることやTNAやTAP結果の国内周知、技術移転に向けた政府の体制作りが重要である。特に後発開発途上国などを中心にトレーニングを実施し能力開発を行うことは有益であると考えられる。

本論

1. Introduction

In 2001, the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC), at its 7th meeting in 2001, adopted “the framework for meaningful and effective actions to enhance the implementation of Article 4, paragraph 5, of the Convention,....., as part of the outcome of the technology transfer consultative process (decision 4/CP.4) and the Buenos Aires Plan of Action (decision 1/CP.4); a framework to implement the Article 4.5 of the UNFCCC.”(decision 4/CP.7)ⁱ. Based on this decision, technology needs assessment (TNA) took place in the developing countries. The purpose of the TNA is “to assist developing countries to identify and analyse their priority technology needs, which can be the basis for a portfolio of environmentally sustainable technology (EST) projects and programmes. This may facilitate the transfer and access to ESTs and know-how.”ⁱⁱ The first phase global TNA was conducted between 2009 and 2013 and was led by the United Nations Environmental Programme (UNEP), supported by the Global Environment Facility (GEF). Since its start, 78 developing countries have completed their TNAs. At COP18 in 2012, in order to respond to the technology needs of the developing countries, technology mechanism was established under the UNFCCC. The Climate Technology Center and Network (CTCN) and the Technology Executive Committee (TEC) are the two arms of this mechanism. CTCN, the operational arm of the Technology Mechanism, consists of the Secretariat, the CTCN Consortium, which is the host of technology center comprised of a group of 13 institutions led by UNEP, National Designated Entities (NDEs), which serve as focal points to the CTCN, and the networkⁱⁱⁱ. The main objectives of the CTCN is to providing technical assistance in order to accelerate climate technology transfer, through enhanced access to information; fostering collaboration among providers of climate technologies and those who seek them, upon request submitted from the developing countries’ NDEs^{iv}. Although the needs to promoting technology transfer to address climate change has been long been pointed out, the international low carbon technology transfer has not been as successful as hoped for. As such, this paper analyzed the challenges observed in the TNA process, suggest improvements for the future TNA, and discusses how the link between TNA and CTCN can be improved towards a further promotion of low carbon technology transfer under the UNFCCC.

Analysis of the processes and results of TNA and TAP was conducted in eight Asian countries: Bangladesh, Cambodia, Indonesia, Mongolia, Nepal, Sri Lanka, Thailand and Vietnam. Interviews were conducted with stakeholders involved (as well as some not involved) in the

process, and feedbacks were received from stakeholder involved in the TNA and TAP processes. These feedbacks included success stories, best practices, lessons learned, and challenges from TNA Phase I. Interviews were conducted through country visits and follow up correspondence by IGES researchers. Key issues analysed through this study include: 1) Institutional arrangement and stakeholder involvement; 2) Sector and technology prioritisation; 3) Main barriers and challenges in conducting TNA and their solutions; 4) TAPs, sector ownership of TAPs and project ideas; and 5) Linking TNAs/TAPs to Climate Technology Centre and Network (CTCN) requests.

2. Methodologies

The study was conducted based on a literature review of each country's TNA reports and face-to-face and telephone interviews using common questionnaires. The questionnaires were developed by the IGES TNA Study Team through consultation with UNEP.

Interviews were conducted by IGES researchers from June to August 2014, and those invited included government officials and other stakeholders involved in the TNA process in each country. In addition, a limited number of stakeholders who were not directly involved in the TNA process were also interviewed to examine additional impacts of the TNA process in some countries. The interviewees were identified through participant lists of each country's TNA process as well as via pre-consultation with the TNA Focal Point who played a key role in stakeholder engagement.

3. Key findings

3.1 Institutional arrangement and Stakeholder involvement

Consistent with UNFCCC's TNA synthesis reports (UNFCCC, 2006; 2009; 2013), all countries reported that the TNA process was participatory and stakeholders were involved in a consultative process to conduct TNAs. In all eight countries, efforts were made to set up the appropriate institutional arrangement. In most cases, stakeholders were involved in a national workshop at the beginning of the TNA process and additional sector-level workshops were organized to solicit their engagement in various steps in the TNA process. However, none of the countries mentioned the use of a questionnaire survey or interviews for stakeholder involvement.

In terms of stakeholder composition, the countries had a very high representation of governmental agencies in the TNA institutional arrangement, a relatively high presence of academic and research institutes, and limited participation of the private sector and funding

agencies. For example, the National TNA Committee of Sri Lanka and Thailand[†] were almost exclusively comprised of governmental agencies and research institutes. In contrast, the private sector and funding agencies accounted for no more than 10% of the institutional arrangement, respectively (Sri Lanka, 2012; Thailand, 2012). Although the private sector involvement was limited in general, the participation of the private sector varied across mitigation and adaptation sectors. More specifically, adaptation in particular the agriculture sector involved more private sector representatives than mitigation sectors such as energy and transport. The sectoral difference of private sector involvement mainly resulted from different levels of enterprise ownership in these sectors. For example, the energy and transport sectors are largely managed by state owned companies; in contrast, the agriculture sector involves many small and medium enterprises and individual farmers.

In addition, regional development banks, bilateral funding agencies, and commercial banks were nearly dismissed in the TNA process. Most countries reported that their TNAs were supported by GEF funding. However, no countries reported that international and/or domestic funding had been committed to financing resulting TAPs. Moreover, funding agencies were virtually not present in the TNA process. For some countries, a research funding agency and/or the finance ministry was included in the National TNA committee. However, the extent to which a research funding agency will support on-the-ground, project-level technology transfer implementation is not obvious; in contrast, most international funding agencies such as the Global Environment Facility, has a focus on technologies at the stages of market demonstration, deployment, and diffusion, and less emphasis on pre-mature technologies at the stages of basic R&D and applied R&D (GEF, 2012).

According to our interviews, the low engagement of the private sector can be explained by the following reasons. First, the private sector was generally not aware of TNA as a consultative process and considered it as a process solely led by the government. The oversight of the importance of the role of the private sector in the TNA process could partly result from the fact that the private sector did not have adequate knowledge of climate change and hence lacked interest in it. The unawareness could also result from the inadequacy of the TNA guidelines so that TNA focal points were not well advised regarding soliciting private sector engagement.

Second, the lack of authority and incapability of TNA focal points in deciding relevant stakeholders also contributed to the low involvement of the private sector. Since the high-

[†] The rest of the countries did not report the composition of their TNA Committee in their TNA reports.

level political support is critical for TNA, the difficulties in securing high-level buy-in escalated the challenges of TNA focal points in inviting stakeholders and organizing workshops. Consequently, TNA focal points had difficulties in securing some of the stakeholders in subsequent consultative workshops. As the nomination of private sector participants changed frequently, the stakeholders attending subsequent consultations were often not informed about the outcomes of previous consultations and much time and effort was spent for reviewing the decisions of previous meetings. It is worth noting that the lack of mandates as well as the lack of incentives for getting involved in TNA could result in private sector's inconsistent and indiscriminate participation.

The same reasons could be applied for the case of funding agencies. In a similar way, funding agencies did not see business opportunities in getting involved in TNA and generally considered TNA as a research exercise. Bankers are not familiar with climate technologies and are not willing to invest in a new field. Bankers do not favor climate projects in general, as climate projects have low collateral value due to the following characteristics: (1) a large part of climate projects are taken up with non-equipment costs, such as buying licenses and patents, which are not considered as acceptable collateral; (2) the expensive monitoring equipment that is essential for climate projects cannot be universally used and has little value outside the project; and (3) the hardware purchased (i.e., a motor or pump) is only valuable when integrated into the whole product process and has little value if removed from the production system. Bankers therefore usually give a large discount for the fixed assets of a climate project (IIP, 2012).

3.2 Main barriers and challenges

Main reasons for the success of the process, barriers and challenges were identified through the stakeholder interviews.

Effective consultations, high level of stakeholder capability, strong leadership and high commitments shown by the lead agency were identified as the main reasons for success in conducting TNA and developing TAP. Consultations helped establish good working relationships between different bodies. Regarding the TNA process, some found it well-structured which allowed for systematic progress, while others found it challenging to follow.

Complexity of the method for the multi-criteria analysis was found to be one of the key challenges in conducting TNA. Moreover, due to inconsistent stakeholder participation, the following challenges arose or were intensified: inconsistent views on technology

prioritization, extended time needed for explanation, and low understanding and knowledge on the process, technology, and climate change, which led to biased selections of the priority technologies.

Overlong process led to another critical challenge of the analysis outcome being outdated, i.e., the prioritised technology was no longer reflecting the need of the country by the time TAP was developed.

As with any capacity building process, consistency and commitment of the participant are important aspects to the TNA process. Interviewees reported that those that participated in the TNA training ended up not involved in the process. On the other hand, high relevancy of the TNA study to the country's sustainable development and climate change policies; high level of capacity building, information sharing, stakeholder commitments, and good use of various means of communication were found to be helpful in mainstreaming and increasing the relevancy of the TNA to the national policy. As some interviewees pointed out, conflicting interests among ministries led to coordination challenges. Limited involvement of the private sector and limited data on market studies led to incomplete information for the TNA study. Unpreparedness of the participants and voluntary participation to the process led to inadequate or only partially accumulated information. Interviewees in several countries pointed out that a pre-assessment of the technologies may be helpful in bringing in the relevant and appropriate stakeholders. A list of mitigation and adaptation technologies may be helpful in identifying appropriate technologies. Due to inadequate understanding of the process and knowledge regarding the technologies in question, some of the TNA participants had ability to provide partial inputs. To fill this technical information gap, involvement of external experts from development agencies and CTCN may be of consideration.

Lack of time and coordination led to inappropriate consultations, leading to low ownership and low acceptance of identified technologies

To address these identified challenges, TNA handbook should i) define technology clearly to incorporate country-specific examples; ii) elaborate on multi-criteria analysis; and iii) be more reader friendly for non-experts.

As for improving the process, stakeholders should i) be selected strategically; ii) attend throughout the process; iii) sufficiently comprehend the meaning of TNA; and iv) be equipped with an understanding of climate change and the technologies in question.

Lack of adequate communication was mentioned as a challenge by some of the interviewees. In order to improve the process and provide timely assistance, establishing frequent

communications among UNEP, the regional coordinating institution and the countries' TNA members.

3.3 Technology Action Plans (TAPs) and project ideas

Following the TNA, TAP development also faced similar challenges. Lack of ownership of the TNA led to low interest in the TAP by the stakeholders and line ministries. As mentioned above, the limited participation from the financial and private sectors was one of the cases for low ownership of the analysis and the TAP development that followed. Lack of follow-up action after TNA approval was one of the key issues stakeholders voiced. Some reported their unawareness of the TNA completion.. In some cases, the maturity level of the technology, led to successful implementation of the TAP. Successful implementation of a local action plan on mitigation and adaptation on climate change may be determined by several aspects: (i) prioritisation by ministries/agencies; (ii) strong leadership and (iii) support system.

It is important to inform private sectors of the benefits and practicality of investing in the prioritised technology, in terms of technology marketability, production cost, profit margin, risk/benefit, and supporting financial policies.

Therefore, a hybrid approach, i.e., combining top-down and bottom-up approaches, may help solve the challenge regarding ownership. This approach can be taken in the following steps: (i) the national Focal Point provides an enabling framework; (ii) relevant ministries, agencies, or local governments are allotted discretion to tailor individual initiatives; (iii) successful examples are replicated or adapted through initiatives led by higher level government or other agencies.

3.4 Linking TNAs/TAPs to Climate Technology Centre and Network (CTCN) requests

In addition to the involvement during the process, utilizing available mechanisms is important for linking TAP to actual implementation. To do so, linkage with CTCN, a technology mechanism under the UNFCCC, should be further improved.

Some explained that no clear link between TNA and CTCN had been made. Some are planning to develop CTCN requests based on TNA. In other cases, the development of TAPs were constrained by timing and funding, thus need further development before being implemented.

A network of neighboring developing countries should be promoted in order to i) share information and knowledge among developing countries with similar circumstances; and ii) promote a regional approach to synergise efforts. In line with suggestions made by the

stakeholders, a regional approach to developing a technology standard and testing facility to assess the quality of products or technologies could ensure the quality of technologies aimed at mitigating climate change.

The interviewees pointed out that it is crucial to source external funding to implement TAP. Therefore, links to mechanisms such as the CTCN (which was frequently misunderstood by the interviewees as being a financial mechanism) are regarded as important. Ambiguity on the link between TAP and CTCN and related financial mechanisms have been a barrier as developing countries do not know how and where to seek external support for their TAP and its implementation. Developing countries should be encouraged to utilise their TAP to develop requests to the CTCN. CTCN can assist countries in doing so by supporting project development and NDE to take TAP into consideration when reviewing the requests. For example, CTCN, in their workshops, can provide guidance on how to take up TAP and link them with CTCN requests.

4. Policy implications

Several lessons and recommendations are drawn from the above observations:

- Awareness and interest are required for participation. Stakeholders need to be well informed of the merits and follow-up of the process.
- To improve the process, the same participants need to be encouraged to be involved throughout. If designated stakeholders are unavailable for meetings, well-informed substitutes from the same office or organisation should attend.
- Selection of appropriate stakeholders was critical, but remains a challenge. Existing networks played a key role in identifying appropriate participants. For the following TNA, efforts should be made to reach out to stakeholders and keep them involved in the process.
- Involvement of the line ministries is important for increased political awareness, smooth implementation, and aligning technology needs with national development policies, which in turn increases the relevancy of TNA to the national needs.

As many have pointed out, engagement of the private sector is key to improving the process. The private sector must be made aware of the benefits to encourage their participation. Providing economic incentives can help promote private sector involvement. The following points could be considered to encourage the private sector involvement:

- Disseminate TNA and TAP reports, especially within the prioritised sectors. This will send

a signal to the private sector, which will become aware of the sectoral priorities.

- Consult with private sectors to identify challenges and barriers in adopting the suggested technologies.
- Engage the private sector in piloting the identified technologies.
- Formulate incentive policies that will encourage the private sector to invest in technologies identified in the TNA/TAP process.
- Clearly state what will follow after the TNA/TAP processes.

In addition to involvement of the private sector, it is important to explore increasing the involvement of financial institutions, as implementing the prioritised technologies will require their help right from the beginning. We suggest that development agencies, such as the World Bank and regional development banks get involved in each country's TNA process from the beginning and ensure their representatives become members of the national TNA team. Involving development agencies can have multiple advantages, such as i) providing technical expert inputs; ii) share experiences of other countries; iii) during the TNA process, developing agencies can help the CTCN grasp the needs on the ground; and hence iv) prioritise support according to their eligibility criteria.

Awareness raising and information sharing were pointed out as important aspects of improving the process. Stakeholders need to be better informed of the impact of climate change and corresponding technology countermeasures. Information dissemination through developing a technology database and platform would also help raise awareness.

Part of the TNA process should be to evaluate the technical expertise of the government ministries and agencies involved in the TNA. For instance, UNEP could request concept notes before implementation of the TNA, which would enable it to evaluate the capacity needs of a country's Focal Point and plan accordingly for training and other necessary guidelines for TNA implementation.

5. Conclusions

Study found that TNA process should be improved through disseminating TNA and TAP reports, especially within the prioritised sectors. This will send a signal to the private sector, which will become aware of the sectoral priorities. Consultations with private sectors to identify challenges and barriers in adopting the suggested technologies may be of another step to identify the on-the-ground challenges. Private sector should be engaged to pilot the identified technologies, too. Formulation of policies that incentivise the private sector to invest in

technologies identified in the TNA/TAP process are of consideration for the government. In doing so, mainstreaming with the national developing goal and climate change policies will be pertinent in ensuring the continuity and assurance for the private sectors' investment. Indication of concrete steps, such as the link to CTCN request, following the TNA and TAP are also important for the stakeholder engagement. Successful technology transfer requires capability of the stakeholders to identifying actual needs and priorities, in line with national policy. TNA process can be improved through addressing the identified barriers and presenting the larger picture and various options within and outside of the UNFCCC mechanism.

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ⁱ UNFCCC. Decision 4/CP.7. Development and transfer of technologies (decisions 4/CP.4 and 9/CP.5). FCCC/CP/2001/13/Add.1. <http://unfccc.int/resource/docs/cop7/13a01.pdf>

ⁱⁱ UNFCCC. Technology Needs Assessment. TT Clear. http://unfccc.int/ttclear/templates/render cms_page?TNA_home (Accessed July 30, 2015)

ⁱⁱⁱ UNFCCC. Climate Technology Center and Network (CTCN). http://unfccc.int/ttclear/templates/render cms_page?TEM_ctcn (Accessed July 30, 2015)

^{iv} UNFCCC. Climate Technology Center and Network (CTCN). http://unfccc.int/ttclear/templates/render cms_page?TEM_ctcn (Accessed July 30, 2015)