Reviewing International Actions against Global Warming: Kyoto Protocol Analysis in Developing Economies

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Abstract
International response to global warming involves several policy options. The Kyoto Protocol is the first protocol designed and supervised by UNFCCC. Many questions have been asked about the Kyoto Protocol and whether it will make the expected difference or not. The current paper analyzes the Kyoto Protocol and reviews its main provisions, opportunities, and shortcomings. An in-depth review of the provisions using SWOT analysis shows that the Kyoto Protocol presents sufficient flexibility for member economies to exercise enough independence to enhance and sustain their sustainable development using friendly environment technology. Explicitly, the agreement puts constraints in Clean Development Mechanism (CDM) projects registration clauses, and in this manner, allows only those projects proved to add value to developmental targets for the host economy. The paper also reviews current international policy options controversies include the debate on adaptation and mitigation actions with special reference to the developing economies. Finally, policy recommendations suggest that the participation of national governments, small organizations, corporations, and civil organizations and individuals are essential in reducing GHG emissions. In this context, global warming is a commitment to change attitudes rather than only an obligation to a regulatory issue.

Keywords: Global warming, Kyoto Protocol, SWOT Analysis, Adaptation, Mitigation.
1. Introduction

The impacts of global warming are increasingly unmanageable due to the continuous accumulation of Green House Gases (GHG). The problem with GHG is not in their presence, but with their unprecedented accumulations in the atmosphere, which continue for decades. In the past, GHG was normally increasing over a vast time span, i.e. thousand years, thus nature was able to divert the excess amount of gases by means of weathering continental rocks and photosynthesis of carbon compounds of plants and marine plankton. However, recent and rapid increase in GHG over short period of time is trapping more heat, and thus accumulates more GHG as time goes by and forcing a continuous rise in temperature, i.e. global warming (Gore, 2006; Maslin, 2004).

Controlling GHG emissions require respecting its public goods attributes. The degree, by which the nature of public good is determined, depends on the features of the product itself. Global warming has non-rival and non-excludable dimensions. On the one hand, non-rival means one person's consumption of the climate does not reduce the ability of others to consume it nor reduce the amount available to other consumers. On the other hand, non- excludable means that those who fail to pay for it can not easily be excluded from using it. This also implies that no human can avoid its impacts, except by leaving the planet; also, the impacts are commonly felt by the entire global population; and finally, there is no market for buying alternative climate (Stern, 2006).

Over the last forty years, developing economies have increasingly suffered costs that are, on a per capita GDP basis, twenty times greater than the cost paid by developed economies from natural catastrophes. These losses were more than $35 billion. Even with lower financial problems, climate change can still have intensive impacts on developing economies, because they have several vulnerable geographic, economic and social factors in addition to inadequate urban facilities (Downie, Brash and Vaughan, 2009). Thus, the more the weather events are becoming frequent, the more is the financial burden on developing economies and on their sustainable development. That is why some leading actions against global warming should be performed through international cooperation and negotiations; while some measures are best handled by local market forces and efforts according to each national economy's circumstances and capabilities.
2. Rationale and Objectives of the Study

The paper first introduces major international developments and policies to control global warming. However, the main objective of the paper is reviewing the developing economies' efforts on mitigation and adaptation actions. Thus, it focuses on analyzing Kyoto Protocol actions using SWOT analysis; with special attention to the developing economies case and accordingly the study provides policy recommendations for developing economies in the next phase of negotiations.

2.1 Developments of Institutional Framework for Climate Changes

Historical chronicles of international responses to the threat of global warming can be traced to the end of the 19th century. In September 1873 at Vienna, the first International Meteorological Congress was held. The meetings of this Congress allowed the establishment of the first formal institution for international cooperation concerning climate. In 1878, at Utrecht the International Meteorological Organization (IMO) was formally established. After the war, IMO became World Meteorological Organization (WMO). The following developments at the Stockholm Conference negotiations in 1972, established the United Nations Environment Program (UNEP) (Paterson, 1996). In 1988, WMO co-operated its efforts with UNEP to establish the Intergovernmental Panel on Climate Change (IPCC) institution. IPCC has marked a new era for taking revolutionary actions against global warming.

As a UN body, IPCC mobilizes scientific, technical and socio-economic information regarding possible climate change impacts as well as adaptation options to decision makers. Its primary objectives were declared in its first meeting on November 9th 1988, mainly: (1) assessing the scientific information relevant to climate changes; (2) assessment of environment socio-economic impacts of climate changes; (3) formulation of responses strategies (Dow and Downing, 2006). Many conventions and protocols have proceeded this era. For instance, the successful Montreal Protocol adopted in 1987 had influential impact on quick depletion of the ozone layer after reducing the chlorofluorocarbons (CFCs). This successful protocol, in addition, to issuing the first IPCC Assessment Report in 1990 encouraged members of the annual Conference Of Parties (COP) organized from 1995-1997 to believe that a similar protocol could have effective results on reducing GHG emissions (Reed, 2006).

The first IPCC Assessment Report constituted a cornerstone in building public awareness and attracting attention to control climate changes. The Report is considered by many economists at that time to be the most authorized scientific assessment on climate change; it summarized the
most likely impacts of the current trends of emissions on future concentrations and eventually their influence on the climate in a systematic and comprehended manner for the first time (OECD, 1999). The call for effective actions together with revolutionary IPCC reports requested further developments to monitor, stabilize and reduce climate changes. The response took the form of the United Nations Framework Convention on Climate Change (UNFCCC) followed by the Kyoto Protocol.

2.1.1 The UNFCCC

The adoption of the UNFCCC was at Rio in 1992; however, the Convention entered into force in 1994. To date, almost 200 economies have ratified the treaty (Downie, Brash and Vaughan, 2009). The convention key provisions call for: (i) acknowledgement of industrial economies that GHG were produced and accumulated due to human activities; (ii) acceptance of national quota and commitments to undertake reductions in GHG emissions; (iii) commitments of all members to take part in future annual COPs, and to abide by their decisions (Reed, 2006).

Although Article (2) identifies several goals for the convention, however, stabilizing the GHG concentrations in the atmosphere at a level that prevents anthropogenic interference with the climate remains to be the ultimate objective of the treaty (Downie, Brash and Vaughan, 2009). Achieving this goal requires commitments within a time-frame to allow for better ecosystem adaptation to climate changes and to enable sustainable development. That is why Article (3) of the Convention requires compliance of its entire members to obligations based on their development level.

In Article (4) all parties are required to (i) develop, update, and publish their GHG emissions; (ii) regularly formulate, implement, and publish national programs for mitigating climate change; however, only developed economies have additional obligations, where each country have to adopt national policies to limit its anthropogenic activities causing GHG emissions. In addition, Article (4) of the Convention stated in clause (3.7) that developing economies are exempted from responsibility for reducing emissions. The clause pays special concern for the needs of developing economies and their priorities toward economic and social development in a world free from carbon fuel. It per-quested the compliance and effective implementation of developing economies based on the effective implementation of developed economies of their commitments under the convention related to financing and transferring technology (Reed, 2006).

Finally, the Convention requires developed economies to finance three funds according to the status of the economy. The first is the Adaptation fund to compensate economies who are
petroleum exporters. The second is the Special Climate Change Fund to finance technology transfer to developing economies. The third is the Least Developed Countries Fund to finance the poorest of the poor. This fund is particularly responsible for economic development projects using alternative energy sources with lower GHG emissions.

However, the adoption of UNFCCC was recognized by its members to be "the launching pad for stronger action" for climate mitigation in the future (Reed, 2006). This belief was maintained throughout all the proceeding meetings of the UNFCCC. At COP1, negotiators started a pilot phase of Activities Implemented Jointly (AIJ), where 150 projects were processed but never fully implemented (Olsen, 2007). However, in 1995, the Second Assessment Report confirmed the responsibility of the human activities for the accumulation of GHG emissions and thus reinforced the increasing attention of the climate change problem. This was the background against which the parties to the UNFCCC agreed to meet at COP3 organized in Kyoto to consider a stronger action in the form of a protocol signed by 38 developed members of UNFCCC after 30 months of negotiations (OECD, 1999).

2.1.2 The Kyoto Protocol

Although signed in December 1997, actual work in the Protocol was not done except after more negotiations on operational provisions such as commitments, procedures and proper domestic inputs of national governments. The Protocol had a binding condition that allows enforcement only when the percentage of emissions of member economies ratifying the protocol reaches 55% of total emissions calculated in the baseline year.1 This was a difficulty since the USA, a major GHG emitter with an average 20% of the total 1990 emissions, announced in 2001, it would not ratify the protocol nor participate in future negotiations or developments unless fast developing economies are required to undertake quantified reductions in GHG emissions (Reed, 2006).

Several economies felt that the American withdrawal would undermine the credibility and authority of the agreement. For instance, Australia refused to join the agreement unless the USA signs first (OECD, 1999). Surprisingly enough, the American withdrawal stimulated quicker resolutions for some basic differences among other members (Babiker et al., 2002). For example, Japan, the third GHG emitter, ratified the protocol as to redirect its industries toward more clean

1 The year 1990 was chosen to be the baseline to give the former Soviet economies a chance to claim major reductions in emissions and secure a guaranteed finance for future commitments.
technology. In addition, the Russians\textsuperscript{2} ratified the protocol in 2004 after securing a guaranteed finance, and joined the other 125 economies, and thus completed the necessary condition of enforcement. After major developments in the ratification and implementation context of the agreement through COP6 and COP7 sessions, the Kyoto Protocol brought into force in 2005 (Reed, 2006; Downie, Brash and Vaughan, 2009).

Concerned by the inability of developing economies to reduce emissions while adapting to climate changes; the protocol follows the main UNFCCC provisions concerning "differentiated responsibilities and respective capabilities". The differentiated responsibilities principle holds the industrialized economies responsible for the GHG emissions\textsuperscript{3} and thus, places heavier burden on them; since they are the only economies that can afford paying the costs of mitigating and stabilizing GHG emissions. Thus, GHG reductions are placed according to specific timetables based on different obligations of members.

The first group of countries known as "Annex I countries". This group has greater obligations, it includes 38 industrial economies, namely Organization for Economic Co-operation and Development (OECD) countries except Korea, Mexico and Turkey, and also it includes some "Economies in Transition", most notably Russia. This group is requested to present annual reports of emissions; national plans to reduce anthropogenic emissions; plans for promoting technology transfer and financial assistance. In addition, because they are held responsible for accumulating GHG emissions, they are required to undertake national actions for achieving 20-40 percent reductions in the emissions below the 1990 levels by the end of the first commitment period 2008-2012 (OECD, 1999; Olsen, 2007).

The second group is known as "Annex II countries" which are the "Annex I countries" without the "Economies in Transition". This group is required to provide financial commitments requested by the convention; namely financial resources for developing economies (non-Annex I) and full funding for the annual meetings and studies. Kyoto Protocol also works under the continuous quest for reducing per capita emissions for Annex I economies while controlling and mitigating the climate change impacts. However, to equate the marginal costs paid by the OECD members, the Kyoto Protocol requires the enforcement of three flexible mechanisms following a "Cap and Trade" policy; the Joint Implementation (JI) (Article 7), the Emission allowance

\textsuperscript{2} Russia has the second highest $\text{CO}_2$ emissions calculated in 1990 with 17.4\% (Reed, 2006).

\textsuperscript{3} The industrialized economies are major contributors to the total global emissions with more than 60\% (Rose and Stevens, 1998).
Trading (Article 17), and finally the CDM (Article 12). On the one hand, these mechanisms are designed to decrease the costs of reducing future GHG emissions while adopting a clean environment technology (Downie, Brash and Vaughan, 2009). On the other hand, by focusing on developmental priorities, CDM is the only mechanism that provides incentives for the developing economies participation through financing their sustainable development plans. Table (1) highlights the main differences between the three Kyoto mechanisms.

<table>
<thead>
<tr>
<th>Table 1: The difference between the three mechanisms of Kyoto protocol</th>
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<tbody>
<tr>
<td><strong>Nature</strong></td>
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<td>Financing projects in non Annex I economies</td>
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<tr>
<th><strong>Purpose</strong></th>
<th>Gain emission rights</th>
<th>Promote technology transfer embodied in the investment</th>
<th>Transfer emission rights</th>
<th>Only allows for &quot;spot&quot; transactions</th>
<th>Transfer emission rights</th>
<th>Promote technology transfer</th>
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<tr>
<th><strong>Features</strong></th>
<th>Do not have emission target</th>
<th>Have emission target</th>
<th>Have emission target</th>
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<tr>
<th><strong>Parties</strong></th>
<th>Sponsor: Annex I economies Host: non-Annex I economies (developing economies)</th>
<th>Only Annex I economies and without restrictions</th>
<th>Only Economies in Transition are to receive from the other Annex I economies</th>
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<th><strong>Problems</strong></th>
<th>-Higher transaction costs caused by the individuality of unilateral agreements for each economy; approvals are granted case by case -Errors in baseline calculation could lead to higher global emissions since the non Annex I partner has no initial emission ceilings -Slow pace of calculating baseline scenarios &amp; validation of projects until issuing CER *</th>
<th>Difficulty of Verifying, monitoring and enforcing</th>
<th>The continuous need for evaluation of the emissions quantity expected without the project being carried out.</th>
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*It takes around two years for the validation process and issuing CER.
Source: Based on OECD, 1999; Reed, 2006; UNEP Risoe Centre, 2010

.3. Policy options and controversies

The debate over the choice of the appropriate bundle of policy options for climate management has been permanent issue in almost all UNFCCC negotiations. This is because the
right package of policies includes several alternatives. There are now several climate policies in place or currently under negotiation, including taxes on emissions, increasing oil prices or emission trading programs, or promoting clean technology programs, etc. However, there are several disagreements among economists on the cons and pros against every policy (Goulder and Pizer, 2006). One of the policies suggested is doubling oil prices. However, this policy can cause reallocation of the resources, namely labor between different sectors of the economy. This will, in turn, induce substantial loss in wages and eventually cause an increase in unemployment (OECD, 1999). Another policy option is using direct regulations by national government. This traditional method can achieve transparency through explicit written limits for economic agents. In addition, certainty is guaranteed through direct enforcing of the regulations by national governments. However, it requires high administration costs. In addition, it is difficult to design effective regulations that can be applied and enforced across diversified societies, economies and legal systems (Bertram, 1992).

3.1 Carbon taxes verses cap and trade

The two leading policy options are, however, "Cap and Trade" and Carbon taxes. Their contributions have been subject to extensive debates. Although both methods stimulate innovation; increase energy prices and raise revenue, yet there exist many differences between them.

Carbon taxes; since Pigou, taxing is familiar as an efficient instrument for environmental issues (Hoel, 1992). In principle, the idea of imposing international taxes on carbon is similar to imposing taxes on regular goods. Each firm pays the government a fee for each unit of pollution it emits. Those firms with low reduction costs would lower their emissions in order to pay fewer taxes. However, those firms with high reduction costs would not be able to reduce their emissions enough, and thus, they will pay higher taxes. This offer will establish the cost level where firms will decide whether to abate or pollute. This is similar to a price mechanism, since it sets a price for CO₂ emissions. However, carbon tax is levied on burning fossil fuels and based on their carbon content. In economic terminology, the carbon tax reflects the social cost of carbon emissions on the producers account; thus, internalizing the costs caused by them.

Taxation can be on carbon, emission or energy. An emission tax means an emitter has to pay a charge for every GHG ton released into the atmosphere. This means its value can be determined in proportion to the consumption of emissions. This type of tax grants several benefits; (i) it increases the price of emissions; (ii) it triggers gradual changes in the permit price that would not discourage the investors; (iii) it can be imposed after reaching a higher income level which
lessens the resistance of developing economies (House of Lords 2nd Report, 2006). However, a carbon tax is more influential in mitigating climate change. Recent economic analysis suggests that imposing environmental taxes on GHG emissions, particularly taxes related to CO₂ emissions from burning fossil-fuel, e.g. at $5-10 per ton of CO₂ equivalent can be effective. This is because carbon tax stimulates the competitiveness of friendly-environment technology against those based on burning fossil-fuel. Furthermore, it accumulates tax revenues, particularly with the advantage of having expert governments facilitating their implementation (Bertram, 1992).

In addition, taxing a participant economy can have spillover effects on non-participant partners. This is known as negative carbon leakage, i.e. it increases the effectiveness of lowering overall emissions; it causes more desirable outcomes through reducing the demand of developed economies on coal, oil and petroleum. In particular, a carbon tax is preferable in cases where taxes could harness markets to minimize the costs of stabilizing climate change or in cases where it would strengthen incentives to develop new technologies (Downie, Brash and Vaughan, 2009). Finally, the third type of taxing is energy tax which charged directly on the energy goods (House of Lords 2nd Report, 2006).

However, adopting an international carbon tax is less supported due to; (i) taxing requires accurate estimation of the emitters behavior or it would not trigger reasonable reductions in carbon emissions and would cause manipulations; (ii) an unified international tax would have less promising results than taxes determined by binding individual or unilateral agreements; unless the carbon tax offers an incentive to switch from higher to lower emitters, the tax will not be successful. Furthermore, the risk of moral hazard involved is very high since taxing on an international level would require an administering agency gaining control over annual revenues on a staggering scale (Bertram, 1992).

"Cap and Trade" method, the idea of this policy requires GHG emission reductions through a quantitative cap over the entire economy or particular sector. The "cap" is a limit on legal emissions of the regulated gas. An emitter can alter or halt production to meet his limit obligations, or can engage in a "trade" that allows him to gain a limited credit above his specified cap for a limited time until he alters his production processes or buy new green technology. This limitation takes one of two forms; absolute limits on the emissions reduction targets; or intensity limits that links emissions to another factor, e.g. the size of the country's income. Although intensity limit helps in improving energy efficiency, yet it is not helpful in reducing the overall emissions. The fixed cap is then allocated to firms through auction or fees in the form of tradable permits, which permit firms to emit a certain amount of emissions. Then, the firms trade the
permits across the entire economy to equate the cost of emission reductions. Finally, the government withdraws a particular amount of permits to reduce the cap and, thus, emissions (Downie, Brash and Vaughan, 2009).

The idea of tradable permits emerged since 1960's, and developed with the writings of Ronald Coase on social cost. The basic idea was using the characteristics of public good to trade the problem of pollution such that agents can move freely toward reducing pollution. These discussions have created a path for tradable permits to form what Kyoto protocol has become today. Permits allowed an effective method of advancing the developmental priorities of developing economies on a par with growing global concern for reducing the GHG emissions using the minimum bureaucratic institutions (Bertram, 1992). Those who have the highest costs of reducing their emissions will be the buyers of the permits to decrease their cost reduction including current operations and shifting to energy-efficient techniques. Those with low clean up costs will sell off permits and use their revenue to pay for pollution reduction, while making profits and shifting to a more friendly-environment technology using CDM projects.

The ability to create economic incentives for low cost and efficient mitigation; in addition to avoiding the bureaucratic efforts and hazards of coordinating an international carbon tax have provided the "cap and trade" scheme with major advantages over other alternatives for controlling emissions on the global level particularly in certain aspects (Hoel,1992). For instance, the "cap and trade" method secures an emission certainty since a cap is settled on maximum emissions, this means direct control on emission levels; while in case of carbon taxes, level of emission reductions across the economy is uncertain (Bertram, 1992; Downie, Brash and Vaughan, 2009). In addition, the ability of a tradable permit to undermine the tendency of market forces toward monopoly power makes it more successful on the global level; whereas carbon taxes are reasonably agreeable at the national level, since verification burden is done by experienced and ready revenue gathering and enforcement infrastructure. Nevertheless, if the two methods simultaneously implemented, better results are expected rather than choosing one method; provided that the tradable permits are allowed at the global level whereas national governments domestically work out carbon taxes to make use of its benefits on the national scale.

3.2 Mitigation verses adaptation measures

During the period 1992-2001, mitigation policies ranked first among the negotiations for feasible responses to global warming. This is because climate change is classified among medium to long-term issues (50-100 years). Mitigation interventions are designed to tackle the causes of climate change, while adaptation refers to interventions designed to assist people and countries in
tackling the impacts of climate change (Prowse and Snilstveit, 2010). Thus, mitigation measures (prevention) were preferred over adaptation approach (cure) in that era (Olsen, 2007).

*Mitigation* actions aim at reducing levels of GHG in the atmosphere by reducing either its emissions or concentrations (Banuri and Opschoor, 2007). A general definition of mitigation measures is outlined by Prowse and Snilstveit (2010) “policies that reduce GHG emissions and preserve/expand carbon sinks⁴”. The mitigation measures are then practices taken to increase different communities’ resilience to the negative effects of the global warming. It includes long-term and protective measures ranging from structural engineering and building code standards to property acquisition and elevation (Macdonald, 2006). Mitigation assessment requires creating more than one long-term mitigation scenarios (UNFCCC, 2008).

The UNFCCC is concerned with providing incentives to national governments for mitigating climate changes. Accordingly, it offers several mitigation assessments, which provide policy makers with possible options for technologies and practices that can mitigate climate change and also contribute to national development objectives (IPCC, 2009). For instance, UNFCCC encourages developing economies toward the Bali action plan that involves several mitigation progressive options. The plan supports and activates National Appropriate Mitigation Actions (NAMAs) pursued by developing economies and financed by developed economies (Teng, 2009). By definition NAMAs are only determined by the country itself. However, under UNFCCC obligations, developed economies are obligated to report their financial efforts for enabling proper means of NAMAs in developing economies (Muller, 2009). The emission reductions achieved by these efforts are only eligible for calculations if they are not fulfilled by carbon trade.

There are many successful examples of mitigation actions currently in place in several developing economies. For instance, Teng (2009) presents a quick review of the major CDM projects currently undertaken in China. In 1200 counties across the country, farmers applied organic fertilizers to reduce nitrous oxide emissions. Crop stalks are also used to feed domestic animals, the manure of which are then added as organic carbon to the soil. A compensatory mechanism for grassland ecology has been created to maintain balance between the grass and livestock; also, the numbers of livestock grazing are controlled to prevent it from deteriorating. Meanwhile, renewable energy technologies are being dynamically developed in the countryside, e.g. the use of marsh gas, solar energy and stoves that saves on firewood and coal. By the end of

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⁴ It is a process allows reforestation to make up for CO₂ (OECD, 1999).
2007, there were over 26.5 M households in China using marsh gas, saving 16 M tons of standard coal annually, with total amount of emission reductions equals 44 M tons of CO\textsubscript{2} (NCCCC, 2008).

International expertise and organization prefer that the major share of its finance mitigation measures should come from the private sector, primarily through carbon markets and investment in low-carbon technology. However, implementing mitigation measures through international agreements such as Kyoto Protocol should not apprehend the domestic efforts to adapt to the current and future impacts of global warming. In fact, Adaptation strategies are important as well; they should be pursued on a par with mitigation measures.

**Adaptation:** it, in any event, is a necessary strategy for coping with climate change (Nordhaus, 1990). Adaptation measures refer to "changes in practices, processes or structures to take changing climate conditions into account, to moderate potential damages and to benefit from opportunities that arise from climate change" (IPCC, 2001). Adaptation is a necessary component of climate policies given the irreversible climate change impacts in the short run. Simple land-use regulations or research investments can prevent harmful climate impacts. Thus, it became the center of attention in the last decade. For instance, in Marrakech, COP7 started a new phase of negotiations by including adaptation measures as a priority for reducing global warming due to its related impacts on poverty alleviation. In particularly, developing economies suffer the most consequences because of their geographical nature and their dependence on water fed agricultures and related sectors, e.g. water supplies, infrastructure, health, housing and coastal development.

Adaptation measures to warmer climate should take place gradually with a decentralized response (House of Lords 2nd Report, 2006; Olsen, 2007). The ability to adapt to climatic hazards and stresses depends on available financial resources for the economy (Dow and Downing, 2006). The inability of many developing economies to finance adaptation measures was the reason for establishing several adaptation funds, for instance:

- The largest source of support is from the Global Environmental Facility (GEF). It runs a Trust Fund where $50 million per year are available for capacity building in climate change adaptation;
- The Special Climate Change Fund (Adaptation Program), to finance technology transfer and economic diversification; funding is at the $50 million level with a development focus;
• A Least Developed Countries (LDC) Fund, to finance the preparation and implementation of National Adaptation Programs of Action (NAPAs) in LDCs; this development-focused fund has a volume of $115 million;

• The Adaptation Fund (under Kyoto), to finance the implementation of adaptation projects; it is financed by a levy on CDM projects (2% of its revenues) and by other contributions, with a possibility to reach $100 million per year (Banuri and Opschoor, 2007).

Agriculture and water supply offer a great opportunity for adaptation measures; it can involve water conservation, diffusing technology, new water supply and measures to avoid weather extremes. Although agriculture is the most climate-sensitive sector; but farmers have historically shown great ability to adapt to changing environmental conditions in different climatic zones. Studies suggest that global warming will reduce yields in many crops, but the associated fertilization effect of higher CO$_2$ will probably offset any climatic harm over the next century. However, adopting agriculture to climate changes include altering crop patterns in line with halting the cultivation of some lands. These measures can yield better results in preventing land changes with relatively low costs (OECD, 1999).

For several economies facing droughts, e.g. Mexico and Argentina, adjusting planting dates and crops are reasonable options. Diversifying crops will allow the growth of drought-resistant plants, e.g. agaves and aloe. Other economies facing droughts, e.g. Philippines have an implemented rotation method of irrigation during water shortage; construction of fire lines and controlled burning; adoption of soil and water conservation measures were considered for upland farming (Downie, Brash and Vaughan, 2009).

The seasonality of water supply can be a source for adaptation polices. Cities that struggle with water scarcity and pollution can follow Singapore’s leading experience in sustainable water management. Singapore’s Public Utilities Board (PUB) manages water supply, water catchments and sewerage in an integrated manner. It has succeeded in diversifying the city-state’s water, while lowering non-revenue water to one of the lowest rates in the world. Singapore's successfully experienced the “Four National Taps” strategy that identifies the integration of four key sources for development: local water catchments, imported water, recycled wastewater and desalinated water. The strategy involves demand-side measures that include progressive consumption water tariffs, water conservation taxes, and standards for household water fittings. In addition, water prices are set at a convenient level to recover its production and supply full
costs, as well as to reflect the scarcity of water in the country with higher costs for additional supplies.

Water tariffs with a true cost of water production, supply and treatment allow the availability of funds for R&D to identify more innovative and efficient ways of treating and supplying water, enough to meet future demand. In addition, per capita domestic water consumption declined from its highest historical level of 175 litres/day in 1994 to around 156 litres/day in 2008. Singapore is becoming more self-sufficient in relation to water. There is also an active water industry with more than 50 international and local companies in the Singapore market (United Nations, 2012).

Other economies face the fear of sea-level rise. The threat of sea rise can be controllable by an effective coast management. There are three main strategies for coast management: accommodation, planned retreat, and protection. In brief, accommodation strategy requires no action while protection means adopting comprehensive installations through sea walls and flood barriers. The planned retreat strategy however is a mix of the two other methods. It calls for abandoning some installations to natural progression while protecting others if costs were worthwhile. However, this strategy requires a lot of information about the projects of sea level and other elements involved (OECD, 1999).

In general, coastal cities likely invest in heavy physical infrastructure projects (protection strategy), e.g.: (i) Sea-surge protective barriers and dams; (ii) Reconstruction of harbor facilities; (iii) Flood barriers and Tsunami-prevention facilities (IPCC, 2001). In specific, experience in coastal adaptation measures evidently suggests that many economies have used one or more of these strategies at a point of time to adapt to climate changes according to its geographic nature and its own experiences of frequent weather extremes. For instance, Egypt adopted National Climate Change Action Plan to face the issue of sea-level rise. This plan allows for integrating climate change into national polices. In addition, the adoption of law 4/94 requires assessment of setback distance for coastal infrastructure and allows for adopting installations of hard structures in areas vulnerable to coastal erosion (Downie, Brash and Vaughan, 2009).

To sum up, for developing countries, the most likely source of carbon finance over the medium term will continue to be one sided “baseline and credit” schemes like the CDM. CDM projects are essential part of mitigation climate policies because they target emission reductions (World Bank, 2009). It is more reasonable, however, to say that both mitigation and adaptation policies are complementary rather than competitive. Both strategies should be pursued simultaneously and in coordination. Integrating adaptation in national development programs became central in the political and research discussions as well as addressing the importance of
mitigation measures in controlling future emissions. Nevertheless, financing adaptation efforts by special funds is an asset in facilitating adaptation measures. Furthermore, financing mitigation measures i.e. CDM projects by developed economies lowers the financial burden on national governments of developing economies.

4. Policy Analysis and Recommendations

Although the international collective efforts and actions of developed economies to reach and sign international agreements concerning climate changes as well as financing their implementation are obviously relevant to the global climate issue, yet, the focus of the paper is to consider the developing economies efforts, threats, constrains and options in light of climate agreements, in particular Kyoto Protocol. Thus, considering the developed economies efforts and policies compared to developing economies would be out of focus due to the difference in geographical, financial nature and obligations as well as climate consequences of both groups. That is why this part of the analysis will specifically focus on analyzing the developing economies case. Also, recommendations will be specifically compatible with their potentials and special nature to narrow the gap in awareness and other related aspects.

4.1 Kyoto Protocol Analysis

The idea of a global agreement such as Kyoto Protocol manifests the primary philosophy of game theory. In the game theory terminology, the payoffs of the non-participants will exceed those of the participants of the agreement which provides incentives to free-riders. However, the payoffs of the agreement will increase with the increase in numbers of the participants to protocol. That is why for such an agreement to successfully achieve its mission; every economy involved should be committed to co-operation. In the sense that each economy should gain compared with the initial situation before co-operation. Second, no economy should have an incentive to leave the agreement (OECD, 1999). In addition, as suggested by the Kyoto protocol the large number of participants will allow economies of scale that undermine any tendency toward market power (Bertram, 1992).

However, a number of key issues remain to undermine the effectiveness of the protocol. The first concern is establishing additionality to sustainable development within the host developing economy. This is a major concern since the inability to proof the additionality condition results in rejection of the CDM project by CDM Executive Board or at best scenario delays the approval. Thus, proofing additionality remains difficult. In addition, it requires large transaction costs. The second concern is that developed economies overuse the CDM in reducing emission reductions.
That is why the protocol requires developed economies first to undertake internal and domestic actions to control and reduce emissions, then get engaged in CDM projects as a supplement action. A third concern is that CDM rewards the emission reductions but does not impose penalty on emission increases. That is a major concern since firms would increase their emissions in the short run so that they become eligible for the rewards of reducing them in the long run. Finally, the largest emitters are not subject for obligations since they are developing economies such as China, Brazil, and India.

However, the global carbon market is worth $64 billion and is doubling in value every year (UNEP, 2011). This serves as a huge opportunity for Foreign Direct Investment (FDI) that would help in tripling domestic investment for developing economies and financing their sustainable development agenda. In particular, CDM projects are a form of foreign resource inflows that encourage domestic investment. Indeed, a dollar of foreign resource inflow on average triggers an increase of an additional $2 of domestic private investment (Banuri and Gupta, 2000).

In detail, CDM represents investment opportunity for cash inflows in certain areas where poor economies would not finance, e.g. fuel switching and evaluating emission projects. Since it reduces the loss odds facing the investors, the Protocol provides developing economies with the advantage of large carbon market size which allows high potential supply of CDM projects and more opportunities to increase their share of FDI. As indicated in the FDI literature, FDI can also be motivated by special investments opportunities that exist due to the special nature of each market. For example, in Cameroon only 15% of rural areas and 50% for urban zones have access to electricity, almost all of that demand is currently provided by hydropower. In addition, the demand is growing by eight percent annually, with the potential of an estimated 115 TWh/year, however, only 3% of these potentials are currently used, the difference in demand provides a great investment opportunity (MEPN, 2011).

A recent study found out that the impact of foreign aid is determined by political and institutional environment in the destination country. Promoting friendly-environment technology requires major advances in energy efficiency, power generation, infrastructure, and a significant increase in the use of renewable energy as well as lower emission rate from land use (Downie, Brash and Vaughan, 2009). Thus, a sound evaluation of the proper climate policy should follow standard cost and benefit approach. This means assessing it as an investment opportunity, where

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5 China has been the largest GHG emitter since 2007 (Downie, Brash and Vaughan, 2009).
the costs are those investments required in new clean technologies and the benefits are avoiding climate change (Banuri and Opschoor, 2007).

Cost-benefit analysis of the right combination of national policies can then be implemented by each individual economy. For instance, a developing economy can simply choose a diversified policy options based on maximizing their net gain, or choose to take advantage of their strengths. Alternatively, they could choose to minimize threats imposed by the Kyoto Protocol on their economy and their sustainable development through other set of strategies. Some economies are already developing more convenient national CDM policies to reduce side effects of reducing CO₂ on their economy, e.g. China (NCCCC, 2008). Thus, regardless the shortcomings of the Kyoto protocol, there exist opportunities. This is because benefits such as increasing FDI inflows, accumulating technological base, developing human capital and stimulating local industries can be achieved if developing economies undertake the right economic development policies while reducing their industrial emissions.

More specifically, the Kyoto Protocol requires no specific approach for structuring national environmental legislations. It only presents some guidelines for accepted practices in reducing GHG emissions through CDM projects, i.e. each individual economy can tailor their reduction mechanisms according to their domestic needs and resources. For instance, Zambia’s subtropical location gives it moderate to gusty winds, which tends to support wind energy generation. Thus, the Zambian government should direct and use clean and renewable sources of energy as well as use wind power as a developmental priority and an investment area (UNDP, 2012).

Thus, using strategic evaluation technique for the Kyoto protocol can provide a set of practical policy recommendations to review the protocol before the second commitment period. The SWOT analysis is a strategic management approach to analyze situations into four components, mainly Strengths, Weakness, Opportunities, and Threats. This analysis provides an overall assessment of the internal and external environment surrounding the subject of the analysis. The SWOT analysis highlights the strengths and opportunities that can be used to overcome the weaknesses and eliminates the threats facing a developing country as presented in Table (2).
### Table 2: SWOT matrix for the Developing economies case

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Large market size</td>
<td>- Low absorptive capacity of technological transfer</td>
</tr>
<tr>
<td>- Large human force with low wages</td>
<td>- Low spending on R &amp; D</td>
</tr>
<tr>
<td>- Open investments policies</td>
<td>- Confusing regulations</td>
</tr>
<tr>
<td>- Low carbon industries (expected CO₂ reduction benefits)</td>
<td>- Lack of applicable decrees</td>
</tr>
<tr>
<td>- Less expensive actions, e.g. avoiding deforestation.</td>
<td>- Weak institutions and enforcement</td>
</tr>
<tr>
<td>- Local resistance for CDM projects</td>
<td>- Lack of pollution measuring systems in the cities</td>
</tr>
<tr>
<td></td>
<td>- Lack of awareness</td>
</tr>
<tr>
<td></td>
<td>- Inconsistent clauses in protocol</td>
</tr>
<tr>
<td>- Flexibility in shaping national legislations</td>
<td>- Local resistance for CDM projects</td>
</tr>
<tr>
<td>- Access to financial resources</td>
<td>- High levels of risk</td>
</tr>
<tr>
<td>- Second commitment period of the Kyoto Protocol (Review)</td>
<td>- Sustainable development concerns</td>
</tr>
<tr>
<td>- A growing International interest</td>
<td></td>
</tr>
<tr>
<td>- Partnerships and civil initiatives (GGFR, Nairobi Framework)</td>
<td></td>
</tr>
</tbody>
</table>

### Opportunities | Threats
---|---
- Integration of large human force through the capacity building process and awareness workshops to lower local resistance and enhance individual capacity for low carbon investments. | - Avoiding deforestation is a good point of strength to overcome the effect of insufficient capital in developing economies to start clean projects. |
- Second commitment period of Kyoto protocol is an opportunity to overcome inconsistent clauses and confusing regulation, to take advantage of new options in enhancing their CDM institutions. | - Taking advantage of the flexibility opportunity to shape national legislations to eliminate threats on their sustainable development. |

The previous table can be transformed into several implementation matrices. Table (3) provides an example of a possible implementation matrix, consists of four major cells: ST, SW, OW, and OT. Each cell of Table (3) indicates what policy is recommended to eliminate a potential threat. Alternatively, the implementation matrix also addresses weaknesses with simultaneous policies.

### Table 3: An example of SWOT implementation matrix of the Developing economies case

<table>
<thead>
<tr>
<th>ST (using strengths to eliminate threats)</th>
<th>SW (using strengths to overcome weakness)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integration of large human force through the capacity building process and awareness workshops to lower local resistance and enhance individual capacity for low carbon investments</td>
<td>Avoiding deforestation is a good point of strength to overcome the effect of insufficient capital in developing economies to start clean projects.</td>
</tr>
<tr>
<td>Second commitment period of Kyoto protocol is an opportunity to overcome inconsistent clauses and confusing regulation, to take advantage of new options in enhancing their CDM institutions</td>
<td>Taking advantage of the flexibility opportunity to shape national legislations to eliminate threats on their sustainable development.</td>
</tr>
<tr>
<td><strong>OW (using opportunities to overcome weakness)</strong></td>
<td><strong>OT (using opportunities to eliminate threats)</strong></td>
</tr>
</tbody>
</table>
The SWOT matrix only represents an example of how to play a win-win game. In this context, game theory concept addressing the Kyoto Protocol presents a game of cooperation where both sides reach a middle ground. A High Quality CDM Project is one in which: Host country wins and Annex I countries win respecting the environmental integrity of the Kyoto Protocol in order to avoid dangerous, possibly irreversible and self-reinforcing climate changes.

4.2 Policy Recommendations

4.2.1 Recommendations related to reviewing problematic Kyoto Protocol provisions

The possibility of a second commitment period provides alternative opportunities for correcting the shortcomings in the protocol with consistent reforms. Some argue that choosing low cost methods for reducing and controlling GHG emissions is the more influential instrument. However, the most efficient policies should involve all countries and different parties of interest. Unilateral action may be better than nothing, but participation of different parties of interest in action is more rewarding. That is why one of the most relevant recommendations is that governments of developing economies should lobby their delegates in international negotiations to have a barging power to pursue their common interest in second commitment, for instance;

- **Options for a proper modification of the clause of 'tool to calculate the emission factor of an electricity system'** (Annex 12 of the Kyoto Protocol) are needed. It could benefit economies such as Mozambique and Swaziland who have limited capacity to engage with carbon markets. This is because they are part of the Southern Africa Development Cooperation (SADC) electricity grid. They have a high ratio of imported electricity with low operational margin emissions within the country; yet the inability to account for the imports from the Connected Electricity System (CES) poses a drawback for grid related CDM projects in both economies. Since the energy emissions of a country that imports electricity are not calculated and, thus have no value in the carbon market. However, future reviews of the Protocol should include a clause in its operational margin for allowing the calculation of a regional grid emission factor for the CO₂ emissions from electricity imports. It could be conditioned, e.g. on the percentage of the electricity imports from the other host country compared to the domestic electricity demand. This amendment would allow members of SADC to become independent from any electricity imports. It would for example redirect investments in electricity generation projects using abundant by-products of Swaziland’s sugar production (UNFCCC, 2011).
• **The baseline calculations** of the Protocol are based on 1990. Many former Soviet Union are left with more emission trading permits than they need. These permits are then sold to other economies that get credit for emission reductions that do not exist. These unreal reductions and their permits are commonly known as "hot air" (Reed, 2006). This is unrealistic; particularly the picture of these economies twenty years later is totally different. This baseline matters must be largely resolved before decisions made about ultimate permit transfers in the second commitment period, to reach maximize benefit of the protocol.

• **Deforestation** is not fully addressed in the protocol; whereas 20% of the GHG emissions are due to land-use change. In Brazil 70-75% of GHG emissions come from deforestation. It should be clear that avoiding deforestation is less expensive method to reduce GHG emissions. For example, the new commitment round of Kyoto could also grant carbon credits for avoiding Deforestation (Downie, Brash and Vaughan, 2009). Reforestation activities offer considerable potential to reverse the deforestation that developing economies has experienced over recent decades. The CDM, by offering project developers accessible carbon credits for undertaking these activities, represents a financial catalyst for such activity. However, CDM methodologies are complex and forestry is a more risky activity than many other types of CDM project because of the long time-scales involved, the risk of damage to trees (e.g. due to fire or flood) and the adverse environmental impacts (e.g. on biodiversity and water) that can accompany badly-designed projects. Nevertheless, UNDP has already developed a CDM forestry methodology tool, to enable project developers to select the most appropriate CDM methodology. For example, Projects provide new technology and capacities to farmers and further resources. It also offers specialized ‘bio-carbon workshops’ from time to time.

The Kyoto Protocol allows only CDM projects that prove to be of additional value and fulfill the priorities and goals of sustainable development of developing and least-developed economies. Accordingly, developing economies are allowed direct control and power on applying the right CDM investment. However, to realize advantages of the Protocol, developing economies need technical expertise at the negotiating table. Lack of expertise was shown in the first Kyoto commitment period negotiations. Many developing economies lacked adequate knowledge, experience, and technical know-how about the impact of different CDM regimes on their respective economies. With the exception of China and India, least-developed economies showed no objections to the initial proposal. There are still other opportunities in the agreement that developing economies can use in order to increase benefits from receiving CDM projects.

4.2.2 **Recommendations related to increase awareness and building capacity**
The integration of human development through building capacity and workshops, as a part of promoting technological development that creates the necessary absorptive capacity for adapting and enhancing the ability of developing economies to benefit new technology embodied in FDI inflows. This integration can be achieved through local civil organizations, or the national governments or international and private public partnerships; for example;

- **Partnerships** present important opportunities due to the growing international concern for climate. For example, Flaring and venting of associated gas (AG) has led to global emissions of GHG of about 300 million tons CO$_2$e per year in the last decade. Large markets such as India, China, and other African developing economies, have huge opportunities from partnerships such as Global Gas Flaring Reduction Public Private Partnership (GGFR) to promote the CDM and to accelerate flaring reduction investment (ICF International, 2006). GGFR was established to supplement and strengthen efforts by governments and the petroleum industry to reduce and eventually eliminate flaring associated with the extraction of crude oil. GGFR is a global partnership, which involves the World Bank and other stakeholders, including governments (e.g., Algeria, Ecuador, Nigeria, etc) and oil companies (e.g. BP, Shell, Chevron Texaco, etc).

- **International organizations** also offer other opportunities to compensate for the lack of information related to marketing CDM potentials of developing economies to the global carbon community. Many potential CDM project concepts are currently unknown to factory owners, communities, NGOs and state utilities. Therefore, workshops on CDM can be instrumental for Awareness-raising among domestic stakeholders and potential project developers. For instance, UNDP and UNEP are jointly organizing a series of workshops and scoping studies to assist project developers in navigating the rules and modalities of the CDM. Also, UNDP is engaged with a number of regional and private-sector banks regarding the CDM investment opportunities in countries such as Ethiopia, Mozambique for Awareness-raising and confidence-building amongst potential overseas investors and carbon buyers.

- **Other partnerships such as Nairobi framework** to which UNFCCC, UNDP, UNEP and World Bank are partners. This framework represents an opportunity to overcome several weaknesses, e.g. shortage in awareness in some developing economies. Thus, its main goal is to catalyze CDM projects in Africa through
  
  * Building capacity in developing CDM project activities
• Building and enhancing capacity of CDM DNAs to become fully operational
• Promoting investment opportunities for projects
• Improving information sharing / outreach / exchange of views on activities / education and training and coordination (UNFCCC, 2007).

4.2.3 Policy Recommendations related to enabling factors

There are several enabling factors include a high level of government effectiveness, strong political will, and finally an experienced and motivated workforce. This requires also effective legal and regulatory CDM framework, where the responsibilities and rights of each party are accurately defined in a way that promotes the transfer of clean technology and enhances its benefits to economic development. Thus, this effectively protects each party rights and interests, and ensures the proper operation of CDM project activities in priority areas, e.g. improving energy efficiency and utilization of renewable energy. A well defined CDM legislation also stipulates consistent CDM project activities with the overall requirements for national economic and social development objectives. This dictates transparency, high efficiency and accountability as well as attracts CDM investments.

There are countless measures that would be beneficial on other grounds and would also tend to slow global warming and strengthen international agreements. A comprehension set of recommended policy measures to overcome negative impacts of climate change should include:

• Improve the understanding of social impacts for past and possible future climate change. Scientists in developing economies should pay more attention in monitoring global environment and analyzing past climatic records. For example, an African Ministerial Initiative for measuring climate is under negotiations among the civil airlines Ministries in major cities in Africa (El-Zanaty, 2012). This will allow economic and international co-operation in gathering information which can yield better results.

• Trigger changes in the traditional ways of production; Governments should support Research and Development of bio-energy technologies that will slow or replace uneconomic use of fossil-fuel; for instance:
  1. **Renewable energy**, a percentage of total electricity generation capacity should come from renewable sources. Public Private Partnerships for the development and demonstration of bio-energy systems is required and recommended to encourage confidence of the private investor. Power Purchasing agreements under which
utilities buy power from renewable energy suppliers are also important (El-Dorghamy, 2007).

2. **Geo-engineering** research involves several approaches or options to lower emissions, for instance, releasing sulfur in the atmosphere to reflect sunlight before it reaches the planet. The use of reflective films lay over deserts or white plastic islands over the ocean to reflect the excess sun radiations. The use of wind turbines or sea motion to generate electricity. Other geo-engineering options include using thermal panels to covert sun radiations into heat or using Photovoltaic panels to convert sun radiations into electricity (Dow and Downing, 2006).

3. **Nuclear power station**; this can involve launching an international project to develop safe nuclear power. Building nuclear power plant has zero GHG emissions. The advantage of using nuclear power includes replacing fossil fuel and reducing dependence on oil and gas imports. These power stations are less expensive to operate, however they have high risk of explosion or leaking especially with unavailable expensive maintenance attention in some developing economies (Downie, Brash and Vaughan, 2009).

- **Changes in the traditional ways of consumption** through the participation of the whole society to activate a resources-conserving and friendly environment community (Baker, 2006). This should involve personal actions and initiatives to foster and support a social net in which the enterprises and the public participate on a voluntary basis to raise enterprises' awareness of Corporate Social Responsibility and the public's awareness in developing economies for the necessary care for global environment; For instance:
  
  1. **Personal actions**, people all over the world start to leave their cars and take public transportation to lower their cars daily emissions. Another example, putting lights off worldwide on earth day and closing machines and electricity for an hour on that day. This is important to trigger awareness about environment. Other personal actions would involve adopting and encouraging actions to reduce emissions in work place, such as separation of different types of wastes, i.e. trashes for plastic wastes, paper and others for food leftovers; this is a way to support solid waste management and recycling to reduce methane emissions.
  
  2. **Voluntarily initiatives** such as the one million tree planting initiative in several developed countries; it should be implemented in developing economies, since reforestation is one of the least expensive methods to fight climate changes. In Egypt,
there is an initiative by Natural Reservation Fan League to activate all the recommendations of climate researches and make them accessible and applicable by all related parties, e.g. local authority officials, private sector and civil organizations (Mahdy, 2012). Another example, there is a Regional Greenhouse Gas Initiative institution (RGGI) which has a target to induce a 10% reduction in CO₂ from power plants by 2018. Also, there are a growing number of websites that have voluntarily initiatives to help organizations develop strategies to deal with global warming (Dow and Downing, 2006).

5. Conclusion

Climate changes involve several consequences on developing economies. Given the different development requirements and domestic endowments of each developing economy, a country-specific approach in inducing reductions in GHG is an important element. Nevertheless, mitigation measures including CDM policies initiated by the Kyoto protocol present an important step in balancing development priorities with environmental targets in both short and long run. There is, however, a need for modifying implemental procedures within the Kyoto Protocol to allow for more individual differences among developing economies' potentials. In addition, promoting green development in developing economies is conditioned on the presence of institutional framework to attract and direct CDM projects and investments. Therefore, the protocol cannot play a monopolistic role in climate policy. Thus, the participation of national governments, small organizations, corporations, civil organizations and individuals remains essential in reducing GHG emissions and adapting to climate changes while promoting sustainable development. In this context, commitment to change attitudes rather than only fulfilling an obligation to a regulation is a key issue.

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**Further Reading**

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