



Technical papers on the impact of the implementation of response measures

Executive Summary



United Nations
Framework Convention on
Climate Change

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INTRODUCTION

Introduction

Response Measures is one of the areas of the international climate change negotiations which deals with the social, environment and economic consequences of impact of implementation of mitigation measures. It refers to the range of actions, policies, and programs that countries, as Parties to the United Nations Framework Climate Change Convention (UNFCCC), undertake to reduce their greenhouse gas (GHG) emissions. Examples of such measures include subsidies to promote low-carbon development, border carbon adjustment or carbon labeling. Depending on how they are implemented, response measures can be classified as unilateral, bilateral or multilateral and their impacts could either be domestic or cross-border

With the implementation of the Paris Agreement, Parties aim, among others, to hold the global average temperature increase to 2° C above pre-industrial level and perusing efforts to limit it to 1.5°C. This important development connotes increase in mitigation ambition with corresponding potential increase in impacts arising from the implementation of these mitigation actions. The increased response measures must be accompanied by increased significance of analyzing the impacts of the implementation of response measures, in particular cross-border impacts, with a view to maximize the positive and minimize the negative impacts. This dovetails well with the expectations under the Paris Agreement related to the forum on impacts of implementation of response measures where the modalities, functions and work programme are looking at increasing the understanding of the impacts of response measures, build capacities of Parties and undertake technical work so as to minimize the negative impacts of response measures; especially in the context of developing countries.

Background

The issue of the impacts of the implementation of response measures has consistently been part of climate change discourse under the Convention (Art 4.8), the Kyoto Protocol (Art 2.3 and Art 3.14) and the Paris Agreement (Art 4.15). To contribute to enhancing the understanding of Parties in their process of minimizing the impacts of the implementation of response measures, the UNFCCC secretariat has published three technical papers:

1. Guidance to assist developing country Parties to assess the impact of the implementation of response measures, including guidance on modelling tools¹
2. The concept of economic diversification in the context of response measures²
3. Just transition of the workforce, and the creation of decent work and quality jobs³

1. https://pvaweb01.unfccc.int/files/cooperation_support/response_measures/application/pdf/technical_paper_beautified_guidance_to_assist_developing_country_parties_to_assess_the_impact_of_the_implementation_of_rm_fccc_tp_2016_4.pdf

2. https://pvaweb01.unfccc.int/files/cooperation_support/response_measures/application/pdf/technical_paper_economic_diversification.pdf

3. https://pvaweb01.unfccc.int/files/cooperation_support/response_measures/application/pdf/just_transition.pdf



GUIDANCE TO ASSIST DEVELOPING COUNTRY
PARTIES TO ASSESS THE IMPACT OF THE
IMPLEMENTATION OF RESPONSE MEASURES

I. Guidance to assist developing country Parties to assess the impact of the implementation of response measures

This technical paper explores the approaches, including modelling tools, available for assessing the impacts of the implementation of response measures, with a view to assisting developing country Parties with such an assessment.

1. The need for assessment

Response measures implemented in one country may have some un-intended adverse impacts both within and outside its jurisdiction. These un-intended impacts need to be identified, assessed and addressed.

Over the years, Parties recognized the need for impact assessments to be carried out in the context of sustainable development and emphasized that such assessments provide information on social, economic and environmental dimensions on impacts of mitigation policies. For example, policies such as carbon taxes, subsidies, energy reforms, green investments, cap-and-trade schemes, trade-related measures, standards and labelling could lead to impacts on economic growth, income distribution, employment, environment, health and food security in other countries besides having impacts on the implementing country as well. It is imperative that analyses and assessments of the impacts on implementation of response measures are carried out to inform decision making processes by governments/policymakers and other stakeholders at both local, national and global levels.

2. Approaches to assessment

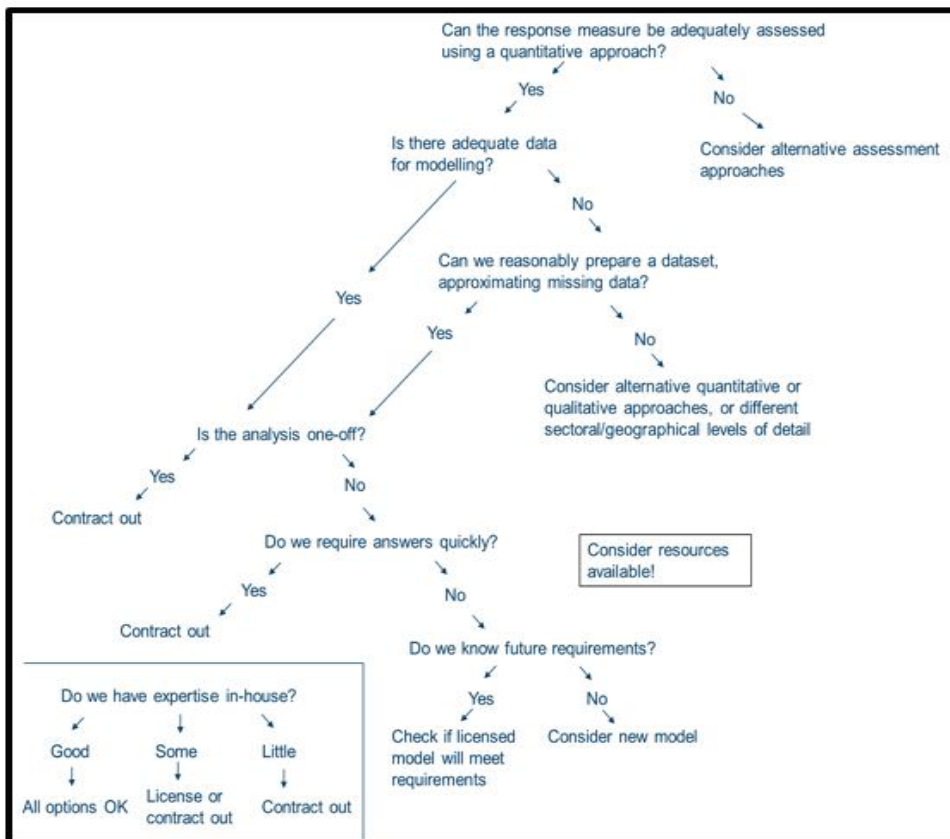
Assessment of the impact of the implementation of response measures can be carried out ex ante (before formulation and adoption of the policy) and/or ex post (after the implementation of the policy with the purpose of evaluating real impacts).

There are two main approaches to assessing the impact of the implementation of response measures: qualitative and quantitative.

(a) Quantitative approach

Quantitative assessment of impacts produces highly accurate results but is generally data intensive and can be expensive. Normally, modelling tools are used as models can improve understanding of response measures by attributing a numerical value to cost–benefit relationships, including environmental, social and economic costs and benefits. Quantitative assessment tools that require fewer data include cost–benefit analyses, econometric analyses and input–output analyses. When choosing an assessment approach, Parties should seek to balance accuracy of results with the effort (time and cost) involved.

Using modelling tools can be data intensive and always incurs high costs. Three options should therefore be explored before a decision is made to use modelling tools to undertake quantitative assessment. First, where endogenous capacities do not exist within the country or institution to conduct the assessment, it is good practice to contract all modelling exercises externally. Second, if some capacities exist within the country or institution to conduct the assessment, a licence for an existing modelling tool could be acquired. Third, the country or institution could develop a new model to use.



Decision tree for the selection of an impacts assessment approach.

An overview of the different assessment tools are provided below:

Tool	Characteristics
Computable general equilibrium model	<ul style="list-style-type: none"> • Used for analysing climate policy at the level of the whole economy across all economic sectors • Based on social optimal (least-costly) options • Provides assessments of feedback effects across all sectors • Highly complex and requires specialist software and expertise • Data need to be collected and processed for a year; a GTAP (Global Trade Analysis Project) database may provide data to some extent • Examples include GTAP, GEM-E3 and ENV-linkages
Macro-econometric model	<ul style="list-style-type: none"> • Assesses policies and measures that have economy-wide effects • Captures linkages between markets across the entire economy • Particularly useful for assessing the impacts of price-based response measures (e.g. for carbon taxes, levies, tariffs and subsidies) • Highly complex and requires specialist software and expertise • Requires more data than computable general equilibrium model (requires time-series data rather than single base-year data) • Examples include E3ME and GINFORS
Cost–benefit analysis	<ul style="list-style-type: none"> • Helps predict whether the benefits of a policy outweigh its costs and by how much relative to alternatives • Data requirements are low and calculations may be made in an Excel spreadsheet • Much less complex than other tools • Could be used to assess the impact of labelling standards using micro-level data and then aggregating them to derive an economy-wide level to determine the overall cost
Marginal abatement cost curve	<ul style="list-style-type: none"> • Basic assessment approach whereby graphs illustrate the projected costs of reducing emissions through a range of measures or technologies, presenting the lowest cost first • Useful for comparing the costs of energy-generating technologies • The data requirement is less than for other tools and calculations can be made in an Excel spreadsheet • Less complex than other tools
Econometric (or regression) analysis	<ul style="list-style-type: none"> • Used to estimate the behavioural response to a change in situation (e.g. price/demand elasticity) • A lot of data required for the indicators covered • Several modern statistical software packages are able to undertake econometric analysis • Examples include Stata and eViews

Input–output analysis	<ul style="list-style-type: none"> • Input–output tables determine the flows between sectors, producers and consumers in the whole economy • Economic multipliers estimate the impact that a change in the output of one sector has on the rest of the economy • Data requirement is low and calculations can be made in an Excel spreadsheet • Much less complex than other tools
Energy system model	<ul style="list-style-type: none"> • Can be used to assess sectoral impacts, including a range of technologies • Lots of data and specialist software required • Examples include LEAP, PRIMES and World Energy Model
Integrated assessment model	<ul style="list-style-type: none"> • Links the economy to energy consumption and impacts on the climate • Provides estimates of changes in climate factors such as surface temperature and precipitation rate • Lots of data and specialist software required • Examples include IGSM and IMAGE

(b) Qualitative approach

The primary output of a qualitative assessment is a description of the potential effects of policies and measures. It is designed to provide an estimate of the direction of change (positive, negative) and its relative size (small, medium, large).

The qualitative approach plays an important role when it is not possible to quantify the effect of a policy; for example, when data are unavailable, or the cost of collecting data would not be justified in view of the expected magnitude of the likely impacts. A qualitative assessment may also serve as a first step, to be followed by a quantitative assessment.

Qualitative assessment is usually conducted by means of individual expert judgment or surveys. In the case of surveys, the involvement of relevant stakeholders is of paramount importance to ensuring accurate results. The qualitative approach does not require a substantial amount of resources but may be time intensive if it involves a large survey.

Qualitative methods can generate sophisticated, robust and timely data and analysis and are given equal importance when evaluating impacts. Given the limitations of the qualitative approach, in particular the lack of highly accurate results, combining quantitative instruments that have broader coverage can yield impact assessment that makes the most of the comparative advantages of both approaches. Some qualitative and quantitative tools that can be used to estimate the impacts of response measures are summarized in the table below

A snapshot of the different qualitative and quantitative tools

Focus	Approach/model	Description
Mapping policy outcomes	Qualitative approach: Delphi analysis	Elicits knowledge from experts through a questionnaire to identify points of convergence regarding suitable expectations of likely policy outcomes.
	Qualitative approach: Tree diagrams	Linear approach to identifying connections between indicators to help map likely impacts, including within a value chain. Supports the identification of entry points to mitigating impacts.
	Qualitative approach: Causal loop diagrams	An extension of decision-tree diagrams that includes feedback loops and social, economic and environmental drivers of change.
Households and the economy	Qualitative approach: Income and expenditure surveys	Detailed survey of data on household budgets and consumption of goods as a basis for projecting impacts on welfare.
	Quantitative approach: Input-output tables	Detailed database of economic interrelations used to project the impacts of price changes on sectors and final goods.
	Quantitative approach: Social accounting matrix	Detailed database of interrelations between all transfers between households and enterprises within the country and internationally.
Sectoral performance (e.g. energy supply)	Quantitative approach: Numerous models (e.g. MARKAL and ORDENA in the energy sector)	Detailed representation of sectoral dynamics (e.g. cement, steel, an energy supply system) that can project medium- and long-term trends in demand, supply and price. Generally allows for the estimation of economic and physical indicators.
Macroeconomic and regional performance	Quantitative approach: Macroeconomic (e.g. E3MG)	Analysis of implemented policies or projection of impacts on the basis of the interactions between economic variables drawn from historical data.
	Quantitative approach: Computable general equilibrium	Analysis of implemented policies or projection of impacts using equations that identify the state of equilibrium that will optimize the welfare of economic actors following a policy change.
	Quantitative approach: System dynamics	Simulation of cross-sectoral impacts over time under 'what if' scenarios. Supports the assessment of policy outcomes and the identification and formulation of complementary policy packages.

3. Reporting

Irrespective of the approach used, reporting is always an important element of an assessment. The assessment report should cover as a minimum: the mitigation policy assessed; the impacts (positive, negative, direct, indirect); the stakeholders affected and how they will be affected; the assessment approach used (quantitative or qualitative); data sources; and details of stakeholder consultations.

Developed countries have carried out some assessments of the cross-border impacts of response measures, but they were mostly limited to the qualitative approach. Any quantitative assessments of cross-border impacts have been less comprehensive than assessments of domestic impacts.

Developing countries are increasingly cognizant of the importance of assessing the impact of the implementation of response measures, but only a few have undertaken comprehensive assessments. Some developing countries have carried out assessments of the overall impact on the economy (using gross domestic product), with a focus on the fossil fuel sector. However, there are many other impacts that should be investigated, such as impacts on employment and jobs, on competitiveness and other socioeconomic factors, and on the environment.

KEY MESSAGES FROM THE TECHNICAL PAPER

- Using modelling tools to assess impacts produces highly accurate quantitative results, but usually requires a lot of data and expertise and is expensive.
- Data are one of the most crucial elements for constructing an accurate model. Options for overcoming the issue of data availability in developing countries should be explored, such as cooperation among governments to publish reliable statistics.
- There are limits to what a model can assess. Models cannot quantify every type of impact, and a model's outputs are limited by its scope. Data limitations may also restrict the types of modelling exercise that can be carried out.
- Most impact assessments of mitigation policies have so far focused on impacts within developed country Parties. The few assessments covering developing countries were carried out at the regional level and did not include analysis of sectoral, national or subnational impacts.
- Developing country Parties require the capacity to carry out their own assessments, particularly when the cross-border impacts of response measures have not been adequately assessed by the implementing country.
- Developing country Parties require guidance, including local capacity-building, to assist them in undertaking national assessments of the impact of response measures, especially with the use of modelling tools.
- The engagement of a range of stakeholders (the public sector, the private sector, academia) can help to deliver higher quality and more credible assessments.
- Developing country Parties have stressed their urgent need for support to build the capacity of policymakers, experts and practitioners to assess the implementation of response measures, including with the use of modelling tools.



THE CONCEPT OF ECONOMIC DIVERSIFICATION IN THE
CONTEXT OF RESPONSE MEASURES

II. The concept of economic diversification in the context of response measures

This technical paper explains the basic concept of economic diversification and its determinants and provides analysis of the available tools and methodologies for measuring economic diversification taking into account specific national circumstances.

1. Why is diversification important for an economy?

Under the Convention, economic diversification has been discussed within the framework of adaptation action aimed at increasing economic resilience and reducing the vulnerability of certain economic sectors, and in the context of response measures aimed at reducing the adverse impacts of the implementation of climate change mitigation policies that have cross-border effects, mainly on developing countries.

Economic diversification is considered one of the many tools for addressing the economic impacts of mitigation actions. Traditionally, economic diversification has been used to transform an economy from one that depends on a single source of income to one that has multiple sources of income spread over primary, secondary and tertiary sectors, involving large sections of the population. Such diversification contributes positively to economic performance and helps reduce the risks associated with a high dependency on single or narrow commodity production.

Economic diversification is particularly relevant to countries that have a narrow export profile and to sectors that are highly vulnerable to the impact of response measures owing to the demands and standards imposed by importers.

Most of the literature and experience of countries suggest that successful economic diversification goes beyond insulating economies from the impact of the implementation of response measures and achieves a number of other nationally enunciated objectives in the context of sustainable development; for example, it creates more job opportunities, improves economic tolerance and alleviates poverty. Economic diversification strategies are being increasingly implemented by countries that are vulnerable to climate change and whose economies are driven primarily by sectors, such as tourism, agriculture, fisheries, forestry and energy production, that are sensitive to climate change and response measures.

Economic diversification is affected by economic determinants (firm productivity and income level), macroeconomic variables (foreign direct investment, terms of trade, exchange rates), non-economic determinants (export volume, country size) and economic reforms like trade liberalization.

2. Tools and methods for measuring economic diversification

Employment, exports or income level are often used as a proxy to measure the level of economic diversification. Economic diversification can be measured in terms of the shares of sectors in gross domestic product, the shares of sectors in exports (export concentration), the dependence of a country on the export of a good or commodity and the employment shares of sectors. The table below provides an overview of different tools and indices for measurement of economic diversification.

Index	What it measures	Characteristics
Industrial organization theory (absolute specialization indices)		
Herfindahl-Hirschman index	Widely used to measure market concentration and economic diversity, it measures the extent to which a particular economy is dominated by a few sectors. A lower value implies a more diversified economy.	One of the simplest and most affordable indices owing to the ease of calculation and the availability of the data it requires, it is regarded as superior to other indices used to measure absolute specialization.
Ogive index	It measures the distribution of economic activity (as a share of employment, exports, income or gross domestic product) among sectors in a country. A more unequal distribution of sectoral activity will result in a higher value of the ogive index.	This measure constitutes a part of the industrial organization theory where a more diversified (i.e. less concentrated) sector is assumed to be more competitive. A region with a greater number of sectors and/or a more even distribution of economic activity is associated with higher diversity.
Entropy index	The entropy measure compares the existing employment or income distribution among industries in a region to an equi-proportional distribution. Higher entropy index values indicate greater relative diversification, while lower values indicate relatively more specialization. The minimum value of zero (maximum specialization) would occur if employment were concentrated in one industry.	Although both the ogive and entropy indices yield similar diversity rankings the entropy index is the more popular measure of sectoral concentration.
Economic base theory (export base theory) (export base theory assumes that economic growth is driven by export demand)		
Hachmann index and location quotient	The Hachmann index measures the degree of similarity between a subject area and a reference area. Hachmann index values are bounded by 0 and 1, where 1 indicates identical industry employment distributions for the subject and reference areas (a perfect balance) and 0 signifies completely dissimilar concentrations.	Hachmann index calculations incorporate location quotients, which measure relative industry concentration in one area compared with that of another area. The higher the value, the more stable the economy.

Regional business cycle theory		
National average index (NAI)	A region's share of stable or unstable sectors is used as a measure of economic diversity. The economy in a region is considered stable if its sectoral composition is like that of the nation. As the region's share of economic activity approaches the nation's share for all sectors, the NAI approaches zero. As the region's shares diverge from the economy, the NAI becomes increasingly larger.	The NAI can be considered a relative measure of economic diversity because it measures the amount of disparity between the nation and the region's industry distributions. The NAI is accepted as a more reasonable standard against which to gauge a region's industry structure.
Portfolio theory		
Portfolio variance	By capturing the characteristics of individual industries and inter-industry relationships relating to regional growth and instability, the portfolio framework assists policymakers in developing appropriate diversification strategies that can serve the purpose of stimulating economic growth and stabilizing the economy. Lower portfolio variance indicates a more diversified economy.	Portfolio variance is a superior measure of economic diversity to explain regional economic instability compared with other measures of diversity (e.g. ogive index, entropy index and NAI).
Input-output matrix		
Input-output model: a unified framework	Economic diversification is driven by simultaneous changes in production, consumption and trade patterns. The input-output framework enables the growth and stability impacts of different diversification strategies involving changes in the level and mix of exogenous final demands.	<p>Import substitution is a popular diversification strategy and its impacts can be modelled using the input-output model. These impacts can be measured for the economy as well as for specific sectors. The sectoral distribution of growth and stability impacts can also be derived. This allows policymakers to rank different policies on the basis of their growth and stability objectives and preferences with respect to growth and stability trade-offs.</p> <p>The main limitation of using this approach on a regional basis is the lack of consistent input-output tables over time. Regional input-output models (i.e. IMPLAN, REMI and RIMS) can provide the necessary data to produce the baseline relationship between economic structure and performance, but the problem is the lack of time-series data on exogenous final demands to estimate their expected growth and variance.</p>

Points to consider when choosing a measurement tool

- The available literature suggests that portfolio variance is a superior tool for measuring economic diversity when explaining regional economic instability to other measures of diversity (e.g. ogive index, entropy index and NAI).
- Analytical tools that focus on specific industries are more useful for planning economic diversification (e.g. location quotient, shift–share analysis and the input–output model).
- Because each country has specific national circumstances, more country-specific case studies are required in order to understand the emerging sectors of a particular economy and how policies can be planned to support their sustainable economic growth.

3. Sectoral vulnerabilities

Vulnerability due to narrow export profile. While many developing countries have progressed in reducing their dependence on a small basket of product exports, diversification has been uneven in terms of sectoral coverage and has mostly taken place in the agriculture sector, while other sectors like metal, minerals and energy remain overdependent on narrow baskets of exports.

Vulnerability due to response measures. Many developing countries are overdependent on the export of only a few types of commodity. The country is affected if the related sectors suffer economically as a result of response measures in their key target markets. Export sectors that might be vulnerable to the impact of the implementation of response measures include conventional oil, gas and coal fuels; renewable energy technologies; consumer goods subject to eco-labelling and standards, including agriculture sector products; energy-intensive trade-exposed goods (aluminium, iron and steel, cement, chemicals, and pulp and paper); air-freighted goods; tourism; and marine-transported goods, including bulk agricultural commodities, such as cocoa.

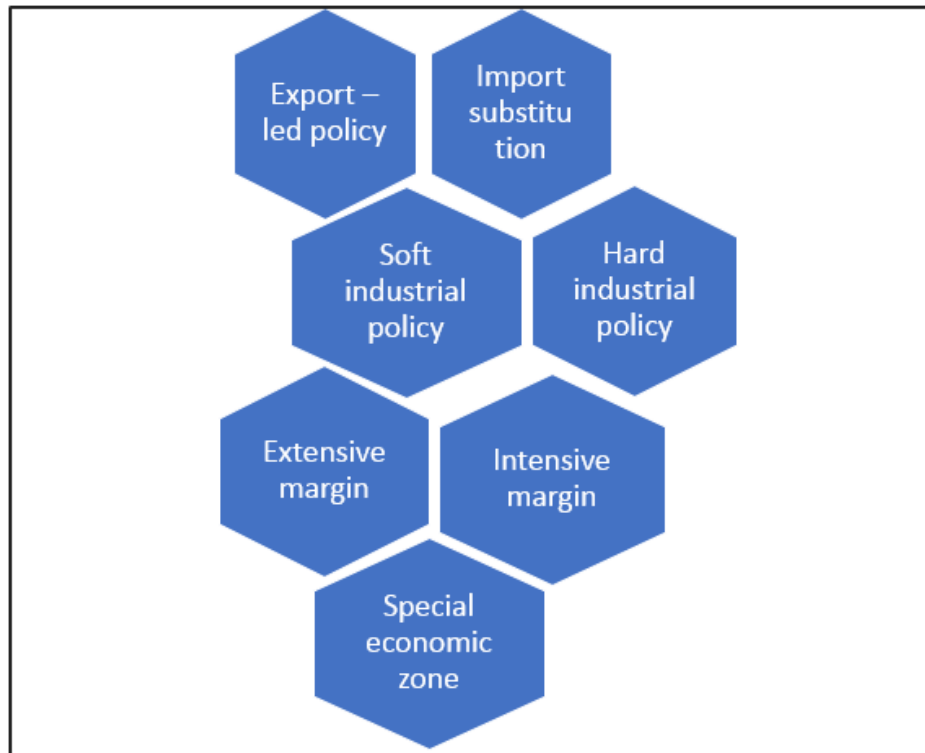
4. Policy options for accelerating economic diversification

Although there is no clear consensus on what measures are necessary to achieve economic diversification, a few general principles are widely accepted. It is important to note that policy options for economic diversification are dependent on national circumstances and that solutions differ widely and need to be specifically tailored to the unique national circumstances in each context.

First, *investment in infrastructure*, such as improving road networks and investing in access to power, is often the most critical requirement for growth in many developing countries. It is important for reducing the cost of doing business and improving competitiveness.

Second, *support provided to agriculture* should be increased. Despite increasing reliance on resource rent, in many countries agriculture is often still the sector that employs the largest share of the labour force. It faces pressures both from exchange rate appreciation and from increasing mechanization as wages are pushed up. Improving agricultural productivity and linking producers to markets are important measures in this regard.

Third, *private investment in non-extractive sectors* should be promoted by improving the business and regulatory environment, providing better access to finance and supporting entrepreneurship and skills development.



Policy mix for economic diversification

The technical report details a number of policy options that could help countries in accelerating their economic diversification as seen from the figure above. They are detailed as below:

(a) Import substitution or export-led policy: Industrialization based on import substitution promotes domestic industries in order to replace foreign-made goods. Export-led industrialization speeds up the industrialization process by opening up domestic markets to foreign competition and supporting export sectors.

(b) Soft or hard industrial policy: Soft industrial policy focuses on improving the investment climate by implementing measures that will improve investment conditions for a range of sectors and actors. Examples include strengthening the banking system; improving access to credit for small and medium-sized enterprises; creating a stable macroeconomic environment (low inflation, stable currency, etc.); building critical infrastructure in transport and communications; and removing regulatory barriers to foreign ownership. Hard industrial policy is designed to foster competitiveness in a particular sector and can take the form of sector-specific tax preferences, grants, land grants, low-interest loans, export financing, tariff protection, support for research and development, or government procurement of supported goods or services.

(c) Special economic zone: A special economic zone is a separate bounded area in a country where business-friendly rules apply. The Government sets the preferential conditions, which may include tax incentives, low tariffs, streamlined customs procedures, flexible regulations, better access to electricity and transportation, etc. The types of special economic zone include export-processing zones, financial special economic zones, eco-industrial parks and charter cities (zones built around new urban areas with the power to set their own laws).

(d) Extensive or intensive margin: Economic transformation depends not only on how much countries export but also on what they export and with whom they trade. Generally, to increase their exports countries can choose to either continue exporting existing products or diversify into new product lines in new trading regions. The intensive margin relates to diversifying a set of products that has been sold by a country over a period of time, while the extensive margin relates to expanding exports to new products and new markets.

There is no one-stop policy that can be adopted for effective economic diversification. Policies must be planned on the basis of national circumstances, on a case-by-case basis, taking into consideration a country's geographical location and available skills, technology and resources. Government intervention is necessary to establish policies that promote export growth and diversification and a rigorous process is required for planning and implementing economic diversification policies.

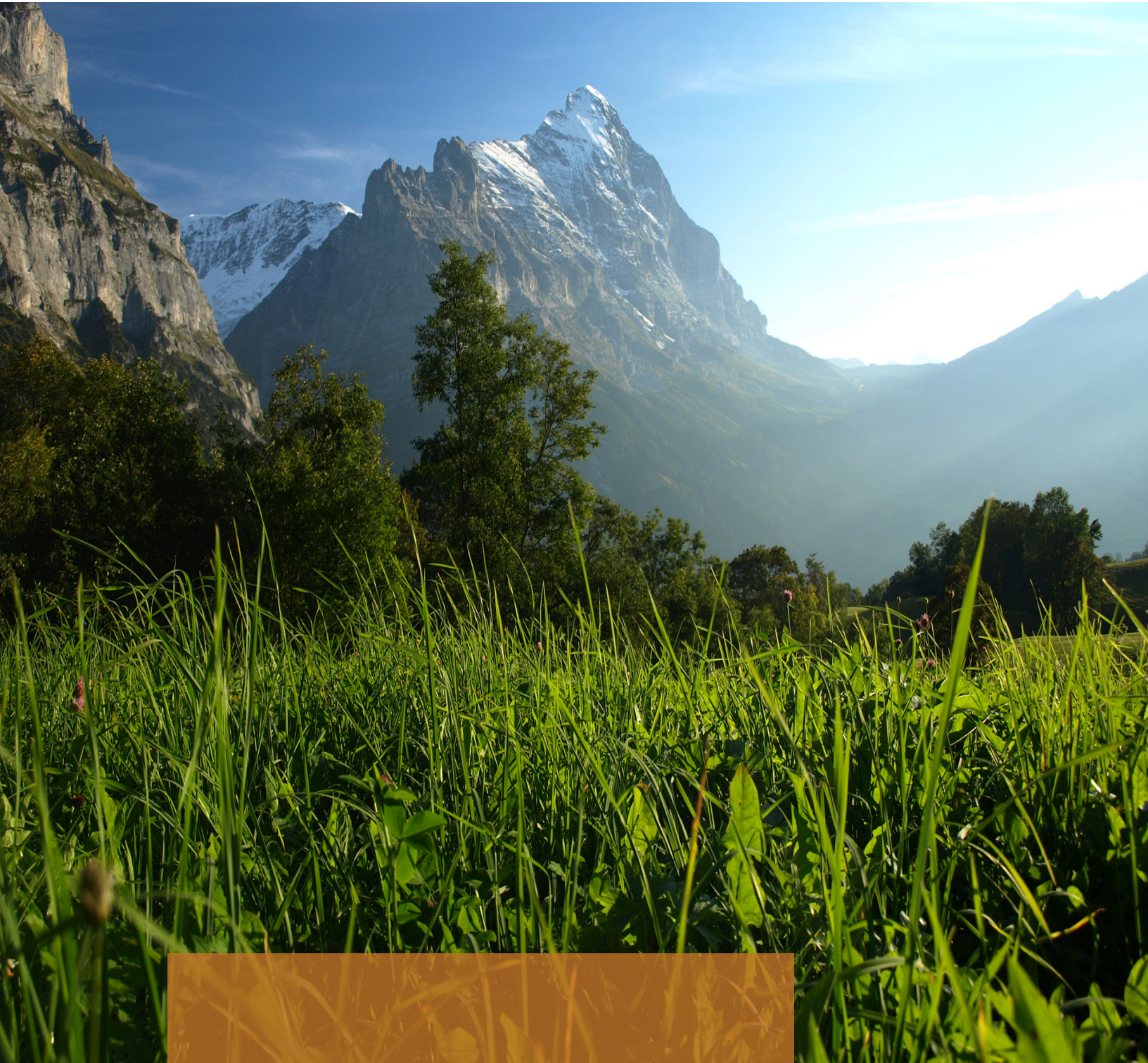
The most important step that a government can take is to focus on getting the fundamentals right: that is, to maintain macroeconomic stability, invest in infrastructure, improve the business climate, encourage private investment and invest in people, especially in education at all levels.

In addition to national-level policy initiatives, international cooperation plays an important role in fostering economic diversification by contributing to the identification and sharing of best practices and experience of countries that have successfully diversified their economies; identifying non-domestic barriers to economic diversification, such as trade barriers; identifying ways in which the international community could facilitate increased foreign investment in non-traditional sectors; and facilitating assistance, in the form of technology transfer, technical assistance and financial support, for the difficult task of diversification.

At the in-forum workshop held in Bonn and submissions received from Parties, it is becoming more evident that Parties expressed interest in having more focused discussions on how a particular sector, such as tourism/agriculture, might be affected by the impact of the implementation of response measures and on the potential for diversification initiatives. In this regard, some Parties suggested that one of the first tasks should be to identify the specific sectors and countries most at risk, informed by economic modelling.

KEY MESSAGES FROM THE TECHNICAL PAPER

- Technical assistance for economic diversification is principally needed to support the formulation of good policy. Since policies are dependent upon the specific national circumstances, having a clear understanding of the institutional and capacity improvement needs of a particular country is of the utmost importance.
- While international cooperation has a clear and important facilitative role in economic diversification initiatives, the actual task of creating and administering programmes for economic diversification should be undertaken at the national level.
- There is a need to conduct more region- and sector-specific studies to support developing country Parties in their economic diversification initiatives.
- From the perspective of the least developed countries and poor economies, economic diversification should be considered as a broader sustainable development strategy, as diversification brings a much wider range of benefits that go beyond greater resilience to the impact of the implementation of response measures.
- The challenge of addressing product dependence is part of the broader economic development challenge of ensuring a stable economic base for the long-term sustainable growth of the economy.



JUST TRANSITION OF THE WORKFORCE, AND THE
CREATION OF DECENT WORK AND QUALITY JOBS

III. Just transition of the workforce, and the creation of decent work and quality jobs

Within the framework of the UNFCCC, just transition of the workforce is considered one of many tools for addressing the social impacts of climate policies and actions. These impacts have received far less attention than environmental and economic impacts from governments when implementing their mitigation policies and actions. Just transition is not generally considered a national priority, and experience of applying a framework to achieve it is lacking.

The importance of just transition of the workforce is underlined in the Paris Agreement, which states that Parties should consider the imperatives of just transition and the creation of decent work and quality jobs in accordance with their nationally defined development priorities. Furthermore, the adoption of the Declaration on Just Transition at the 2018 United Nations Climate Change Conference in Katowice, Poland, underscored that just transition is critical to the interests of governments, workers and employers around the world and provided significant political momentum. These precedents in the international climate regime imply that the concept of just transition has been mainstreamed in global climate policies.

Policy responses to climate change must take into account the major structural transformations that will affect society at all levels, ranging from national economies to enterprises and communities to individual workers. The impacts on employment of a shift towards a climate-compatible economy result, most directly, from changes in government policy, which in turn translate into changes in investment, trade and productivity.

This technical paper aims to assist Parties in realizing just transition of their national workforce and creating decent work and quality jobs. It is a step-by-step guide for developing country Parties on carrying out such a transition, from taking employment into consideration when devising climate change response measures, to preparing the workforce for and implementing the transition, and assessing the effect of the transition. The technical paper also sets out what governments should consider at the national level to maximize the positive impacts and minimize the negative impacts of response measures during just transition of the workforce.

1. Impacts of climate change on employment

Global transition to low-carbon and sustainable economies has both positive and negative impacts on employment. Reducing emissions through mitigation efforts involves not only fundamental restructuring of certain sectors, such as the energy sector, but also shifts within sectors (e.g. from a focus on fossil fuels to clean energy) and between primary, secondary and tertiary economic sectors, as well as shifts within different regions of the world. Generally, output and employment in low-carbon industries and services will grow, while energy- and resource-intensive sectors are likely to stagnate or contract.

Mitigation efforts affect employment in terms of the number of jobs affected (quantitative impacts) and in terms of the quality of the jobs created or transformed (qualitative impacts).

(a) Quantitative impacts of climate mitigation on employment.

Job creation	The expansion of less carbon-intensive products, services and infrastructure will increase labour demand across many sectors of the economy (renewable energy, energy efficiency, etc). In addition to creating direct jobs, the expansion will trickle down and create jobs in the supply chain (indirect jobs). As the income generated is spent across the economy, there will be growth on the demand side, creating further employment (induced jobs).
Job substitution	Some existing jobs will be substituted as a result of shifts in the economy, such as from fossil fuels to renewables, from road-based transportation to less carbon-intensive modes like rail, and from the manufacturing of traditional internal combustion engines to the production of electric vehicles. These shifts may be gradual or sudden and have implications for the required occupational profiles and skill sets.
Job elimination	Certain jobs may be eliminated – either phased out or massively reduced in number – without being replaced. This might happen where polluting and energy- and material-intensive economic activities are reduced or phased out entirely, which also eliminates indirect jobs and reduces the number of induced jobs.
Job transformation	Many workers in existing occupations, such as plumbers, electricians, metal workers and construction workers, will simply see their jobs transformed and redefined as the associated skill sets, working methods and job profiles are ‘greened’: automobile workers will produce more fuel-efficient (or electric) cars, farmers will apply more climate-appropriate growing methods, etc.

It is important to note that the low-carbon economy may not provide sufficient numbers of jobs exactly where jobs in the conventional economic structure were lost. Likewise, green job creation might not happen at the same time or pace as conventional job losses occur. To the extent possible, these disconnects need to be bridged by transition policies in order to minimize dislocation and human suffering. Policymakers must smooth the edges of this transformation by developing just transition policies for affected workers, enterprises and communities.

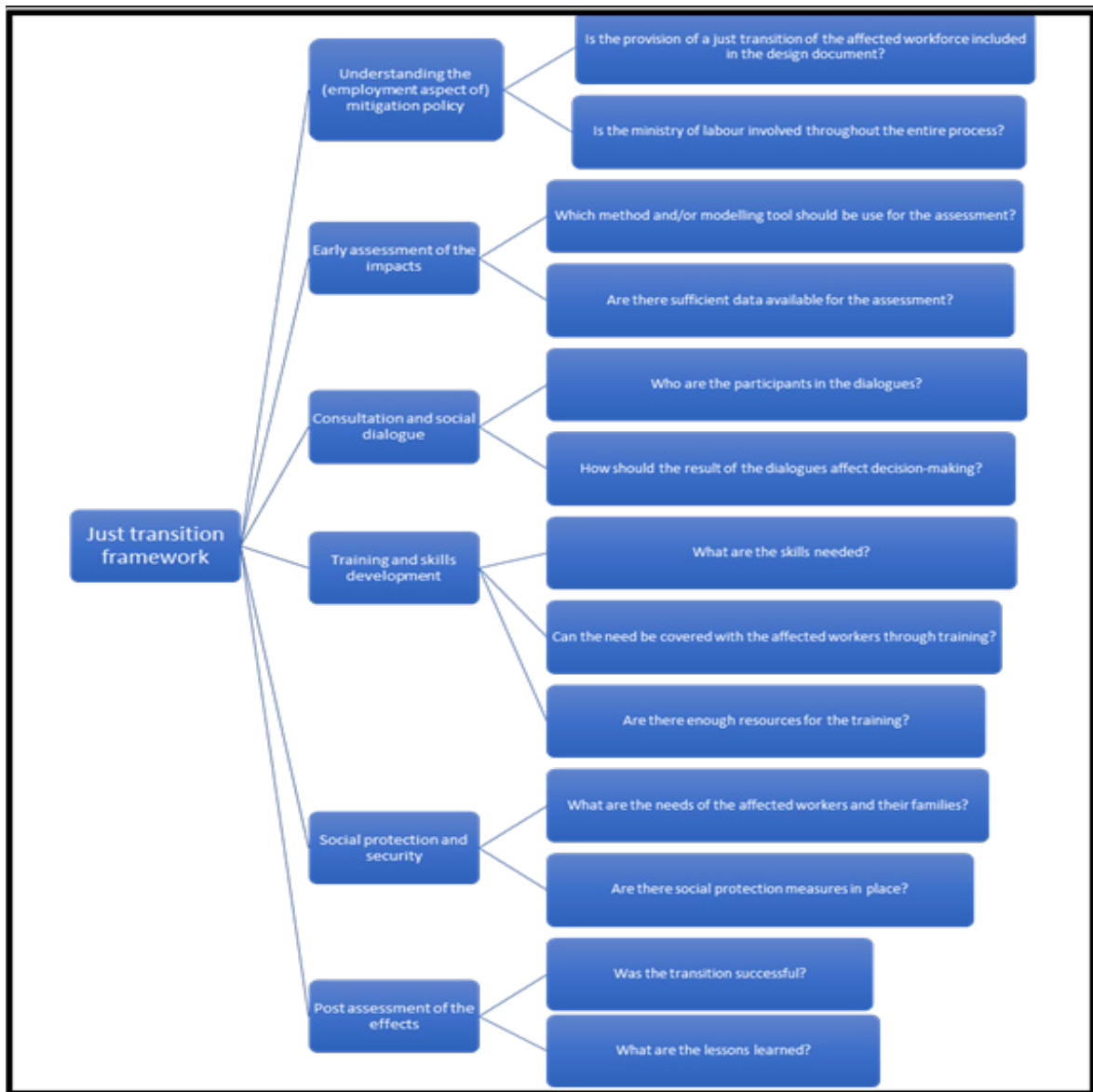
(b) Qualitative impacts of climate change mitigation on employment.

Jobs created in the transition to a low-carbon economy must be ‘decent’, that is provide adequate income and social protection and offer safe working conditions within a framework that ensures respect for rights and promotes effective social dialogue.

Some occupational hazards are reduced by the transition to a low-carbon economy. For example, a shift to renewable energy will eliminate many of the severe health risks associated with coal mining. At the same time, new hazards may arise that require attention; for example, workers producing solar photovoltaic panels are exposed to a number of toxic substances and electrical hazards, which may prompt additional concerns.

2. Just Transition Framework

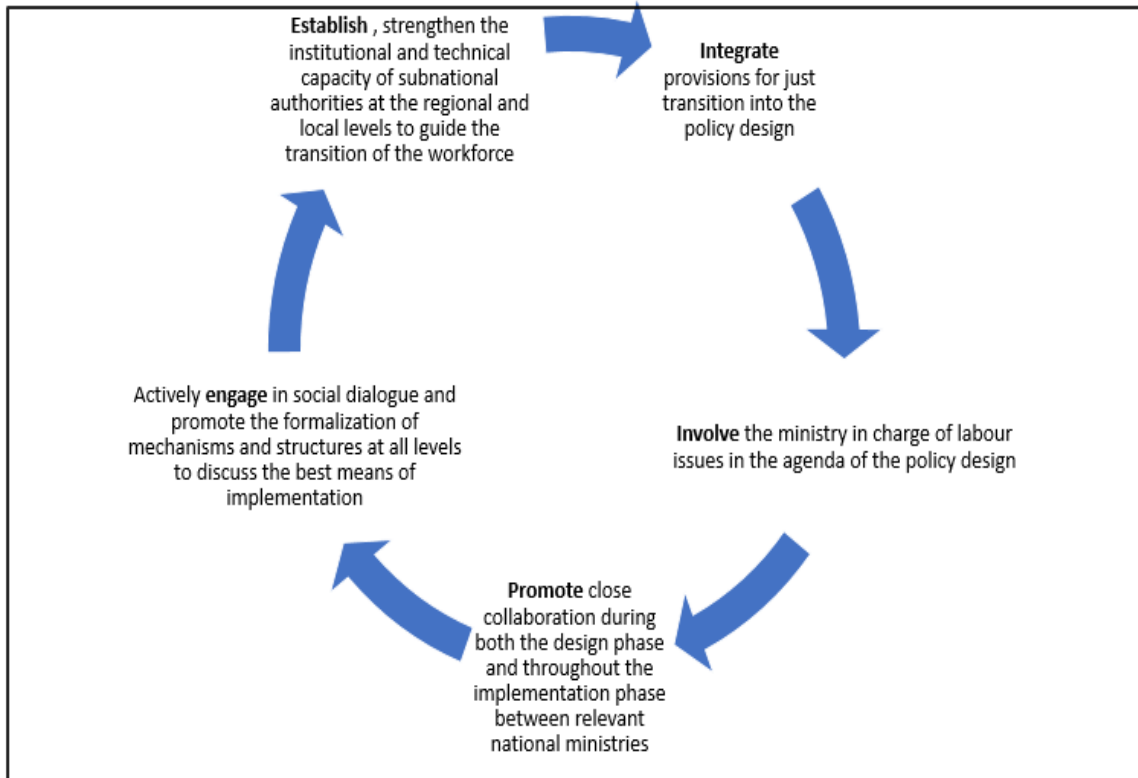
Coherent policies must provide an enabling environment for enterprises, workers, investors and consumers to embrace and drive the transition to environmentally sustainable and inclusive economies and societies. A just transition framework could be used when developing environmental policy in order to take into account just transition of the national workforce, including by maximizing the positive impacts of implementation and minimizing the negative ones. The elements of the framework are summarized in the figure below.



Main elements of the just transition framework

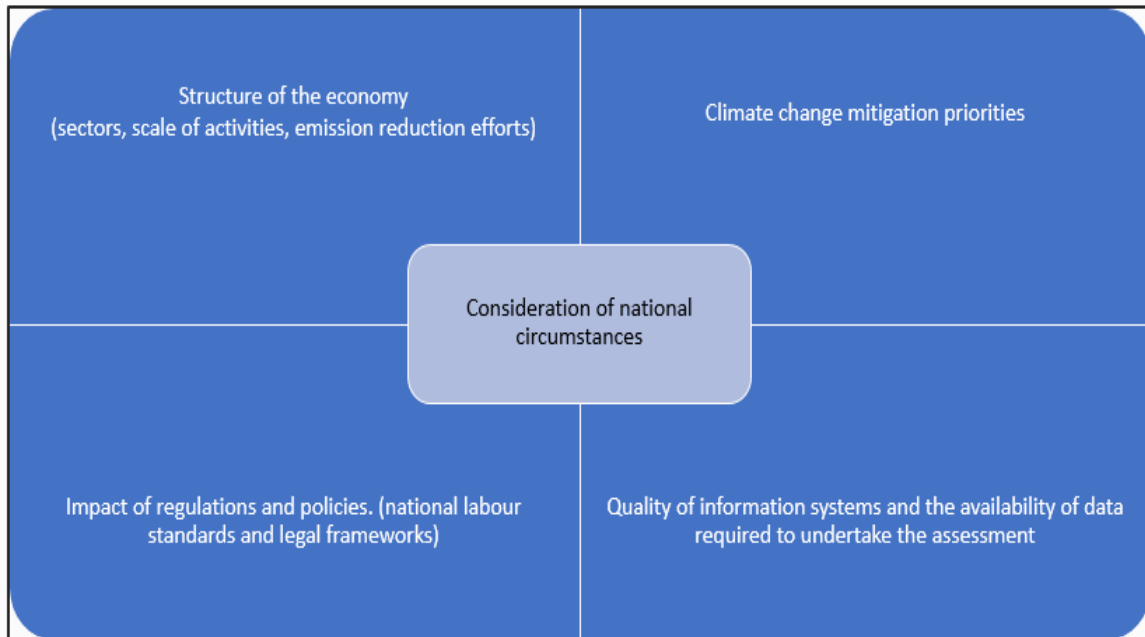
The just transition framework includes the following elements:

Understanding the impacts of mitigation policy: In order to address the impacts of mitigation policies, climate change policies should take into account employment and social impacts. Actions that promote understanding of the impacts of mitigation policy on employment are illustrated in the figure below.



Actions to promote understanding of the impacts of mitigation policy on employment

Research and early assessment of the impacts of a mitigation policy on the workforce: This involves understanding national circumstances in relation to climate change management and analysing impacts by sector. Various methods and modelling tools can be used for the assessment, which require a thorough understanding of local socioeconomic conditions and national priorities in the area of climate change management.



Factors to consider when formulating policies aimed at reducing emissions (developing country context)

Analysis of impacts by sector: When considering the impacts that mitigation policies have on the workforce, the agriculture and energy sectors stand out. Agriculture provides livelihoods for many of the most vulnerable people to climate change. The energy sector is central to the economy and a successful energy transition is therefore critical to the shift towards a climate-compatible economy.

Consultation and social dialogue: Consultation and social dialogue with those most affected by the effects of climate change and related policies are at the core of the just transition framework. Social dialogue has been identified as an essential tool for anticipating and managing the effects that greening the economy will have on the quality of work and employment. Social dialogue can take place at the regional level, at the national level, through cross-industry consultation or at the sectoral and company level, and varies from simple consultation, through coordination of the implementation of a specific policy, to the negotiation of binding agreements.

Training and skills development: Studies conclude that skills shortages are already a major obstacle to the transition to greener, climate-compatible economies and thus job creation. Moreover, this problem is likely to grow in the coming years. Enough labour market entrants must have the skills needed for the transition, and existing workers must acquire new skills in order to meet new job requirements. Thus, it is of paramount importance that education and training efforts are linked with the just transition policy. Action is required at all levels (individual, enterprise, industry and government) to formulate and establish training and skills-development programmes that are in line with future requirements. The potential for transferring skills and regional development should also be taken into account where feasible.

Social protection and security: The majority of the world's economically active population does not benefit from any protection in case of unemployment, work-related injury or maternity. Nearly half of all people over pensionable age do not receive a pension, and pension levels are often inadequate

for those who do. In recent years, social protection has received attention via international agreements and development policies because of its significant contribution to poverty eradication, gender equity and the promotion of social inclusion and sustainable development.

Post-implementation assessment of just transition measures and their sustainability: In the context of future planning, such assessment can provide valuable input to addressing the risks and needs of affected workforces and enterprises, and for governments can identify whether all the needs and concerns of the just transition have been addressed and pinpoint possible avenues for improvement.

KEY MESSAGES FROM THE TECHNICAL PAPER

- Just transition for all towards an environmentally sustainable economy needs to be well managed and contribute to the goals of decent work for all, social inclusion and eradication of poverty.
- The aim should be to generate decent jobs throughout the supply chain, especially in high value-added sectors that stimulate the upgrading of jobs and skills and job creation.
- The greening of economies in the context of sustainable development and poverty eradication requires a country-specific mix of macroeconomic, industrial, sectoral, social protection, skills-development, social dialogue and labour policies that establish an enabling environment for the creation of decent work opportunities by mobilizing and directing public and private investment towards environmentally sustainable activities.
- The emergence of additional jobs necessitates new competencies and shifts in occupational demand. There is a critical need to focus on training and education policies that facilitate job transitions and improve workers' employability. Without skilled workers and competent enterprises, the shift to a low-carbon economy will be neither technically feasible nor economically viable.
- Regions that lack diversification and have limited capacity for innovation or whose economic mainstay is vulnerable to the impact of decisions made elsewhere will face the greatest challenges.



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