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THE GREEN ECONOMY:

TRADE AND SUSTAINABLE DEVELOPMENT IMPLICATIONS

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Executive summary

The 2012 Rio+20 Conference will provide an opportunity to reaffirm the positive links between trade and the environment, and allow developed and developing countries alike to define and shape a green economy that supports sustainable development objectives while generating new investments, income sources and jobs among countries of varied levels of development.

International trade represents a powerful channel for spreading green economy gains among countries at the global level. By transmitting growing environmental and social preferences of firms and consumers in world markets, trade plays a central role in the diffusion of green goods, services, technologies and production methods among countries. The 1992 Rio Declaration and Chapter 2 of Agenda 21 acknowledge that trade can have a positive environmental impact and therefore make an important contribution towards sustainable development. Twenty years on, the fundamental message remains that mutually supportive trade, environment and development policies are needed to promote sustainable development.

With supportive national policies and institutions in place, trade opportunities offered by a global green economy can enhance economic growth and contribute significantly to national environmental and developmental objectives. This green growth should be inclusive; building developing countries' human and productive capacities to enable them to participate in a global green economy and thereby stimulate economic diversification, generate employment for the poor, and increase access of the poor to basic services such as energy, water, housing, education, communications and transport.

Discussions at the Rio Conference will need to identify effective approaches to accelerating the transition to an equitable, inclusive and development-led green economy. Approaches will necessarily need to be comprehensive yet practical to ensure an internationally managed transition that promotes and supports the participation of developing countries.

This note aims to present key issues and considerations that need to be taken into account in the Conference deliberations. It argues that sustainable development is an imperative rather than an option; describes the role of states and markets in a transition to a green economy; highlights the role of trade in advancing a green economy; and examines developing countries' need for technical and financial assistance.

In ending, the note explores possible roles for UNCTAD to support countries in their transition to a green economy, including by developing practical tools, and generating new approaches, to help ensure that trade and development benefits accrue to developing countries in the transition to a green economy.

1. Introduction

In December 2009 the United Nations General Assembly adopted Resolution 64/236 to organize the United Nations Conference on Sustainable Development in Rio de Janeiro in 2012. The Conference seeks to secure renewed political commitment for sustainable development, assess progress to date and remaining gaps in the implementation of the outcomes of the major conferences on sustainable development, and address new and emerging challenges. It is widely anticipated that the Rio Conference will reaffirm Principle 12 of the 1992 Rio Declaration on Environment and Development, and Chapter 2 of Agenda 21 to build a supportive and open global green economy, and consider proposals to advance their implementation.

Now, with the 2012 Rio Conference just months away, it is important to reflect on why sustainable development is such a defining issue of our time; what constitutes a green economy in the context of sustainable development and poverty eradication; and how such an economy can help us address the urgent environmental, social and economic problems we face. It should be emphasized that the concept of a green economy itself remains unclear for many. Moreover, some governments have concerns that a transition to a green economy may not generate net gains for their countries. While the debate over the development prospects of a green economy continue, it is clear that if the transition to a green economy is to generate gains for all, across and within countries, it must be carefully designed and managed by an active development state.

International trade represents a powerful channel for spreading green economy gains among countries at the global level. By transmitting growing environmental and social preferences of firms and consumers in world markets, trade plays a central role in the diffusion of green goods, services, technologies and production methods among countries. The 1992 Rio Declaration and Chapter 2 of Agenda 21 acknowledge that trade can have a positive environmental impact and therefore make an important contribution towards sustainable development. Twenty years on, the fundamental message remains that mutually supportive trade, environment and development policies are needed to promote sustainable development.

With supportive national policies and institutions in place, trade opportunities offered by a global green economy can enhance economic growth and contribute significantly to national environmental and developmental objectives. This green growth should be inclusive; building developing countries' human and productive capacities to enable them to participate in a global green economy and thereby stimulate economic diversification, generate employment for the poor, and increase access of the poor to basic services such as energy, water, housing, education, communications and transport. More attention needs to be focused on helping developing countries to connect with global production and supply chains, including by meeting growing environmental requirements in global markets, and facilitating the participation of low-income country producers and exporters in green production and trade.

There have been concerns that national measures put in place to advance the transition to a green economy could potentially create trade distortions or new forms of 'green' protectionism. Indeed, certain national policies and actions used to promote a green economy may have an adverse impact on trade. Multilateral trade rules and institutions can help guard against green economy related measures that have unnecessary trade restrictive effects, as well as those which may be employed for trade protectionist purposes. The multilateral trading system must continue to be strengthened and updated to meet future challenges in this area.

The 2012 Conference will be an opportunity to reaffirm the positive links between trade and the green economy, and allow developed and developing countries alike to define and shape a green economy that can attract wide interest by generating new investments, income sources and jobs among countries of varied levels of development. This note aims to present key issues and considerations that need to be taken into account in the Conference deliberations. It argues that sustainable development is an imperative rather than an option; describes the role of states and markets in a transition to a green economy; highlights the role of trade in advancing a green economy; and examines developing countries' need for technical and financial assistance. Specifically, the paper seeks to promote reflection on how to advance development within the constraints of environmental and social systems by:

- exploring ways to stimulate green economies to materialize in all countries;
- identifying opportunities for developing countries' profitable participation in the green economy and trade in related products and services;
- highlighting requirements for effectively managing a green economy transition at national and international levels;
- considering ways to promote technology transfer with and among developing countries;
- exploring cooperative mechanisms that can reduce threats of green protectionism.

In concluding, ideas are suggested on what UNCTAD can do to help developing countries secure development gains from a green economy.

1.1 Sustaining human development and advancing social goals

The introduction of modern technologies in the mid-1800s ushering in the industrial revolution extended the frontier of human development by improving living standards for a growing world population. Social benefits include improved access to food, water, energy, transportation, housing, health and education services, and, closing the circle, the economic growth and employment opportunities their production provides. However, with ever increasing levels of fossil fuel and natural resource consumption needed to accelerate and spread the benefits of our technological revolution, we now recognize that in recent decades human development has pushed the planet as a whole past limits of environmental stability.

The global challenge of reducing the impact of human development on the environment is compounded by rapid population growth. Based on an extension of global economic and demographic trends, world population is forecast to climb from 7 billion today to over 9 billion in 2050, nearly 8 billion of which will reside in countries that are today developing countries and only just over 1 billion in developed countries. To meet the consumption requirements of a growing population, and rising per-capita consumption levels in emerging economies as living standards improve, world GDP is projected to expand by as much as 3 times from its current level by 2050, with well over a half of world GDP generated in developing countries.

Certainly economic growth to reach higher levels of world output is required both to meet the consumption needs of a growing population and to create jobs and reduce poverty for the world's poor. However, simply scaling up current production methods to support continued economic growth is not feasible; it would significantly deplete natural resource endowments, deteriorate natural ecosystems and accelerate global climate change. It is thus imperative that the

fossil fuel energy intensity, and natural resource intensity, of economic growth be substantially reduced in order to sustainably manage natural and environmental systems. At the same time, when considering roles and responsibilities in redressing global environmental problems, it is important to take into account equity concerns both among and within countries and in relation to their current and historical contribution to environmental degradation and high levels of natural resource use.

A key thrust of the green economy concerns unlocking technological progress. Not for its own sake, but to stabilize natural and environmental systems so that economic and social objectives can continue to be advanced. It aims to identify and promote new approaches to stimulate and diffuse technological progress to steer our economy towards an economically, socially and environmentally sustainable trajectory. It is not only about hard technologies – the equipment and hardware we use to produce goods and services – but also about the soft technologies – the institutional arrangements, production processes and consumption patterns we adopt in our economies and lifestyles.

Importantly, to become politically and economically viable, the green economy must represent much more than simply 'green washing' the global economy. Beyond improving the economy's environmental performance and sustainability, the green economy must be inclusive and development-led, addressing current social and economic imbalances within and among countries. It should improve living standards by generating new employment opportunities for the poor and enhancing their access to basic services such as energy, water, housing, transportation, communications, healthcare and education. It calls therefore for an active development state committed to enabling an equitable transition to a green economy.

Prompt and effective actions need to be taken by the international community as the world economy struggles with acute environmental and natural resource constraints. And although countries have varied capacities to respond to the challenges of sustainable development, all share a vision that our global commons must be effectively managed so that the needs of current and future generations can be met – a vision enunciated explicitly in the results of the 1992 Rio Summit. Building on this momentum, the upcoming Rio Conference aims to reaffirm political commitment for urgent action and strengthened international cooperation to ensure an inclusive green economy transition that is truly global in scope. In other words, Rio + 20 should open the door for a new era of development-centred globalization which effectively addresses current environmental, economic and social imbalances.

2. Stimulating the green economy transition

2.1 The green economy transition is already underway

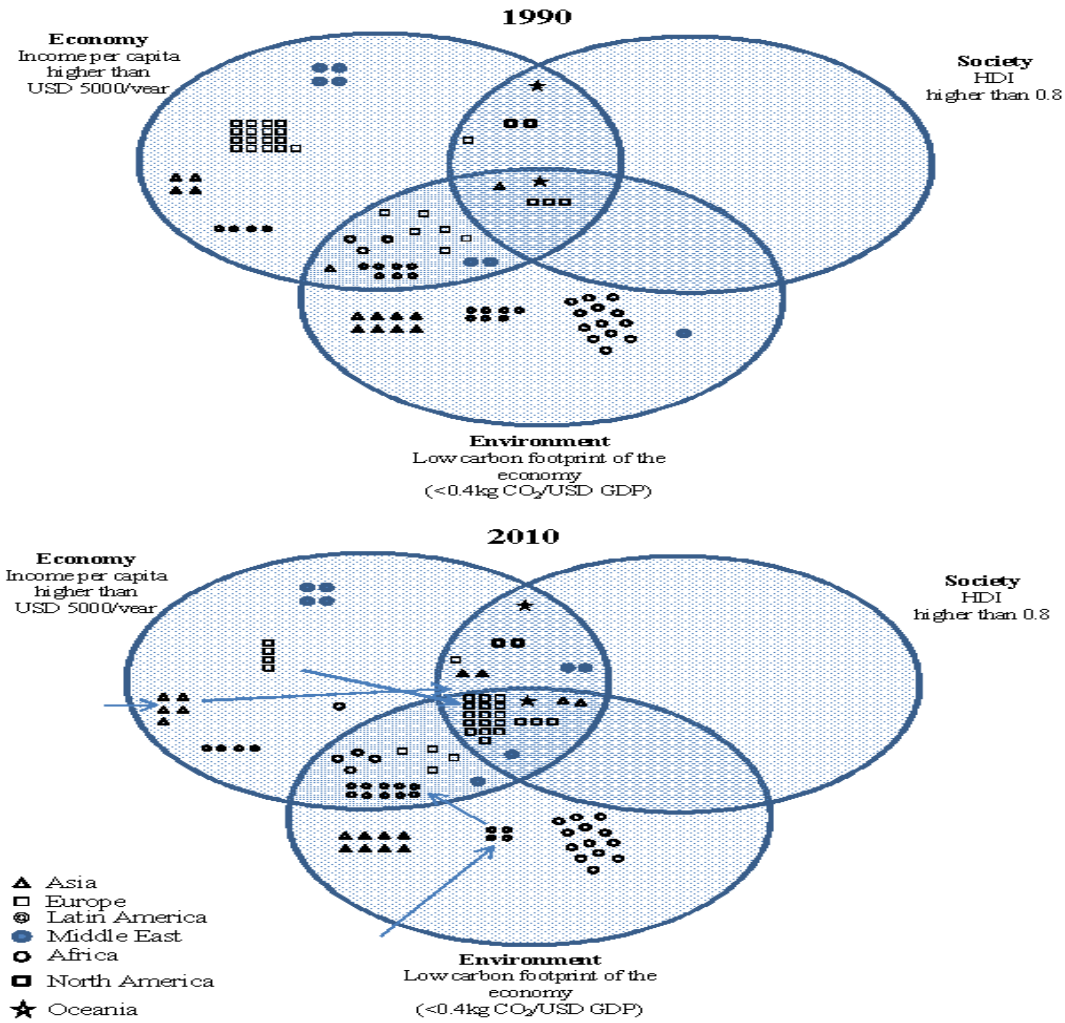
The UNCSD Rio+20 Conference aims to promote the green economy concept in order to stimulate more rapid global progress on sustainable development. However, it is important to recognize that a transition to a green economy is already underway. It began largely in response to the increased public awareness and strengthened political will on sustainable development that were generated by the Rio Earth Summit in 1992. The challenge for Rio+20 is to build momentum behind the nascent phase of a transition to a green economy that is now underway.

Market trends reveal an advancing green economy transition. The number of firms with ISO 14001 environmental management certification rose from under 40,000 in 2000 to over

200,000 in 2009; and over 40 per cent of registered firms are in developing countries.[1]

Box 1. Progress towards sustainable development

Substantial progress on sustainable development has been attained during the last decades. Figure 1 illustrates an overlap of three sets of countries which fulfil different criteria which could be attributed to a green economy, namely a per-capita income higher than 5000 US$ /year, Human Development Index (HDI) higher than 0.8 (e.g. developed country) and a low carbon footprint associated to their economies (e.g. less than 0.4kg of carbon per dollar of GDP). The charts in Figure 1 indicate large changes between a 20-year time span (1990-2010). They show that while movement has taken place towards a wealthier, socially-inclusive and greener society, progress has been uneven with many nations lagging behind, specially on the social and environmental dimensions.



Source: Based on work from Doka Life Cycle Assessments and iNodes AG.

From 1990 to 2010, many countries achieved higher income levels, especially in Asia and Latin America. Regions which were already wealthy in 1990, such as Europe, saw there economies become less-carbon intensive and move into the central area overlapping the three dimensions of the chart. Many African countries, however, lagged behind. Although many have less-carbon intensive economies - often brought by energy and material poverty - few are among the set of countries with high HDI and/or income.

[1] ISO, 2009, The ISO Survey.

Importantly, 'green' is not just about environment. It is also about social responsibility. A growing number of firms now integrate social concerns into their business operations and interactions with stakeholders. Over 2,000 corporations in over 90 countries now practice Corporate Social Responsibility (CSR); a figure up from virtually zero at the time of the 1992 Rio Summit.

A green economy also advances ethical trade through Fair Trade production chains which ensure that small developing country producers receive fairer terms of trade and better prices. Sales of Fair Trade products are on the rise around the world. In 2008, consumers worldwide spent $ 5 billion on Fairtrade certified products, a major Fair Trade label, almost double the figure of the previous year and directly benefiting over 7 million people – farmers, workers and their families in 58 developing countries.[2] Fair Trade principles can be expected to be applied more widely, and respective products attract increased demand, in a green economy.

Momentum towards a green economy transition in both developed and developing countries is evident in a wide range of sectors including the energy, agriculture, forestry and services sectors among others. Within the energy sector, global growth in renewable energy sources contributing to world primary energy supply now greatly exceeds growth in fossil fuel based energy sources. Since 1990, annual growth in solar photovoltaic (PV), wind and biofuel supply capacity has averaged 42, 25 and 15 per cent respectively, compared to the rate of only 1.3 per cent for oil.[3] In 2010, $211 billion was invested in renewable energy supply, more than 5 times the amount invested in 2004, with more than half of these investments made in developing countries.[4]

Commodities production is also greening. Developing countries are increasing their participation in these new green markets. Some examples are illustrative. The global market for organic food and beverage products is projected to reach $60 billion this year; a more than three-fold expansion from 2000 levels. Organic farming is practiced on 37 million hectares in 160 countries; a nearly four-fold increase over the past decade. Most of this increase is occurring in developing countries in response to growing demand in developed country markets. Developing countries are also increasing their presence in sustainably harvested timber products markets. Globally, forest land area certified by the Forest Stewardship Council (FSC) has increased seven-fold over the past decade to reach nearly 140 million hectares in 2010, with developing countries' share of this total rising to about 20 per cent. Metals and minerals recovery through recycling has risen significantly over the past two decades. Today, nearly 80 per cent of lead and well over 50 per cent of iron, steel, aluminium, gold, platinum and silver are recycled from products they are embedded in, with recycling activity growing dramatically in emerging economies.[5] Biofuel production and export is growing rapidly and biofuels have become a growing export commodity for some developing countries. Today, developing countries as a group account for over 40 per cent of world bioethanol production and about 15 per cent of biodiesel production.

The services sector is greening. Ecotourism is projected to capture 25 per cent of global tourism revenues in 2012, with international tourists spending $240 billion in ecotourism destinations the majority of which are in developing countries. Markets for solid waste

[2] Fairtrade International, 2011, Facts and Figures.
[3] IEA, 2011, IAE Database.
[4] UNEP, 2011, Global Trends in Renewable Energy Investment 2011.
[5] UNEP, 2011, Recycling Rates of Metals.

management services are growing. The world market for waste, from collection to recycling, is now worth over $400 billion a year.[6]

Cross-border investments in green economy activities are also on the rise. Over the past decade, the global carbon market has grown from infancy to become a major world market today. Its value rose from only $11 billion in 2005 to $142 billion in 2010. Much of this market, $120 billion, involves emissions trading among developed countries, but CDM projects in 81 developing countries supported investments worth $20 billion in 2010.[7]

The production of many of green products (i.e., both goods and services) provides decent employment and increased development opportunities for poorer communities in developing countries.[8] Moreover, green economy market opportunities not only have direct impacts on growth and poverty but the technology itself offers indirect benefits for poverty reduction. For example, renewable energy technologies can bring electrification to rural areas, where most developing country populations live, thereby providing power, light, water, refrigeration, information and communications to homes, schools and small businesses which help communities to boost economic productivity and meet health and education goals.

2.2 National actions to accelerate green growth

A successful transition to a development-led and inclusive green economy will not be automatic. Effective frameworks to durably support the development of the green economy will require reforms at the national and international levels. National policies and actions are needed to stimulate and mature green economy markets, while at the international level, institutional structures are required to ensure developing countries derive attractive benefits from engaging in a global transition.

In view of its broad, cross-cutting nature, stimulating and supporting a green economy transition will require a rich mix of national policies and measures as well as effective institutions to apply, monitor and enforce them. The optimal mix of national policies will depend on a country's institutional setting, level of development, resource endowments and specific social and environmental conditions.

Governments have several levers available to drive the transition: regulation, market-based instruments, investment measures and information campaigns.[9] All of these can be woven into a national green economy policy framework. Gradually phasing-in and strengthening regulation to modify production and consumption patterns can induce structural changes over time within industry and commerce without causing economic dislocations. Regulations are also needed to open markets for new green economy activities. For example, regulations for mandatory recovery of glass, metal, plastics and electronic equipment are needed to encourage firms to populate respective recycling industries. Often, national policy frameworks also use complementary regulatory and market based-instruments to reorient firms and consumers in a transition. For instance, within the electricity sector, feed-in tariff regulations can accompany market-based incentives to encourage individuals and firms to invest in renewable energy

[6] Veolia, 2009, From waste to resource: An abstract of world waste survey
[7] World Bank, 2011, State and Trends of the Carbon Market 2011.
[8] ILO, 2008, Green Jobs: Towards decent work in a sustainable, low-carbon world.
[9] The OECD has recently published a 'Tools for Delivering on Green Growth' and 'tools for Green Growth', 2011, which together provide a thorough discussion of the wide range of policy tools available to advance a green economy transition.

systems and become independent power producers. Phased performance and technology standards can also be promulgated through regulation in order to force new private investment in green technologies over time.

While regulations can be viewed as directing traffic to the road towards a green economy, market-based instruments help make it the most profitable road to follow. A wide variety of market-based instruments are available to support a green economy transition. They can take the form of carrots and sticks. Sticks include environmental taxes, charges and permits that induce consumers and producers to adopt more environmentally compatible behavior in order to reduce costs. Carrots include grants, subsidies, tax holidays, etc. that encourage investment in green economy activities. However, national policies should be coherent so as not to provide carrots for both 'green' and 'brown' consumption. In many countries today there is a need to reduce and eventually eliminate many 'brown' subsidies that encourage over-exploitation of natural resources (e.g., water and fuel) and result in high levels of environmental damage (e.g., fertilizer subsidies and fossil fuel subsidies).

National budget allocations and government procurement can also stimulate a transition by ensuring a base market needed to sustain environmental R&D and green business activities, including many start-up efforts. Already an increasing number of countries have embarked on deliberate and comprehensive new growth strategies to rebalance their economies and place them on a more sustainable development path. Such strategies, already launched in most developed countries and a number of developing countries, seek to set a framework wherein governments allocate subsidies and direct public investments into green economy activities, particularly in the energy, construction and transport sectors. Government support for a green economy is already a reality in several parts of the world. In 2009 almost $200 billion of green stimulus spending – in the form of subsidies and government procurement – began to be disbursed globally in 2009 and by early 2010, over 100 countries, developed and developing, had some policies in place to promote the use and dissemination of renewable energy.[10] To varying extents, these approaches are advanced through national industrial policies which have an important role to play in creating incentives for green economic activity, but care must be taken to ensure that they are compatible with WTO rules.

Aside from regulation and economic incentives, information dissemination campaigns to encourage green consumption preferences among consumers and green production choices among firms will also be essential in driving the transition. Information campaigns help stimulate voluntary actions based on a clearer perception, and long-term view, of costs and benefits. Governments can institute mandatory labeling (through regulation) to help consumers identify more efficient, less polluting products. They can also encourage workers to opt for jobs in new green businesses by providing low-cost training opportunities. In addition, the reach of non-governmental organizations, including educational institutions and environmental advocacy and consumer groups, are influential in encouraging green employment and consumption choices.

2.3 International actions to support green growth in developing countries

A successful transition requires addressing significant challenges facing many developing countries that lack sufficient financial, technical and human capital needed to structurally transform their economies along a new green trajectory. International cooperation to provide

[10] UNCTAD, 2011, Technology and Innovation Report: Renewable Energy Technologies for Sustainable Development.

capacity building, technology transfer and financial assistance will play a central role in filling these gaps. There is thus a need for international cooperation and collaboration on research and development; placing green technologies in the public domain; and introducing policy incentives for green technology transfer in both developed and developing countries. Greater policy coherence and financial and technological cooperation will thus be essential as countries continue to advance through a green economy transition period.

Capacity building programmes are also needed to assist developing countries to identify, develop and pursue strategies to stimulate growth in green sectoral activities. Programmes should assist developing countries to build their green goods and services sectors in order to participate in global green economy trade and benefit from its opportunities. Deliberate policies and improved institutions are needed to create an enabling environment at the domestic level which, coupled to greater openness of green markets, can promote increased investment and the transfer of skills and technologies needed to build green supply capacities for domestic and export markets. UNCTAD is currently developing practical analytical tools to assist in this regard (see Box 2).

For many developing countries, access to new, additional and innovative sources of financing to support their transition to the green economy is a *sine qua non* condition. Some green economy domains in which developing countries require financial assistance are green technology transfer, climate change mitigation and adaptation, biodiversity conservation, mitigation of desertification, export capacity development in green sectors, capacity-building on international standards (e.g., green economy related SPS, TBT and private standards), and assistance on mainstreaming green economy policies into national economic, employment and trade policies.

With the persistent global economic recession, developed economies are finding their treasuries under significant pressure. This means that new green economy finance cannot rely solely on official grants and development aid. It should also include public-induced private investment. A key priority for developing countries interested in attracting private investment in green projects and sectors is to create a conducive domestic environment consistent with the country's own green economic and broader sustainable development objectives. However, given wide differences in their institutional development, resource endowment, and human capital, there will be many developing countries that have little or no ability to attract private investments towards green projects and sectors. These countries should be the primary targets for new and additional official financial support.

To date, there has been no dedicated work to date on an international financing mechanism to assist developing countries to advance their own national green economy transition. Nevertheless, a number of important initiatives to provide developing countries with financial support for environmental activities have already been planned and designed following extensive negotiations. Some mechanisms, such as the Global Environment Facility or GEF (currently allocating $1 billion/yr to environmental activities in developing countries), the CDM (which supported investments worth $20 billion in 2010 in 81 developing countries) and the Aid-for-Trade initiative coordinated by the UN are already being successfully or partially implemented.

Box 2. Using product space to identify 'green' export strengths

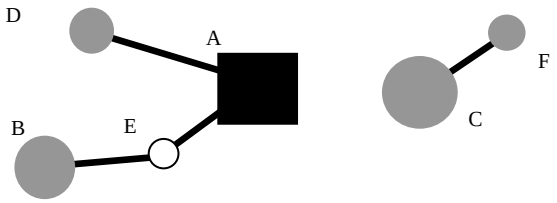
Policymakers face a number of challenges when designing government initiatives that aim to foster the development of new green sectors. The first and most critical challenge the encounter concerns selecting which, among many, green sectors to promote. The literature on industrial policy shows that this selection process, often referred to as 'picking winners', has more often been a failure than it has been a success. Importantly, however, it also indicates that when governments have designed policy packages to support those sectors in which their country has a demonstrated comparative advantage, industrial policy is most likely to succeed. Following their areas of natural and comparative advantage has produced clear successes for some developing countries. For example, in recent years government initiatives helped to successfully spawn IT services in India and Mauritius; the salmon and wine industries in Chile; and the cut flowers sector in Kenya, among others.

As the global economy increasingly orients itself towards a green economy, many policymakers would like to know which green sectors offer the greatest potential for diversification and growth of their economies. Based upon the 'Product Space' model pioneered by Hidalgo and Hausmann,[11] UNCTAD has developed a data-based analytical approach to help policymakers identify green sectors and green products which a country is best positioned to produce and export.

Within product space, product groups classified according to SITC-4 at the 4-digit level. For any given country, product space can be visualized in a two dimensional network representation wherein each product occupies a node (shown as a filled-circle) of size proportional to the product's share of the country's total exports (or alternatively by the product's share of world exports), and color corresponding to the category of the product (e.g., textile, machinery, chemicals, electronics, etc.). However, when a country has a revealed comparative advantage for exporting a given product, the product node is depicted as a black square. Also, when a country does not export a particular product it is depicted by an unfilled circle.

Product space also incorporates the concept of proximity. Products that are situated close to each other, and connected by a link, are known to be strongly correlated in countries' export profiles based on historical trade data. When one product is produced and exported there is a high propensity for the other nearby product to be produced and exported as well. There could be many reasons for the close proximity of products. For example, among other reasons, nearby products may require the same inputs, share the same or similar production processes, or in the case of agricultural goods and minerals, they may share common geographical, climatic or geological factors related to their natural occurrence or production.

The simplified product space of a hypothetical country 'terra' is shown in the figure below to illustrate the basic features of product space described above. Terra exports all of the products A-F except E (unfilled circle) which is not exported by Terra. Its largest exports are product A and C and its smallest exports are E and F. It has a revealed comparative advantage (RCA) in the production and export of product A (black square), but none of the other products. Noticing the close proximity of products A and E, and recalling that Terra has a comparative advantage in exporting product A, strongly suggests that Terra may be well positioned to build productive capacity in, and competitively export product E.



Simplified product space of the hypothetical country Terra, see text.

UNCTAD's analytical approach to identify green products of export interest to individual developing countries is based on delineating green products in product space and assessing their proximity to products in which a country has export strengths. Of the many and varied green products that can be identified in a country's product space, UNCTAD's analysis can help policymakers and other stakeholders to identify which ones the country may best be placed to export, and in this way help policymakers select winners rather than losers when formulating green economy development strategies and industrial policy to support green growth.

[11] Hidalgo, C., and R. Hausmann, 2009, 'The Building Blocks of Economic Complexity', Proceedings of the National Academy of Sciences 106(26):10570-10575.

International mechanisms providing financial assistance under the UNFCCC are making an increasingly significant contribution to technology transfer to developing countries, particularly in the area of renewable energy technologies. Supported by such initiatives, investments in renewable energy technologies in developing countries are increasing. For the first time, in 2010, developing countries surpassed developed countries in new spending on utility-scale renewable energy projects and provision of equity capital for renewable energy companies; $72 billion was invested in developing countries versus US$ 70 billion in developed economies.[12] Building on this momentum, the recently announced UNFCCC Green Climate Fund is expected to be operational soon, helping to mobilize, through public and private sources, financing of $15 billion/yr in 2012 scaling up to $100 billion/yr by 2020.

The Rio+20 Conference should aim to take into account UNFCCC, GEF, Aid-for-Trade and other existing mechanisms as sources of financing for green technologies and for capacity-building aimed at raising technical and human capacities for green economy activities. Importantly, the Conference will recognize that countries are at different levels of development and will therefore move towards the green economy transition at different speeds. Therefore, in accordance with the 1992 Rio principles, whatever international mechanisms may be agreed upon to support the transition to a green economy, it is important that they refrain from imposing new conditionalities on, and distortions in international trade, development cooperation and financial assistance. They should also provide developing countries with sufficient flexibility to sequence and implement rules that may be adopted by the international community to support the transition, and to implement national policies needed to foster growth of their domestic green industries.

3. The central role of technology

With technological progress as the motor of a green economy, prompt and effective technology transfer will be critical in promoting a global green economy transition. While best available technologies need to be improved upon, and new technologies developed, to ensure environmentally sustainable growth going forward, we need not wait for improved technologies to accelerate progress on sustainable development. Even with today's state of technological development a lot can be done to limit both fossil fuel and material intensity in production and consumption activities. Concerted policy support is required to enable innovation and the enhanced transfer and adoption of green technologies.

Over the short-term there is an immediate need to more widely disseminate best available technologies for cleaner and more efficient production and consumption. Significant advances have already been achieved in renewable energy systems and fuels such as solar, wind and biofuels. Current renewable energy technologies allow for increases in energy supply in developing countries, since in many rural applications distributed renewable energy is less costly than any conventional energy supply. But the diffusion of less sophisticated green technologies is also very important; the transition from firewood burning to solar cookers, energy-efficient woodstoves, biogas and ethanol stoves can also produce significant economic, social and environmental benefits.

A key industrial sector of the green economy is renewable energy equipment and production. According to a joint report by Bloomberg New Energy Finance and UNEP, this

[12] UNEP, 2011, Global Trends in Renewable Energy Investment 2011.

sector received investments amounting to US$ 211 billion in 2010, or 1.5 per cent of all investments reported in that year. The forerunners in capital attraction were wind and solar power, however, to achieve production efficiencies both rely on economies of scale which lie beyond productive capacities of most but not all developing countries. Renewable energy technologies such as solar panels and wind turbines are among the manufactures seeing the sharpest rise in production. Developing countries have made significant progress in supplying global markets for these products; their share of world exports increased from 20 per cent in 2002 to 53 per cent in 2009.[13] China is now the world's biggest producer of solar panels. Similarly in the wind power market, China is the world's top producer of wind turbines followed closely by India in third place. In the biofuels market, developing countries account for over 40 per cent of world bioethanol production and 12 per cent of world biodiesel production. Top producers are Brazil, China, India, Colombia, Republic of Korea, Thailand and Malaysia.

As the green economy creates higher levels of demand for environmental technologies in developed and emerging economies, it is driving down prices. For example, the cost per Watt of capacity of solar PV panels has dropped from US$ 22 in 1980 to under US$ 3 today, and some estimates expect this figure to fall to only US¢ 50 cents by 2016.[14] This decline has accelerated just over the past few years; falling by around 70 per cent since 2008 and allowing a solar PV project in a sunny location to produce electricity for US¢ 17 cents per kWh (without subsidies).[15] These favorable cost reductions are allowing developing countries to benefit from more affordable access to renewable energy systems that can bring electricity to rural areas where the majority of developing country populations live.

Solar and wind energy systems can also be effectively commercialized in poor rural communities to provide jobs in manufacturing-related hardware and distribution, installation and maintenance. There are now numerous programmes supported by international organizations, donor agencies and NGOs to bring low-cost and efficient renewable energy systems to the rural poor in developing countries. For example, supporting 250 independent local retailers in Africa, the Rural Energy Foundation has successfully commercialized solar home systems in Burkina Faso, Ethiopia, Ghana, Mali, Tanzania, Uganda, Senegal, Mozambique and Zambia. In Bangladesh, the Grameen Shakti organization has successfully introduced a market-based approach that has sold over 500,000 solar home systems in the country over the past decade. In these and other countries, renewable energy systems are bringing power, light, water, refrigeration, information and communications to homes, schools and small businesses, improving the quality of life and opening new business opportunities for the rural poor while boosting economic productivity in their communities.

Beyond energy, access to green technologies is important to decouple economic growth from harmful patterns of resource use, improving people's livelihoods and moving to more sustainable growth paths. Of special interest to developing countries, agriculture could benefit from advanced crop varieties that need less fertilizer, pesticide and water inputs, and from more efficient field machinery – technological advances that can generate more rural income and improved food security, at the same time allowing higher yields from lower quality farmland. The promotion of sustainable and organic agricultural methods also have an important role to

[13] See UNCTAD, 2011, Technology and Innovation Report: Renewable Energy Technologies for Sustainable Development, chapter 3, box 3.3.
[14] Naam, R., 2011, Smaller, cheaper, faster: Does Moore's law apply to solar cells? By Ramez Naam, Scientific American.
[15] Liebreich, M., 2011, UNCTAD, Road to Rio+20, Vol.2, Rio +20: manifesto for a green economy.

play in a green economy, as do improved post-harvest storage and processing methods. In other sectors such as manufacturing, construction and distribution, technology also plays a major role in enhancing energy and material efficiency in industrial processes, improving the thermal efficiencies of buildings, and facilitating less resource-intensive packaging and post-consumption recycling of goods.

3.1 Green technology dissemination

How can green technology transfer be accelerated? Developing countries remain disadvantaged since most of them lack the sophisticated regulatory and institutional frameworks, as well as the business environments, needed to attract technology transfer. Developed country governments also have limited power to promote technology transfer since they do not often have direct ownership over technologies. Universities and governments can stimulate technological progress, but it is the private sector which effectively bridges technology deployment between countries.

In developing countries, private agents transfer technologies predominantly via licensing agreements, joint R&D initiatives, through greenfield foreign direct investment, via corporate mergers and acquisitions, public-private partnerships, joint ventures, as well as through capacity-building initiatives. However robust technology transfer occurs more often towards countries that already have a number of macroeconomic and institutional conditions in place, such as rule of law, good governance and institutional robustness, financial and regulatory stability as well as the existence of intellectual property rights (IPR) protection systems and national capacity to absorb new technologies. Also important is the ability of consumers to pay for final products; a limiting factor in the transfer of clean technologies used in providing energy and water services to low-income populations.

Insufficiently strong investment and business climates narrow prospects for green technology transfer to many low income developing countries leaving them without access to critical technologies and IPRs needed for their economic and social development. Supportive financial and technology transfer mechanisms are needed in order to offer tangible opportunities for less advanced and less diversified economies to leap forward.

Technology gaps are another concern. Technology gaps might widen further if technology transfer lags significantly behind technology advances in a global green economy. This could leave many developing countries unable to compete in the field of new green technologies and industries. However, global links through trade and investment are providing opportunities to diffuse and stimulate green technologies, including through the growth of global supply chains.

3.2 Future directions for technology policy

Drawing on the discussion above, three widely understood starting points are useful to guide thinking about future directions for debate and policy in the area of technology, including in the context of the green economy and the Rio+20 Conference:

- the vast majority of proprietary technology is in private hands, and most of that is held by firms in developed countries;

- as noted above, almost all technology transfer currently takes place as a commercial transaction, through licensing, joint ventures or FDI;
- there is an urgent need for faster and more complete dissemination of new green technologies, for many different types of environmental challenges but particularly climate change mitigation and adaptation.

These starting points lead to several important lines of thought about how technology might best serve efforts to achieve a green economy.

The first is the importance of stimulating increased flows of private investment – both domestic and foreign – in green technologies, particularly in those countries that have not been major recipients of such flows to date. While public investment is critically important at the front end of technological development – for example, in R&D, commercialization and demonstration – governments simply do not have the resources to make investments at the scale needed for the dissemination of new technologies.

There is, however, an important role for governments in helping catalyze private investment flows. At present private investment is well below its potential, but not for a lack of technology to disseminate, or for a lack of available resources. The barriers to green investment range from standard issues of investment climate such as macroeconomic stability, rule of law and security, to those that are more specific to the countries and technologies involved: gaps in communications, energy and transportation infrastructure; energy, environmental and other sectoral policies and regulations; fiscal policies favouring competing technologies; technology-specific financing barriers, and so on. While these barriers can be addressed by domestic policy makers, and the international community should provide financial and technical assistance to help make those efforts successful, at a minimum through the many existing sources of funding described above.

It bears noting that in the rush to entice new green investments, host country policy makers should not abandon the need for regulatory and review instruments that would allow them to ensure that any investment is of good quality – that is, that it genuinely contributes to sustainable development. Being green should not mean being exempt from normal due scrutiny.

Another line of thought pertains to the role that intellectual property rights (IPRs) might play in green technology dissemination. Some have argued that the world's environmental problems are urgent enough to justify compulsory licensing of critically important technologies, for example in the area of climate adaptation and mitigation. They point to the precedent of the WTO's *Declaration on the TRIPS Agreement and Public Health* as a precedent on which to build. But, leaving completely aside the trade law issues that this might raise, the context is somewhat different. For one thing, pharmaceutical products are fairly easily manufactured and used once the patent is owned. By contrast, a wind turbine is made up of hundreds of working parts, all under separate patents and often owned across a number of firms. And even if the turbine could be easily manufactured, the new owner would lack the essential working knowledge that is vested in the commercial owners of the patents: how is it maintained and operated? How is it connected to the grid? Not all countries have built up the capacity to address these sorts of challenges, which vary in difficulty depending on the technology involved. The more complex the technology, the more important it becomes to actually have the commercial owner of the patent involved in the working of the patents. These challenges suggest that compulsory licensing in the area of green technologies may not be an effective course of action

for many technologies. Any decisions to implement compulsory licensing should thus be made on a case-by-case basis, according to the technology in question.

Intellectual property protection needs to carefully balance the need to provide incentives for further innovation, and the wider public benefit that could derive from public ownership of new innovations. Any technology-driven economic development in low-income and least-developed countries will eventually depend on fostering innovative capacity, and history shows that this can grow initially out of the ability to legally imitate and reverse engineer existing intellectual property. Existing IPR law is not able to distinguish between countries at different stages of development in ways that might help IPRs fully contribute to development objectives.

There is still an important role for governments as concerns green technologies that have been developed with public support, and there are strong arguments that such technologies should be the subject of public efforts at wider dissemination. Prizes for publicly available innovations can serve similar purposes. And existing efforts at joint public R&D can be significantly scaled up.

If the international community aspires to catalyzing vast flows of private investment in green technology in developing countries, it should also help ensure that such flows achieve their full potential in terms of spin-off benefits. As well as creating backward and forward linkages, those flows might eventually also contribute to indigenous capacity in the sector. But the prerequisite is a domestic pool of skilled technicians, managers and engineers capable of learning from foreign investors, and applying that learning to innovative entrepreneurial activities in country. The role of governments in formulating innovation strategies, and the role of the international community in supporting those efforts, is clear: there needs to be investment in education, in linking investors to academic and research centres, in patent law infrastructure, among others.

Of course, not all countries can foster competitive exporters in the same green technologies. As with industrial policy generally, countries will fail if they try to force a leap too far over the chasm of inexperience in related sectors, lack of infrastructure and other barriers. Insights from UNCTAD's work on product space discussed above point strongly to this conclusion. Such failures, where they occur, represent a waste of resources from an economic perspective (it would have been cheaper to simply import technologies than to try to build up domestic capacities), and at the same time an environmental loss, since the available resources purchased a less significant environmental outcome than they could have done. In this context it is worth highlighting the lesson that there is no tension between environment and development; they will both succeed or fail in tandem. This underlines the importance of understanding how to conduct good policy in seeking to have technology serve sustainable development and the greening of the economy.

3.3 Supporting technology transfer through Rio+20

The Rio Conference will certainly recognize that developing, absorbing, adapting and diffusing green technologies requires strengthened international cooperation and collaboration on research and development. Green technology transfer will certainly benefit from experience gained through the United Nations Framework Convention on Climate Change (UNFCCC) process. In 2012 the UNFCCC will launch a Climate Technology Mechanism to facilitate the implementation of enhanced action on technology development and transfer in order to support developing country action on mitigation and adaptation to climate change. The Conference could

identify ways to extend international cooperation on technology R&D in other sustainable development areas not closely related to climate change. It may also encourage the introduction of policy incentives for technology transfer in both developed and developing countries, and improvements to the dissemination of information on available green technologies.

Additionally, the Conference could explore options to increase flexibility in the global intellectual property regime for green technologies. Given the global public-good character of climate change mitigation, consideration could be given to interpreting the flexibilities of the WTO Agreement on Trade-related Aspects of Intellectual Property Rights (TRIPS Agreement). Increased flexibility could include broadening the scope of compulsory licensing for essential green technologies; limiting the duration of patent protection; and allowing more liberal use of existing patented knowledge to generate new innovations, particularly in least developed countries.

This flexibility could enhance the dissemination of future green technologies that will be protected by IPRs. But it should be emphasized that many current green technologies are not IPR protected; their dissemination is limited by unfavorable domestic business environments, and limited access to finance. Indeed, in many cases, it is easier to attract foreign investment in technologies that are IPR protected than those which are not as investors often seek secure guarantees for exclusivity in the commercial activities their investments support.

4. Trade and trade policies as drivers in the green economy

Trade and the investment that underlies it can be powerful positive drivers of green growth, opening up possibilities for low carbon development paths that would otherwise be impossible. But trade policy in the pursuit of such growth can also be contentious, creating both winners and losers, and potentially providing cover for what are essentially economic measures.

This section looks first at the scope for such *green protectionism*, asking what it really means and looking at how it might manifest. It then examines the concept of environmental damage and materials embodied in traded goods, asking what that means for traditional accounting of trade flows. Finally, it asks what options there are for addressing the novel challenges that countries might face in reconciling existing trade law and principles with the pursuit of a green economy.

4.1 New green protectionism

The concern with green protectionism is very relevant to the interplay of trade and green economy policies. It tends to discriminate against ‘brown’ goods that do not conform with green regulations and standards, and typically recognises developing countries as *standard-takers* and developed countries as *standard-makers*. The so-called *new green protectionism* is about measures introduced to promote the transition to a green economy and eventually could also be about social standards – actual or alleged – deployed by developed and developing countries alike.

It is of no surprise that trade tensions could increase as countries transit to a greener economy. In section 2 above, reference was made to a series of policy instruments that countries

could implement as they seek to reallocate resources away from brown activities towards greener ones. Some of those instruments – i.e., local content, preferential financing, domestic targets on government procurement, subsidies, local content, carbon taxes, feed-in tariffs, etc. – are similar to those used in traditional industrial policy, which seek to create advantages for local sourcing of goods and services. Special attention needs to be taken in the design and implementation of domestic policies and regulations, so discrimination against foreign sourcing is avoided or at least kept to a minimum.

The global nature of current production chains and their ability not only to source materials and services from many different countries, but to drive the location of the investment that generates those materials in services in the countries of origin, presents new challenges. Multinational businesses are in a position to take advantage of the domestic incentives provided by the various countries along the supply chain, to the point that those benefits become a significant driver of the trade flows, even more important than the existence or not of border adjustments. Local incentives do not need to be incentives directly provided to producers, but could also include public investments in areas like: infrastructure (communications, transportation, water, waste management), education, and health care among other public investment to oriented to reduce the cost of doing business.

The notion of a new green protectionism has recently been propelled to the forefront by commercial and trade tensions, some of which have made their way into the WTO dispute settlement. These tensions and disputes seem to fit one of the following two types: (i) import-restricting measures deployed as part of *industrial policy* that doubles as a *green economy*, such as subsidies, border carbon adjustments and local content requirements in the renewable energy sector; and (ii) export restrictions on *industrial inputs*, specifically raw materials.

Conditioning FIT (feed-in tariff) support on local input requirements is of the first type: it discriminates against renewable energy equipment manufacturing outside a particular jurisdiction. While these measures may be needed to promote both green jobs and green energy, they may be construed by some as a prohibited subsidy under the WTO Agreement on Subsidies and Countervailing Measures (ASCM). The differing perspectives on this issue are beginning to draw legal attention in the WTO as well as under investment rules adopted by some regional trading arrangements.

The relationship between green economy, renewable energy support and subsidy rules remain largely unexplored. Subsidies rules might treat each national FIT programme differently—not only depending on its economic effect but more so depending on its design and the role that governments play. Subsidies can be well designed and badly designed, and the design elements are key to deciding whether they violate SCM rules. More importantly, green subsidies such as the support schemes mix together elements of classic industrial policy and elements of environmental protection. It is a mix that the current subsidies rules were not designed to address. Countries will need to decide whether they find certain types of support aligned and consistent with the objectives of the green economy and in such cases a new interpretation of existing rules could be beneficial.

Concern about the second type of green protectionism – export restraints – is growing amidst the background of rapidly increasing global requirements for some materials fueled, among other things, by the deployment of green energy technologies. Export restraints can provide substantial competitive advantages for downstream industries in a particular country at the expense of users of these materials in other countries and cause massive distortions and

harmful disruptions in supply chains. Export restraints can also create substantial pressure on foreign downstream producers to move their operations and, as a result, their technologies to the country deploying these restrictions. On the other hand, these restrictions may be justified as conservation, environmental protection or short supply measures.

Concealed in all green protectionism cases are wider concerns about market dislocations and concomitant socio-economic changes. What kind of shifts in competitive advantage might result from the increasing industrial penetration of green technologies? Which countries or companies may become new – or major – players?

One of the most critical questions concerns the ways governments pursue green industrial policy and steer their economies toward competitive advantage in the production of new green goods and services. The potential for rule breaking linked to the *green economy* highlights some questions about the applicability of the WTO rules. These rules are primarily focused on non-discrimination but allow derogations to deal with non-trade concerns such as environmental protection. As a wide range of products are important for a *green economy*, countries may need improved trade disciplines across the board, including in areas such as subsidies, technical barriers to trade, trade-related investment measures, government procurement, general exceptions under GATT and export restrictions.

In diffusing the tension between promoting the *green economy* and seeking protection from competition, the former concern should not be allowed to become a disguise for the latter. That said, neither should all trade related measures in pursuit of a green economy be seen as protectionist – some are legitimately environmental. Given the rapidly growing prevalence and breadth of such measures – and with the aim of sparing the WTO's dispute settlement mechanism from adjudicating issues on which there is as yet no international consensus – there is a need for institutional space outside of the WTO context to achieve common understanding and agreement on which green economy policies are acceptable from a trade and development perspective.

Box 3. The case of resource flows and value chains

Trade flows can be thought of as embodying both *direct* and *indirect* resource flows. Direct flows consist of those materials which are actually moved around as part of the traded goods – the steel in automobiles, for example. Indirect flows consist of the resources that are consumed in producing a good that is then traded. In a sense, the energy, fertilizers and other resources used to produce a tonne of wheat can be thought of as being 'exported' to the consuming country in as much as they are embodied in the final exported good. These indirect resource exports are greatest for countries that extract large amounts of natural resources, but export these resources in highly concentrated forms.

Analysis conducted for some countries, mainly in Europe, demonstrates that (i) indirect resource flows tend to be in the same order of magnitude or even larger than direct flows, and (ii) indirect flows associated with exports do not necessarily balance with indirect flows associated with imports; countries are either net indirect importers or exporters of materials and the environmental damage associated with their extraction, production methods and end-use. Net importers—traditionally these have been developed countries—are in effect 'externalizing' the environmental and resource depletion costs of their consumption. [16]

The conclusion to be drawn from this analysis is that the multilateral trading system needs to take better account of the growing importance of global value chains as transmitters of resource and environmental costs.[17] Production-based systems of accounting for resource use and environmental impacts are not sufficient.[18] In order to properly take trade related effects into account, complementary consumption-based accounting systems may be required at the global level.[19]Assessing the effects of any trade measure is no longer a simple matter. The effects of trade restrictions are no longer the concern of only one or a few nations. The relationship between national value creation and international trade is increasingly important for the understanding of global issues such as climate change or green economy.

4.2 Cooperation to prevent potential trade disputes

Given the lack of coordinated multilateral progress on climate change and other key global environmental issues, bottom-up policy approaches are bound to prevail in promoting the *green economy*. This may be appropriate, since each country faces distinct circumstances that dictate a different path. But these approaches may become a source of tension as quite costly, differentiated policies take hold and have competitiveness consequences that will provoke a clamour for action on the trade policy front.

There are several ways of dealing with this. One would be to let WTO dispute settlement decide. This might be the path of least resistance given the evolution of dispute case law towards a more accommodating view of the public policy imperatives arising from environmental and

[16] Over the past decade, the group of economies in transition has also turned into net material exporters.

[17] Decoupling natural resource use and environmental impacts from economic growth, A Report of the Working Group on Decoupling to the International Resource Panel. Fischer-Kowalski, M., Swilling, M., von Weizsäcker, E.U., Ren, Y., Moriguchi, Y., Crane, W., Krausmann, F., Eisenmenger, N., Giljum, S., Hennicke, P., Romero Lankao, P., Siriban Manalang, UNEP, 2011.

[18] Resource use and environmental pressures may be accounted for from a production perspective, i.e. allocation to the country where the pressure occurs or from a consumption perspective, i.e. allocation to the country where the product is finally consumed.

[19] Peters, G. 2008. From Production-Based to Consumption-Based National Emission Inventories. Ecological Economics, 65 (1): pp. 13-23.

developmental challenges more generally. One can argue that the declared general objective in the WTO Agreement of fostering sustainable development is finding expression in the interpretation of public policy exceptions. Considerable uncertainty remains, however, with respect to many interpretative issues.

There is growing perception that the two current mechanisms for dealing with non-trade concerns—the Committees that oversee the implementation of relevant Agreement, and the Dispute Settlement—are insufficient. This perception has been articulated in a number of proposals for an efficient and effective horizontal mechanism that is solution-based rather than rights-based and meant for dispute avoidance and mediation, rather than arbitration or litigation. Since trade measures change over time, a legal solution is in any case not necessarily a definitive one, as the measure in question may be replaced by another, leaving the complainant in the same situation as before. Moreover, in many cases the "source" of the trade measure is a legitimate policy objective, unrelated to trade, yet the means of implementing it can have an undue trade-distorting effect.

Another option, proposed by some analysts, is for the launch of a *green round* to cover issues such as subsidy rules, public and private labels and border adjustments. Some experts advocate new *energy negotiations* to address all the pertinent problems, ranging from issues of classification of goods and services, to disciplines on subsidies, to issues of competition and state trading, as well as intellectual property rights and government procurement.[20] However, multilateral negotiation processes are slow, long, and contentious; so the possibility of large damages for trading partners could occur way before any agreement is reached.

Without disavowing any of the routes described above or any other ones, a softer approach could be implemented. A consultative, evidence-based mechanism outside the contractual framework of WTO could reduce the potential for trade frictions before they turn into legal disputes. Trading partners would ideally be able to diffuse commercial or trade tensions in real time. There are many trade measures that could be dealt with by the parties involved with the support of independent experts on a case-by-case basis, focusing primarily on their adverse trade impact and objective economic analysis. A major advantage of this approach is that it can promote common understanding, afford countries an opportunity to resolve their differences among themselves rather than relying on the (quasi-)judicial system(s), reduce the scope for conflicts, and ultimately to build capacity to shift policy when it becomes feasible.

[20] For instance, this line of argument is advocated by the World Trade Institute.

5. Ways forward from the perspective of UNCTAD

Discussions at the Rio Conference will need to identify effective approaches to accelerating the transition to an equitable, inclusive and development-led green economy. Approaches will necessarily need to be comprehensive yet practical to ensure an internationally managed transition that promotes and supports the participation of developing countries, whilst preventing the use of possible new forms of "green" protectionism. Based on its mandate and areas of comparative advantage, UNCTAD stands ready to support countries in their transition to a green economy. With a view towards developing practical tools for and generating new approaches to ensuring that trade and development benefits accrue to developing countries in the transition to a green economy, UNCTAD is exploring the feasibility of:

- ***establishing a forum for international cooperation on trade-related green economy challenges.*** As described above, a *Forum on Green Economy and Trade* can offer the institutional space for experts and economists to engage government officials with their analysis to promote evidence-based policy and decision making, provide consultative and information exchange services reframe discussions from conflict resolution to conflict prevention;

- ***launching a demand-driven technical assistance programme that responds to increasing demand for capacity building with respect to issues relating to green economy and trade.*** Activities within the programme would be designed to assist interested developing countries to identify their comparative advantage for the production and export of specific green goods and services with dynamic growth trends. The programme would also support trade analyses and national reviews of economic, regulatory, institutional and policy factors relevant to green sectors of national and regional interest;

- ***organizing a multi-year expert meeting focused on examining critical green economy issues of importance to developing countries.*** Over a 4-year period, UNCTAD's multi-year expert meeting would support innovative approaches to a green economy by promoting open intergovernmental discussion on a wide range of topics selected by member states, and by serving as a vehicle for the exchange of best practices, national experiences and success stories. Among others, topics could include: the design of national and regional policy frameworks to support green economy activities; ways to enhance international cooperation on technology transfer; leveraging finance for technology transfer; trade implications of greening agriculture, manufacturing and services sectors.

UNCTAD stands ready to further develop these proposals and looks forward to its participation in the preparatory discussions and the Rio Conference itself with a view to advance the consideration of practical approaches in support of a development-centered transition to the green economy.