Low carbon competitiveness

Analysing opportunities and threats for low-income countries, and the business case for low carbon investment

Karen Ellis

Working Paper 368

Results of ODI research presented in preliminary form for discussion and critical comment

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Tables, figures and boxes

Acronyms

BRIC	Brazil, Russia, India and China
CASS	Chinese Academy of Social Sciences
CCD	Climate Compatible Development
CDM	Clean Development Mechanism
DECC	Department of Energy and Climate Change
EIA	Energy Information Administration
ERD	European Report on Development
EU	European Union
FAO	Food and Agriculture Organization
FDI	Foreign Direct Investment
FSC	Forest Stewardship Council
GCI	Global Competitiveness Index
GDP	Gross Domestic Product
IAEA	International Atomic Energy Agency
IDR	Industrial Development Report
IEA	International Energy Agency
IPCC	International Panel of Climate Change
IRENA	International Renewable Energy Agency
LCCD	Low Carbon Competitiveness Diagnostic
LECRDS	Low Emission Climate Resilient Development Strategy
LEDS	Low Emission Development Strategies
LIC	Low-Income Country
MIC	Middle-Income Country
NAMA	Nationally Appropriate Mitigation Action
NAPAs	National Adaptation Programmes of Action
NTFP	Non-Timber Forest Products
ODI	Overseas Development Institute
OECD	Organisation for Economic Co-operation and Development
REDD	Reduced Emissions from Deforestation and Degradation
SME	Small and Medium Enterprises
SMF	Sustainable Forest Management
TPES	Total Primary Energy Supply
UNCSD	United Nations Conference on Sustainable Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	The United Nations Industrial Development Organization
WEF	World Economic Forum
WTE	Waste to Energy
WTO	World Trade Organization

1 Introduction and rationale

This study sets out to answer the following questions:

1. How will climate change, international mitigation, and scarcity of natural resources affect trade opportunities and the competitiveness of the most important economic sectors in low-income countries?
2. How can policymakers and businesses in those countries best respond to the opportunities and threats identified?
3. When do these three competitiveness-related drivers create a business case for low carbon investment, and when do they create a trade-off? What are the implications for policy?

Achieving competitiveness is important for achieving growth and development, and most countries are keen to identify and support domestic sectors where they may have a competitive advantage. At the same time, many countries are developing green growth or climate compatible development strategies in order to promote sustainable growth trajectories. Yet few developing countries, and no existing tools, bring these two sets of analyses together coherently. Based on this research, we hope to develop a 'Low Carbon Competitiveness Diagnostic' – a framework to help policymakers think through these issues – to help fill the gap.

These three drivers – increasing natural resource scarcity (particularly with the growing global demand for energy), the impact of climate change, and the impact of international climate change mitigation policies – will inevitably create transformational shifts in prices and patterns of production and demand in future. And the changes in competitiveness patterns generated are likely to have implications for low carbon growth. For example:

(1) Increasing natural resource scarcity – particularly relating to energy, land and water, and partly driven by economic growth in the emerging economies – will result in (for example)

- higher oil prices, reducing the competitiveness of energy-intensive industries in oil importing countries, which could enhance incentives for energy-efficiency measures in those countries;
- increased competition for land and water, which could strengthen incentives for effective natural resource management and sustainable agricultural practices that improve land and labour productivity.

(2) Mitigation policies introduced at the global level or by trading partners, which may affect export opportunities or import prices faced by developing countries, could result in (for example)

- new standards requiring carbon footprinting of production in some sectors, potentially reducing access to markets for relatively energy-intensive products or products which are not certified;
- carbon taxation, which could lead to certain energy-intensive industries shifting to non-mitigating countries (often termed 'carbon leakage'), generating a possible trade-off between competitiveness and low carbon growth;

- increased climate finance to support the development of new green industries such as renewables (most likely from public funding sources in the short term, in the absence of well-functioning carbon markets).

(3) The impact of climate change – in the sense of planetary warming – will be significant for some sectors; for example:

- It will reduce yields/productivity of certain agricultural crops, undermining competitiveness of those products.
- It is reducing the efficacy of certain renewable energy sources, such as hydropower, in certain contexts, undermining the competitiveness of countries reliant on them.
- It threatens the prospects for tourism development by increasing the incidence of extreme weather events and reducing water supplies.

The transmission mechanisms through which these drivers will affect competitiveness are analysed in Section 2 below, followed by a discussion of the potential impacts, opportunities and risks for five key sectors for low-income countries (LICs): energy, agriculture, forestry, manufacturing and tourism. These changes could have significant implications for the sources of competitive advantage, growth, and economic opportunity that countries will face going forward. We focus on changes that might be expected over a ten-year time frame.

Our initial analysis suggests that a desire to remain competitive in the face of these drivers will generate a business case for low carbon investment in some sectors. This is particularly important in light of the poor state of carbon markets, which were previously seen as a key mechanism for funding the transition towards a low carbon growth trajectory in developing countries. In the absence of this funding, understanding the economic incentives that could help drive such a transition even in the absence of carbon markets will be key to developing smart and well-targeted policy and donor support mechanisms in the short and medium term.

However, in other cases there will be trade-offs between maintaining short-term competitiveness and achieving low carbon growth. Therefore, the analysis will aim to identify both synergies and trade-offs and identify implications for policy and donor support.

This study focuses on the opportunities and risks facing low-income countries in particular, and asks how they can start to analyse these issues and apply what we have termed **'low carbon logic'** in their economic decision-making.

1.1 A focus on low-income countries

This study focuses on the opportunities and risks facing low-income countries in particular. Previous ODI analysis suggests that competitiveness and growth prospects in low-income countries will be significantly affected by the global trends discussed above, through their impact on trade patterns (Ellis et al, 2010). Thus, competitiveness strategies in LICs will need to be reassessed if they are to be resilient in the face of these changes.

Some high- and middle-income countries are already beginning to adjust their growth strategies, generating striking results and impressive projections for growth and employment impacts. For example, in Germany it was estimated that by 2006 there were already around 2 million people employed in what they termed 'green growth sectors', and an additional 1

million jobs were expected to be created by 2020 (Ellis et al., 2009). A study of the potential for green jobs in China within the energy, forestry and other industries found that there is potential to create around 30 million new jobs by 2020 (CASS, 2010). Yet it seems that few LICs are thinking about these issues.

The issues low-income countries face are likely to be quite different to those faced by richer countries. For example, LICs usually have substantial amounts of underutilised labour, which generates opportunities to gain a comparative advantage in labour-intensive forms of production, which could be a significant advantage if capital-intensive forms of production become less competitive in light of future increases in energy prices.

Energy costs are often high in LICs, access to electricity is limited, and power supplies are unreliable. This has undermined competitiveness in LICs significantly in the past and has been one of the biggest barriers to industrial development. However, it also creates much stronger incentives for energy-efficiency measures and strengthens the economic feasibility of renewable technologies such as solar, hydro and biogas. Energy infrastructure in LICs is usually relatively undeveloped, so there is scope through the development of national grids etc. to better incorporate renewables as one of the sources of power, leapfrogging some of the problems of dependency on fossil fuels. So this could create a new source of competitive advantage in future.

LICs generally have much lower emissions than middle-income countries (MICs), so there is less scope for mitigation. Carbon markets and mechanisms such as the Clean Development Mechanism (CDM) promise to make climate finance available to developing countries to help pay for the investment and adjustment they would need to make in order to follow a low carbon growth pathway. However, MICs have been the main beneficiaries to date, with few LICs having sufficiently large mitigation opportunities to qualify. Going forward, MICs will be excluded from the CDM altogether, which could provide new opportunities for LICs, although reforms will need to be made to the CDM if it is to work for the sectors of most relevance for LICs, such as agriculture and forestry.

However, the carbon market is currently foundering, with very low prices undermining returns and reducing the demand for carbon credits, so carbon finance for LICs through these mechanisms is currently not promising. Things may improve over time as international mitigation gathers pace, but in the short to medium term this looks more likely to happen through unilateral, perhaps regional, approaches rather than through an internationally coordinated climate change agreement and carbon market. (Kossoy and Guigon, 2012). Thus, efforts to develop the mechanisms in LICs to support access to carbon markets have not generated the hoped-for benefits and are unlikely to do so for a while. A switch in focus is required towards supporting other drivers of low carbon outcomes – such as the competitiveness drivers we discuss in this report. LICs are also more likely than MICs to benefit from public sources of climate finance, and can position themselves to better access these kinds of funds through a low carbon growth framing for their development strategy.

While most LICs still tend to rely on primary commodity exports, importing most of their manufactured goods, they are keen to move up the supply chain, add more value to the products they export, and expand their manufacturing base. The implications of changing trade patterns, increased transportation costs, and carbon emissions labelling could affect

their ability to achieve this aim, creating both new opportunities and new threats to the growth of the manufacturing sector.

Most low-income countries remain heavily dependent on agriculture. There will be new market opportunities in the agriculture sector going forward, as food, fibre and raw material prices increase as projected, and demand for biofuels is also likely to increase. But these developments could also create problems for domestic food security and competition for land and water, problems that are likely to be particularly acute for LICs. Incentives for sustainable agricultural practices are likely to increase as a result of these trends, and this effect could be strengthened by mitigation policies and certification. But responding appropriately could be a challenge for many LICs, which tend to struggle with capacity and the absence of the necessary market institutions such as standards and certification bodies and auditing mechanisms.

These issues are discussed in more detail on a sector-by-sector basis in section 2 below.

1.2 Developing a diagnostic

Despite the plethora of tools that have been developed in recent years in relation to climate compatible development (CCD), very few, if any, analyse *competitiveness* impacts of wider global changes in resource prices, production and trading patterns, arising from climate change, mitigation and increasing resource scarcity. Even recent reports on green growth and on trade and climate change (such as World Bank, 2012, and WTO, 2009) contain fairly limited discussion of the competitiveness impacts of mitigation (apart from potential carbon leakage effects associated with mitigation, which are then usually dismissed on the basis that the evidence suggests such effects are likely to be small). Any work that does consider wider competitiveness impacts tends to focus on rich or middle-income countries that themselves need to undertake mitigation, rather than low-income countries, which generally face very different opportunities and challenges, as discussed above (e.g. the G20 Low Carbon Competitiveness Index, Vivid Economics, 2012). Conversely, existing competitiveness studies usually fail to incorporate climate change related impacts.

To respond to this gap in analytical tools, ODI plans to develop a 'Low Carbon Competitiveness Diagnostic' (LCCD), which will adapt the traditional approach to competitiveness analysis in order to help low-income countries answer the following key questions:

(1) How will climate change, international mitigation, and natural resource scarcity affect trade opportunities and the competitiveness of the most important economic sectors in their country?

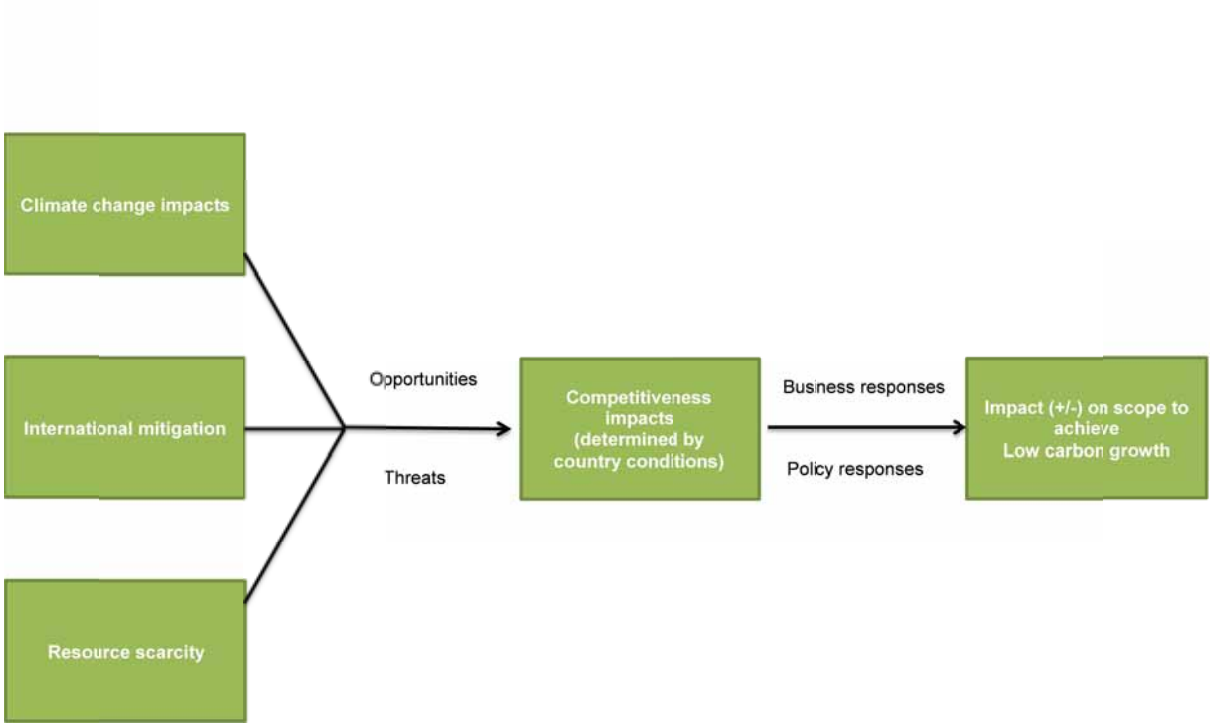
(2) How can policymakers and businesses best respond to the opportunities and threats identified?

(3) When do these competitiveness-related drivers create a business case for low carbon investment, and when do they create a trade-off? What are the implications for policy?

The Diagnostic will provide a set of questions to answer, and point to appropriate data sources to draw on, to facilitate the analysis of these issues in a particular country's context.

The results can then be used to generate a set of practical policy recommendations, identifying the kinds of investment climate reforms, competition policy, regulatory frameworks, growth, and trade policies that are needed to position the country to capitalise on opportunities and manage the risks in key sectors. The Diagnostic will help low-income countries to apply low carbon logic to the analysis of their future competitive advantages and growth prospects. A schematic illustration of the Diagnostic is provided in Figure 1.

Figure 1: Schematic illustrating the Low Carbon Competitiveness Diagnostic



This approach will be particularly relevant for Ministries of Trade, Industry and Finance in low-income countries, making clear the economic ramifications of future global trends for their growth outcomes. It may also help overcome political economy barriers to reform, building buy-in amongst a wider set of economic and political stakeholders whose first priority is to maximise growth.

This working paper is the first major output in developing the Diagnostic. It sets out the rationale for the development of the Diagnostic and our approach to the work, and it summarises initial ODI thinking on the risks and opportunities that will need to be taken into account on a sector-by-sector basis.

The Diagnostic will be further developed through a programme of engagement with a number of low-income countries, chosen carefully to represent a wide range of different country characteristics, thus ensuring the applicability of the Diagnostic across LICs generally.

In the next section we discuss the rationale for competitiveness analysis and associated government policies. We then discuss our approach to applying low carbon logic to

competitiveness analysis, before moving on to a summary of initial ODI thinking on the risks and opportunities facing different economic sectors.

2 Analysing competitiveness

There is no single definition of competitiveness. It is sometimes defined very broadly; for example, the World Economic Forum's (WEF) Global Competitiveness Report states the following: 'Competitive economies are those that have in place factors driving the productivity enhancements on which their present and future prosperity is built.' (WEF, 2009-10). However, for the purposes of this study, in which we are analysing how global changes affect particular countries through specific trade-related transmission mechanisms, we define competitiveness more narrowly, to mean a situation where a country produces goods/services cheaply enough (and of adequate quality) to compete on world markets, and is thus able to export successfully, and/or to sell domestically, without being out-competed by imports from other countries or requiring protection through costly trade barriers.

While reliance on market forces to identify a country's comparative advantage has been a traditional prescription, in practice many countries undertake competitiveness analysis, which seeks to identify sectors that are, or could be, internationally competitive on world markets, and could thus constitute potential future growth sectors. Such studies are often used to guide the prioritisation of associated investment climate reforms and industrial development policies by the government. Various tools already exist to support such analysis, but currently they overlook some of the most important changes in patterns of global demand that can be expected in the next decade, and could lead to misinformed policy-making.

Competitiveness analysis at the national level (e.g. UNDP, 2009) often involves the following steps:

- examining patterns of trade and production;
- identifying the key industries (in terms of export, output, growth, jobs, tax revenue etc.) and potential future growth industries;
- reviewing the cost base in those sectors specifically, and/or reviewing information on the cost of doing business, as well as the overall investment climate, which will determine the competitiveness of industry as a whole in that country;
- consultation of business, government and civil society to assess key opportunities and constraints;
- identifying the key opportunities and barriers, and developing policy recommendations to promote competitiveness and growth, at either the general or industry-specific level.

Through this study we plan to develop an additional component – the Low Carbon Competitiveness Diagnostic – which can be added to this analytical process, thus incorporating an assessment of the possible future changes in global patterns of trade, where those changes result from the three drivers identified previously (natural resource scarcity, international mitigation, and climate change impacts).

In the next section we discuss the rationale for government intervention to promote competitiveness, address related theoretical debates, and set out our approach to this study.

2.1 The rationale for government intervention to promote competitiveness

Governments usually undertake competitiveness analysis with a view to identifying how they can intervene to shape domestic markets to take advantage of international trading opportunities and promote exports, industrial development and jobs. This implies a particular take on trade theory and policy. There is an ongoing debate, as discussed by Lin and Chang (2009), about whether countries should focus on their existing comparative advantage or seek to upgrade their export capabilities more proactively so as to promote industrial development. Justin Lin argues that market interventions need to support opportunities associated with a country's existing comparative advantage whereas Chang argues that countries need to 'defy' comparative advantage to some extent in order to upgrade their industries, because they need a period of learning and policy support while the necessary forms of physical and human capital and technological capabilities are accumulated, before they can be expected to become internationally competitive in a new industry.

In practice, most countries – developed and developing alike – have adopted proactive policies designed to upgrade their industries, often aiming well beyond their existing patterns of comparative advantage. However, this has generated mixed results. The proactive role of the state has often been cited as a driver of the success in the East Asian Tiger economies, and more recently in countries such as China and Chile (Chang, 2006; Rodrik, 2010). But there are also many examples where such policy has failed (Pack and Saggi, 2006).

It could, however, be argued that the failure of these policies has had more to do with how they were implemented. Governments have often relied on traditional industrial policies such as infant industry protection, which has resulted in monopolistic or oligopolistic outcomes, and the creation of vested interests that provide strong opposition to subsequent attempts at liberalisation, all of which mean the industry never in fact becomes competitive (Ellis, 2009; Ellis, 2010). However, there are ways to provide support that are much more market friendly – see Box 1 – and the merits of different policy levers have been extensively discussed (e.g. World Bank, 2005; Porter, 1990).

Box 1: Market friendly policy levers to promote competitiveness

Removal of counterproductive subsidies
Regulatory reforms
Feed-in tariffs
Research and development support
Mandatory and voluntary standards, certification and labelling schemes
Skills development
Round-table dialogues with business to identify market opportunities and required reforms
Public/private coordinated sector development strategies
Public/private partnerships
Strategically targeted tax breaks
Procurement policies
Advanced market commitments
Local content requirements/requirements for technology transfer from foreign direct investment (FDI)
Prizes for innovation

Climate change itself creates an additional rationale for government intervention in markets. Because climate change constitutes an externality that will not be addressed by markets operating on their own, it will necessarily require policy intervention to tackle it. Thus, more proactive approaches to managing economic activity will be essential, and may include industrial policy (World Bank, 2012). The World Bank cites a number of reasons why countries have been adopting green industrial policies (ibid.):

- to compensate for the uncertainty in future environmental policy and promote new industries and technologies, and to take advantage of a latent (potential future) comparative advantage, create jobs, and pursue new sources of growth;
- to level the playing field and prevent a loss of national competitiveness resulting from the introduction of environmental regulation;
- to smooth the transition to a green economy by providing temporary support to declining energy-intensive industries, in order to secure political agreement to the transition.

Country efforts to promote greener growth already include many tools that effectively constitute industrial policy, i.e. industry-specific research and development subsidies, capital subsidies, tax breaks, feed-in tariffs and import protection. Many rich and middle-income countries are already pursuing these policies. For LICs to thrive and compete in a world that is moving towards these greener forms of growth, assessing and responding to these trends will be important, and responding effectively will likely involve similarly proactive government intervention.

Indeed, there is a risk that escalating support to green industries in relatively rich countries will create unfair competition, which will effectively shut out other countries from certain industries where such support is unaffordable. Finding ways around this problem will be important; for example, identifying cost-effective ways to adopt and adapt new technologies that are being developed and subsidised by richer countries could help to maximise domestic gains in productivity and low carbon competitiveness.

2.2 Applying 'Low Carbon Logic' to competitiveness analysis – identifying the transmission mechanisms

In this section we set out the main economic transmission mechanisms through which the three drivers identified (natural resource scarcity, climate change and international mitigation) could potentially affect competitiveness. In the next section we discuss how these drivers affect five different economic sectors that are key for LICs: energy, agriculture, forestry, manufacturing and tourism. The analysis is then summarised more systematically in a matrix format. The analysis has been informed by a series of internal ODI papers that were commissioned from different authors to identify key future trends (relating to energy prices, mitigation policies, etc.) and associated risks and opportunities.

We identify eight possible transmission mechanisms:

(1) The creation of new markets (domestic or international) or a reduction in the size of existing markets. For example:

a. Mitigation policies are likely to create new markets for waste-to-energy products such as briquettes.

b. Natural resource scarcity will create new demand for innovative energy- and water-efficient manufactured products.

c. Climate change will create new demand for products that improve climate resilience.

(2) Changes in prices of exports/imports due to changes in global supply and demand. For example:

a. International mitigation could give rise to increased international demand for energy-intensive products from non-mitigating countries.

b. Natural resource scarcity associated with growing demand is likely to lead to food and other agricultural commodity price increases.

c. Climate change is likely to reduce agricultural yields in many countries, thus reducing supply and pushing up prices on international markets.

(3) Changes in costs due to changes in input prices. For example:

a. Increased air travel costs arising from mitigation-policy-related transport taxes may reduce long-haul flights affecting growth potential of tourism.

b. Increased timber prices reduce the competitiveness of those sectors that are dependent on fuel wood.

c. Reduced rainfall associated with climate change may reduce potential supply of hydropower, pushing up energy costs for some countries.

(4) Changes in flows of foreign direct investment, and location decisions by multinationals. For example:

a. Mitigation could stimulate increased foreign direct investment (FDI) in renewable energy generation (e.g. hydropower).

b. Higher oil prices could generate increased investment in local manufacturing production for local markets to avoid costs of transportation, or conversely, reduced FDI into production facilities for export markets.

c. Climate change may reduce investment in climate-affected agricultural products in vulnerable locations.

(5) Impacts on the value of assets such as land, water resources, fossil fuel reserves, forests, etc. For example:

a. Mitigation may push up the value of land as a result of competing demand for biofuels, and loss of cultivable land flooded for hydropower.

b. Natural resource scarcity could increase the value of fossil fuel reserves, making more viable over time those that are harder to access.

c. Climate change may contribute to driving up the value of land and water resources by increasing the proportion of arid land, and reducing the productivity of existing agricultural land.

(6) Increased climate finance, either from public sources such as donor budgets, or from the private sector through the further development of carbon markets such as initiatives like CDM and Reduced Emissions from Deforestation and Degradation (REDD). By definition an outcome of the mitigation driver, these potential new sources of finance could be used to support competitiveness in different economic sectors, for example:

a. to support energy-efficiency measures and the development of renewables;

b. to pay for improved forest management and help support the development of new livelihoods in order to reduce unsustainable forest practices, e.g. through developing markets for non-timber forest products or ecotourism;

c. to support soil carbon sequestration and sustainable agricultural practices that improve yields.

(7) Higher standards demanded in global value chains, and requirements for **certification and labelling,** e.g. for sustainable agricultural practices and carbon footprinting. For example:

a. Mitigation (including voluntary mitigation efforts by the private sector) could result in increased demand for carbon footprinting and associated certification, which could exclude producers without certification or with relatively high emissions.

b. Natural resource scarcity is likely to increase demand for certification of sustainable agricultural practices, sustainable forest management, or energy-efficiency standards, which could exclude producers without certification.

(8) Technology transfer could be facilitated through FDI, through demonstration projects with climate finance support, or through imports. This could result in, for example:

a. the development of lower-cost renewable energy generation technologies which improve the competitiveness of these energy sources vis-à-vis alternatives;

b. production processes that are more energy-efficient and can improve the competitiveness of the manufacturing sector;

c. technologies (e.g. seeds, irrigation) that promote increased agricultural yields.

2.3 Low carbon competitiveness issues by sector

We will now discuss how the three drivers affect competitiveness in five different economic sectors that are key for LICs: energy, agriculture, forestry, manufacturing and tourism. The analysis is then summarised in a matrix format.

2.3.1 Energy issues

One of the biggest constraints to competitiveness in low-income countries is the high cost of energy, along with the restricted access to it. In addition, LICs tend to have higher energy intensity in production, and thus their competitiveness will be more adversely affected by rising oil prices than will that of higher-income countries (IDR, 2011), exacerbating the problem further. However, this creates a strong business case for the adoption of less-energy-intensive forms of production, together with the development of non-fossil-fuel-based sources of energy, that could actually become a source of competitive advantage for LICs going forward.

For most LICs, the priority is to improve the supply and reliability of energy at as low a cost as possible. For some countries this will mean investment in fossil fuel energy, and for others, investment in renewables. The optimal decision will also vary depending on what is assumed about future prices of oil and other fossil fuels.

Projections vary depending on assumptions made, but generally, oil prices are expected to increase in real terms to 2035 by 1.5-2.5% annually, in response to increased costs of production and increased demand (EIA, 2012). Gas prices are expected to increase to the end of this decade and then stabilise as production from unconventional gas resources (e.g. shale gas) increases to meet growing demand (Department of Energy and Climate Change, 2012). Coal prices are also expected to increase to the end of this decade and then stabilise (ibid.). These projections incorporate assumptions about the future evolution of policy including mitigation policies. Thus while international mitigation is expected to temper fossil fuel price increases to some degree, the overall price trend is still upwards.

This will push up prices in LICs, and have a negative effect on economic growth. Previous analysis by ODI found that a one-third increase in oil prices over a two-year period would lead to a 1% reduction in GDP in sub-Saharan Africa, and as much as a 4% reduction in the poorest countries (te Velde, 2011). In addition, where fuel subsidies continue, government

budgets will be adversely affected, and as most LICs are net oil importers it will worsen the balance of payments.

Higher prices will increase revenues for oil exporting LICs. This represents a significant economic gain but also creates the risk of Dutch disease, whereby the competitiveness of other tradable goods is undermined, leaving countries relatively undiversified and more vulnerable to oil resource depletion. Reinvestment of rents from oil exports to support the development of other sectors of the economy can help to promote productivity and broaden competitiveness. Rising fossil fuel prices will also increase the value of fossil fuel reserves, making the exploitation of even relatively inaccessible reserves more viable over time.

LICs tend to be much more reliant on renewable energy sources than other countries, particularly biomass (e.g. fuel wood). Across all LICs (excluding Afghanistan, for which data is unavailable), 77% of total primary energy supply in 2009 was from renewable energy sources (including biomass) and 23% from fossil fuels, according to statistics from the International Energy Agency (IEA) and International Renewable Energy Agency (IRENA). This is almost the reverse of the energy supply mix in OECD countries, where 81% is from fossil fuels and 8% from renewables (excluding nuclear).

Renewable energy is becoming increasingly competitive as technologies mature, and some renewable energy costs (e.g. solar, wind) are already falling, making renewable energy increasingly competitive (Brown et al., 2011). In rural and remote locations, decentralised renewable energy generation is often the most cost-effective option (Intergovernmental Panel on Climate Change (IPCC), 2011), and its expansion – potentially supported by new forms of climate finance – can support increased economic development and improved competitiveness in those areas.

Price reductions relating to one renewable energy source represent a threat to competing renewables sources. However, given the existing scale of the energy deficit in most LICs, there is a long way to go before particular energy sources are abandoned in favour of cheaper alternatives.

Exports of renewable electricity are also a realistic prospect for some LICs, particularly those with substantial hydropower potential (Scott, forthcoming). Standards and labels could start to reward products made using renewable energy, and this could provide further benefits to renewables-dependent LICs, though there are few international moves in this direction as yet.

The long lead time for large-scale infrastructure projects, and fixed investment in currently installed capacity, would make a full transition to renewable energy systems difficult in many LICs. The costs of implementing energy projects and the capacity to do so usually take higher priority in decision-making than the nature of the source energy. Whether it makes economic sense to embark on such a transition immediately is uncertain and would require a long-term time horizon in energy planning, as well as sustained policy commitment.

However, there is scope for increased FDI in energy generation, both fossil-fuel-based and renewables, in light of rising energy prices, and growing concerns about energy security. In addition, the potential for carbon finance could make large-scale investments more attractive.

The economic trade-offs associated with different energy mixes (including both costs and reliability) need to be considered on a country-by-country basis, and the short- and long-run impacts on competitiveness assessed, including risks associated with high carbon lock-in. The competitiveness impacts and financial sustainability of subsidies to fossil fuels (and other forms of energy) also need to be considered, as do the competitiveness benefits of increased energy security, and access to electricity for previously underserved areas.

The CDM has the potential to increase as a source of finance for low carbon investments in LICs, though probably worth only up to several millions of Euros per year, rather than tens of millions (ibid.). There is the potential for CDM benefits for LIC producers of renewable energy such as hydropower associated with electricity exports to markets where electricity emissions are higher. However, carbon prices have been falling and are expected to remain low in the short to medium term. As a result, the carbon revenue from CDM projects in LICs will be lower than was expected when the projects were initiated, reducing the attractiveness of future investments in the short to medium term at least.

The carbon price is generally predicted to rise over the long term, (IPCC, 2007; DECC, 2011) but the size and pace of that increase is unclear, as it will depend on the extent of international mitigation. Public climate finance is also likely to become increasingly available for investment in renewable energy generation, and may provide an important new source of funding for investment in LICs.

Oil price rises could improve the financial viability of biofuel production in LICs, perhaps directed mainly towards the domestic market, although potentially for export too. The price advantages of biofuels production relative to importing fossil fuels are increasing rapidly (Wiggins et al., 2011). This could give rise to new markets for biofuels in developed countries facing mandatory renewable energy targets, as well as in other regional and domestic markets. These new markets could provide some LICs with new opportunities to export biofuels and related products, e.g. sugar. Wiggins et al. (ibid.) found that economic returns on potential biofuel feedstock – especially sugar – can be high, assuming oil prices of $90 per barrel or more. Indeed, returns can be many times higher than those of the main food crops.

However, there are also risks associated with exporting biofuels, since biofuel export markets are politically created and thus vulnerable to policy reforms (Oxfam, 2008). In addition, a small group of countries already dominate production and are effectively able to set prices internationally, and new R&D that increases productivity tends to be less available in developing countries. In addition, any biofuels exports would have to meet sustainability criteria, and this may be difficult for LICs.

There is also considerable opportunity to expand biofuels production for domestic use within LICs. However, policymakers would need to consider possible negative impacts associated with increased competition for land and water, which could result in rising food prices. Dual crops such as sweet sorghum or cassava, which can provide both food and fuel, represent one way forward.

Climate change itself may affect potential energy sources. For example, reduced rainfall may reduce the potential supply of hydropower, while increased temperatures may increase the supply of solar power. Biofuel crop production could also be affected by climate change.

2.3.2 Agriculture sector issues

By affecting weather patterns and water availability, climate change will affect yields associated with particular agricultural crops, which will in turn affect revenues and investment decisions of farmers (Nelson et al., 2009; PACJA, 2009). Climate change will thus affect the global supply of many crops and alter trade patterns. It will result in increased scarcity of certain crops, driving up market prices and undermining food security in some countries. This is likely to increase demand for land for agricultural production.

As discussed above, international mitigation and energy insecurity are raising the global demand for biofuels, and returns for biofuels crops are increasing, although the returns can be volatile. This greater demand represents an opportunity for farmers to make higher revenues but also creates concerns at the national level about food security, and increases competition for land and water resources.

This effect is compounded further by growing demand for food in the emerging economies, which is pushing up the value of land, resulting in increased foreign direct investment into land assets. Often this land is held speculatively and unutilised, undermining the value of this FDI. In addition, there has been some concern about the impact of these acquisitions on the local population. However, in principle, and if well managed, these acquisitions could potentially result in spillover benefits in the form of technologies (e.g. climate resilient seeds or irrigation techniques) that could promote increased yields and build competitiveness.

Forested lands are frequently targeted for land acquisition, as they are less densely populated and may be easier to acquire, and this can undermine attempts to achieve sustainable forest management. However, increased demand for land could also result in increased pressure for land reclamation or increased use of arid land, with appropriate irrigation mechanisms.

Foreign direct investment in land and agriculture can thus bring potential economic gains, but it also poses risks. The challenge for LICs lies in appropriate management of the sale or lease of these resources, and regulation of their use (including ensuring appropriate competition in the sector, incentivising pro-development business models that benefit the entire value chain, and promoting productivity improvements ahead of expansion into new areas), in order to maximise benefits and minimise risks including resource depletion (e.g. deforestation and depletion of scarce water resources) (European Report on Development, 2012). Political and social risks are also considerable in relation to large-scale land acquisition (Deninger and Byerlee, 2010).

Conservation agriculture and sustainable agricultural practices can help to increase yields, and this will become more important in light of the changes discussed above. Low carbon agricultural techniques such as intercropping, zero tillage and cropland nutrient management can improve productivity, often at zero or negative cost, resulting in higher growth and income (Wiggins et al., 2011; McKinsey, 2009). Sustainable agricultural practices can generate reductions of between 25% and 50% in energy inputs used (United Nations Environment Programme, 2011) thus enhancing competitiveness considerably. Such techniques can also enhance soil resilience to the impact of climate change (Lal, 2011).

The challenge, as with most agricultural innovations, is that producers, many of whom are smallholders, need extensive support during the transition. Barrett (2007) notes that

smallholder farmers need access to productive technologies and the right resources and know-how. Measures that can help farmers (especially smallholders) move towards more sustainable and competitive practices include easier access to finance, improved access to agricultural extension services, knowledge, and incentives to use appropriate techniques.

In principle, carbon markets could help to finance these kinds of changes, which enhance soil carbon sequestration, as this is one of the most relevant and substantive mitigation opportunities available in LICs. However, mechanisms such as CDM currently do not provide carbon credits for emissions reductions through agriculture, and there are many technical issues (e.g. relating to the monitoring of emissions reductions achieved) that would need to be resolved before this could become a feasible option. Public sources of climate finance could provide significant support for these types of efforts, however.

Certification and labelling of sustainable agricultural practices is increasingly demanded in global value chains (such as the GLOBALG.A.P. certification scheme, which has become a de facto requirement for many retailers in the EU). These certification schemes have the potential to reward those who adopt sustainable agricultural practices and penalise those who do not, and thus it represents a threat to those farmers unable to meet the requirements, particularly in countries where market institutions for certification are undeveloped. Hence, LIC producers may need support to meet labelling requirements in order to maintain competitiveness and access to markets (Ellis and Keane, 2008).

Carbon footprinting or labelling is also likely to increase over time, with a growing number of businesses developing their own tools for measuring and reporting carbon emissions in production processes, such as the Cool Farm Tool developed by Unilever.[1] This represents a threat to products that are relatively carbon intensive but an opportunity for those that are less carbon intensive. This will need to be assessed on a case-by-case basis, and represents a risk but also a possible opportunity for low-income countries. For example, a country may produce agricultural crops in a way that is relatively less energy intensive than other countries, perhaps due to its tropical growing conditions and relative abundance of labour. This could be particularly valuable if the country is able to market itself as a relatively 'green' source of products. Kenya's 'Grown Under the Sun' initiative is an example of how a reputation can be developed for relatively 'green' forms of production.[2]

However, the possible inclusion of emissions associated with transportation could disadvantage low-income countries that are located a long distance from their main markets, particularly those that rely on airfreight. Higher transport costs and carbon footprinting could potentially result in consolidation of global food value chains, if that reduces the 'food miles' generated to produce a particular product. This could result in increased investment in local agro-processing as local markets avoid the costs of transportation associated with reimportation. However, it could also strengthen incentives to export in a raw form if that results in a lower weight-to-value ratio than that of packaged products. The impact would need to be assessed on a case-by-case basis.

1 http://www.coolfarmtool.org/

2 http://grownunderthesun.com/

Many LIC agricultural producers are keen to move up the agribusiness value chain, and certain innovations could help to enhance competitiveness in a carbon constrained global economy. For example, appropriate processing and packaging of agricultural products could potentially reduce the perishability of products and thus remove the need to airfreight them, reducing the carbon footprint considerably.

High energy costs can undermine the competitiveness of agribusiness, especially as rural areas are often off grid and suffer from poor infrastructure, which makes it expensive to transport fuel. However, there are opportunities associated with cogeneration and waste-to-energy technologies to improve and diversify incomes of agricultural producers. There is also potential for cogeneration from by-products such as bioethanol, which in large enough quantities can potentially be sold on to the grid. Agricultural residues can be burned to generate electricity to provide energy for farmers, or used as feedstock for village-based centralised waste-to-energy (WTE) plants; it can also be used to create biogas at the household level through small units, or used to produce biogas on a more industrial scale. There is also potential to develop export markets; for example, rice straw pellets or straw briquettes can be manufactured and exported (Ellis, 2012[3]). However, for most LICs such waste materials, though often relatively abundant, are barely utilised.

2.3.3 Tourism industry issues

Tourism to developing countries has been growing fast, and the industry represents a significant opportunity for some LICs. Ecotourism – as a specific subset of the tourism industry – has been growing even faster, at rates up to two to three times higher than normal tourism activities (FAO, 2011[4]). Ecotourism allows countries to take advantage of, and at the same time preserve, their natural capital (e.g. forests), through tourism-related activities and products aimed at environmentally aware international tourists. By incentivising sustainable forest management, and creating alternative livelihoods to logging, ecotourism can create stronger incentives for low carbon outcomes. In addition, there is greater inclusion of local communities in the value chain, as they tend to provide the majority of ecotourism services, as opposed to larger international or national tourism service providers (ibid.).

However, a failure to constrain the numbers of tourists visiting a particular location can damage natural capital, sometimes irreversibly. In addition, threats from growing pollution; competing uses and poor management of land, forest and marine resources; and climate-change-related impacts such as droughts and floods, coastal erosion and coral bleaching may jeopardise the growth of the tourism industry. On the other hand, the value of areas high in biodiversity and wildlife may increase over time, as demand increases and supply falls.

There are significant opportunity costs – in terms of the development potential of other sectors – associated with the often very high energy and water usage in tourist resorts, costs that could be exacerbated by climate change and further tourism development. For example, this could threaten access to water by local communities for other purposes such as irrigation of agricultural crops (UNEP, 2011).

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3 Ellis (2012), “Green Growth Opportunities & Requirements in Egypt”, GIZ

4 http://www.fao.org/news/story/en/item/90192/icode/

Pressure from tour operators for more sustainable operations is slowly growing. Partly this reflects demand from customers for more sustainable holidays, but it is also a result of pressure from investors. This voluntary self-regulation is exemplified by the Travelife award system – an international certification scheme set up by tourism industry members, which awards a Gold, Silver or Bronze rating to participating hotels and accommodations (currently represented in 25 countries, of which Kenya is the only LIC to date) based on a number of environmental and social criteria. Growth of such certification schemes may drive increased water, energy and carbon footprinting etc. and may become increasingly important to remain competitive going forward. Thus putting in place the necessary natural resource management policies, regulations, and private sector incentives for efficiency and sustainable natural resource management could help to enhance the sector's competitiveness, especially for early adopting LICs who can establish a reputation and associated international 'brand' for green tourism (ERD, 2012).

Increased air travel costs arising from higher fuel prices may reduce long-haul flights affecting growth potential of tourism. In addition, aviation carbon taxation could affect tourism in LICs; air passenger duty is being imposed by a number of countries, and air travel is now a part of the European Emissions Trading Scheme, which could affect prices of travel to long-haul destinations including LICs. The impact of such measures has been questioned, however, with some arguing that the price elasticity of demand for flights is low, in which case the measures would generate considerable revenue without resulting in any significant reduction in flights.[5] But if they are effective, or set very high, and adopted on a wide basis so as to significantly reduce the demand for long-haul flights, then developing countries that previously benefited from tourism from the developed world could suffer economic losses as a result of these mitigation policies. However, if much of the growth of tourism to LICs is from neighbouring MICs rather than from more-distant rich countries, these risks may not represent too significant a threat.

Climate finance could potentially support the development of low carbon tourism, for example by supporting the use of solar power by hotels, or by supporting ecotourism projects as a way to promote sustainable forest management.

2.3.4 Forestry sector issues

Forestry is an important sector in many LICs, and if managed sustainably can potentially support a wide range of livelihoods, including (sustainably harvested) timber and non-timber forest products (NTFP) such as fruits and nuts, furniture, pulp and paper, and tourism. However, deforestation and forest degradation is widespread and often uncontrolled, reflecting competing – often more lucrative – economic opportunities, such as unsustainable timber production, or forest clearance for other uses such as agriculture and rubber or palm oil plantations.

5 Oxford University (2005). "Predict and Decide: Aviation, Climate Change and UK Policy" Report. Greener by Design (2006 – 2007). "Air Travel" Annual Report.

Increasing competition for land arising from growing demand for livestock, agriculture and biofuels presents a significant threat to the sustainable management of forests. By reducing agricultural yields, climate change could also exacerbate this problem. However, this means that longer-term and more-sustainable economic opportunities, as well as socially valuable forest ecosystem services, are being lost (UNEP, 2011).

Increasing domestic demand for energy in the form of fuel wood or charcoal also is threatening forests in many LICs, and rising prices for these products are undermining the competitiveness of other industries. However, there are also opportunities associated with fuel wood scarcity; for example, private sector entities have purchased degraded land with a view to investing in forests, which they plan to manage sustainably in order to generate their own fuel wood on an ongoing basis. And shortages of fuel wood create incentives for alternative energy sources to be developed, such as biogas from agricultural waste products like manure and rice husks.

The development of alternative livelihoods that are consistent with sustainable forest management (such as non-timber forest products and ecotourism) can help to create stronger incentives to protect forests. There is also scope to develop new manufacturing industries, e.g. paper or furniture production. Building competitiveness in these sectors can thus potentially help to support more sustainable forest management. However, the economic returns from competing uses can often considerably outweigh the economic benefits from these other sources of livelihoods in the short term, thus the opportunity costs often remain high.

There are some existing incentives for sustainable forest management (SFM); for example, certification programmes such as that operated by the Forestry Stewardship Council, which can potentially increase access to markets for timber products, or facilitate a price premium. However, certification requirements are quite demanding, and only a small proportion of the world's production forests are currently certified under the Forest Stewardship Council (FSC) standard (ibid.), even fewer of which are in developing countries (Ellis and Keane, 2008[6]).

REDD+ has the potential to provide much more finance to reward forest conservation and incentivise sustainable forest management, including by helping to develop alternative livelihoods, but it is still being developed. In addition, the institutional requirements to make it work are not yet in place in most LICs. Nonetheless, there is scope to follow countries such as Guyana, which has put in place a sophisticated strategy for capitalising on REDD+ mechanisms, once they are developed, by quantifying the opportunity cost to determine compensation requirements, and developing a plan for the use of those funds if and when they are forthcoming (Ellis et al. 2009[7]). Such a strategy could also help to support other forest dependent livelihoods.

However, REDD+ financing presents risks as well as opportunities, as the scale and pace of its future development remains to be seen. Many projects have been developed in LICs to capitalise on expected REDD funding which has failed to materialise, resulting in

6 http://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/3332.pdf

7 http://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/5528.pdf

disappointment, disillusionment, failed projects and wasted resources. The value of continuing to invest in REDD-Readiness projects is questionable, and more urgent measures are needed in order to support sustainable forest management in LICs in the short term. However, in the absence of significant donor funding, it is not clear where the resources will come from to support this, and future prospects for effective international or domestic action to protect forests are not promising. This is one sector where competitiveness drivers will not be adequate to generate low carbon outcomes.

2.3.5 Manufacturing sector issues

While most LICs do not yet have a large manufacturing sector, most are keen to develop their manufacturing base. The growing trade volumes between MICs (and particularly the BRICS) and LICs could help to drive this growth in manufacturing. While the initial pattern of BRIC investment in LICs was one where resource-rich LICs were investment targets for resource exports to BRICs, BRIC investments are now shifting to encompass a wider range of activities including manufacturing. In the long term, BRICs could potentially outsource a lot more low-value manufacturing to labour-intensive LICs (IMF, 2011[8]) in the same way that high income countries did with MICs in previous years. Thus, LICs can take the place of BRICs which are moving up the manufacturing value chain, providing a boost in growth for LICs.

There is currently a degree of speculation about a possible new trend for manufacturing production to return to the USA in light of recently discovered cheap sources of fuel from shale gas and oil. This is most likely to be true for products involving energy-intensive manufacturing processes, however, and is unlikely to have a major impact on LICs, as their comparative advantage tends to be in products involving more labour-intensive manufacturing processes.

Another possible driver for movement up the value chain by LICs is increased outsourcing of relatively dirty industries as MICs introduce regulation to curb growing pollution problems and – if MICs adopt more stringent emissions reductions targets going forward – carbon leakage. However, many studies (e.g. OECD 2009) show that this 'carbon leakage' effect is likely to be limited, as fuel prices are only a small proportion of overall costs, and other factors such as the investment climate are more important in determining investment location decisions. However, if more stringent mitigation policies are introduced over time, this could increase the carbon leakage effect. There is therefore a potential economic opportunity for developing countries that have in place an adequate investment climate, although it also poses a threat to the achievement of a low carbon growth trajectory.

However, higher transportation costs (driven by higher oil prices) could potentially offset this increase in demand for manufactured products from MICs – something that is likely to vary by product depending on the proportion of total cost represented by transport costs. Indeed, higher costs of transportation could potentially contribute to a wider trend towards vertical reintegration of supply chains, generating sector-specific opportunities and threats.

8 Samake I., Yang Y. (2011), Low income countries BRICS linkage: are there growth spillovers?", IMF working paper WP/11/267, http://www.imf.org/external/pubs/ft/wp/2011/wp11267.pdf

Over the last couple of decades, a trend towards supply chain fragmentation in the manufacturing sector has been observed, as firms strive to maximise efficiency in production. However, the rationale for this fragmentation was based on the availability of cheap oil. Indeed, in many industries transportation costs represented only a small proportion of total cost. As oil prices rise, we may see a reversal of this trend and a reintegration of supply chains, with sourcing and production moving closer to where the final consumer is located (Simchi-Levi, 2012[9]). Clearly, this has important implications for the development of the manufacturing sector in LICs. While it means that the development of manufacturing industries targeting distant export markets may be jeopardised, it also means that local manufacturing of goods for domestic and regional markets may be stimulated.

However, it also implies that to be successful, manufacturing industries may be required to undertake a wider set of tasks within the manufacturing process rather than specialising in a particular component of the manufacturing process, as has been the case under fragmented supply chain models. This could be challenging for LICs, which may not have the range of capabilities needed to fulfil different parts of the supply chain (Hausmann and Klinger, 2006). On the other hand, it could create stronger incentives for multinationals operating in LICs to invest in them to develop these capabilities.

Thus, there is the potential that increased demand from domestic consumers or neighbouring countries for manufactured products will create a new source of growth for the manufacturing sector in LICs, underpinned by higher transportation costs, which drive up the prices of imports from more distant locations.

Overall, it seems there is a potentially significant economic opportunity for LICs in terms of increased investment opportunities and the potential for industrial upgrading and increased rents as they progress up the value chain. Which LICs stand to gain most from these opportunities will depend on many factors, including the costs of doing business – where energy costs are likely to be an important element – and geographical location.

However, industrial upgrading would also pose challenges. It would mean an additional source of competition for resources, further compounding any future scarcity issues. And it would generate increased pollution and carbon emissions. This is a particular challenge as production in developing countries tends to be much less efficient and more energy intensive.

Research has shown that firms in developing countries tend to use three times as many resources and energy as equivalent firms in developed countries (UNIDO, 2010). This is partly explained by the different mix of industries that exist in developed as compared with developing countries. However, it probably also reflects relatively less-efficient production processes in developing countries as compared with similar industries in rich countries. For these reasons, higher future energy prices will clearly undermine the competitiveness of these industries within LICs as compared with those in other countries.

9 http://www.supplychainquarterly.com/topics/Strategy/201201reading/

Thus efforts to improve energy efficiency, including through the introduction of standards or labelling, will be important to help LICs take advantage of these new opportunities in the manufacturing sector. This is especially true as other countries may impose such standards themselves on manufactured imports. There is also a strong case for LICs to impose similar standards on their own imports of manufactured products from other countries. This will prevent unfair competition from non-compliant imports, can help improve energy efficiency in the utilisation of these manufactured products, and can help to stimulate technology transfer. Climate finance may also be available to support energy-efficiency measures and clean-energy technologies.

Improvement in the economic and environmental efficiency of production can be achieved with improved technology and knowledge transfer from more advanced economies to lower income economies (UNEP, 2011). For example, there is growing emphasis within the manufacturing sector on the Three R Strategy: Reduce (resources used), Recycle and Reuse. This is generating innovative thinking by business about new technologies and production processes that deliver more sustainable business models. Thus, efforts should be made within LICs to maximise the adoption and adaptation of such technologies, e.g. through training and awareness raising for small and medium enterprises (SME).

Different opportunities and threats can be expected to arise in different manufacturing industries. For example, there are likely to be new opportunities for manufacturing sector exports of green goods and services, such as waste-to-energy techniques that can be used to convert agricultural residues (and other forms of waste) into fuel products (such as briquettes) for either domestic use or export. There is also likely to be increasing international demand for expertise in green sectors such as waste-to-energy or hydropower generation, creating scope for exports of services including technically skilled labour and training courses.

There will likely be growing demand for manufactured products that are more energy or water efficient in utilisation, and for products that improve climate change adaptation or resilience (such as solar water heaters, water storage tanks, drip irrigation systems, etc.), some of which are already manufactured in whole or in part within LICs. Waste products can also generate revenue if they can be recycled and reused, and there is considerable scope to develop waste management industries that provide the co-benefit of helping to solve the growing problem of waste management. This area also has the potential to generate jobs for the urban poor.

On the other hand, some existing industries will face a growing threat to their business models. For example, cement is an extremely energy-intensive product, which may be particularly vulnerable to energy shortages. Yet many LICs produce cement domestically and it is important for their wider international competitiveness given its indispensability to the construction sector. The impact of increasing energy prices on the competitiveness of cement production is likely to be significant, with implications for national competitiveness. New technologies, inputs and processes are being developed by the cement industry internationally to respond to energy and resource scarcity, and many of these are already

delivering cost savings (Saidi et al., 2012[10]). Cement firms in LICs will need to keep up with these technological developments if they are to remain competitive.

10 http://www.kccap.info/index.php?option=com_phocadownload&view=category&id=29

Table 1: Matrix of drivers and transmission mechanisms by sector

The analysis of drivers and transmission mechanisms is summarised in a matrix of five sector-specific parts below, in order to provide a more systematic breakdown of the relevant issues. The matrix will be used to guide the subsequent in-country analysis.

Energy

Energy	New markets/dying markets	Changes in prices of exports/imports due to changes in global supply and demand	Changes in costs due to changes in input prices	Foreign direct investment (FDI) levels/location decisions	Asset values	Climate finance	New standards and labels	Tech transfer
Mitigation Policies in other countries	Increasing demand for renewable energy. Increasing demand for biofuels.	Mitigation may temper fossil fuel price increases but overall expected price trend is still upwards.		Could stimulate FDI in renewable energy generation (e.g. hydro) from other countries.	Will potentially reduce value of fossil fuel reserves ceteris paribus. May push up value of land as competing demands for biofuels.	Climate finance could support renewable energy projects.	Standards and labels could start to reward products made using renewable energy.	Technological innovation to promote renewable energy drives down prices. Price reductions relating to one renewable energy source represent a threat to competing renewables sources.
Increasing natural resource scarcity	Increasing demand for renewable energy. Increasing demand for biofuels. Increasing demand for fossil fuels even if relatively difficult/ expensive to	Higher prices of fossil fuel imports, and increased revenue from fossil fuel exports.	Increased cost of fossil fuel imports will result in higher costs for many sectors of the economy. Results in reduced competitiveness of firms using relatively energy-intensive forms of production.	Could stimulate FDI in energy generation (e.g. fossil-fuel-based and renewables) from other countries.	Will increase value of fossil fuel reserves Biofuels demand will increase value of land.		Standards and labels could start to reward products made using renewable energy.	Technological innovation in renewable energy drives down prices. Price reductions relating to one renewable energy source represent a threat to competing renewables sources.

	access.							
Climate change			Reduced rainfall may reduce potential supply of hydropower. Increased temperatures may increase potential supply of solar power. Yields of biofuel crops may be affected.					

Agriculture

Agriculture	New markets/dying markets	Changes in prices of exports/imports due to changes in global supply and demand	Changes in costs due to changes in input prices	FDI levels/location decisions	Asset values	Climate finance	New standards and labels	Tech transfer
Mitigation	New market for biofuels.	Food price increases as a result of growing demand for biofuels.			Growing demand for biofuels may push up value of land.	Possible climate finance available to support sustainable agricultural practices, or agroforestry.	Increased demand for carbon footprinting and associated certification which could affect market access. Air freighted products may be vulnerable to future standards and labels.	
Natural resource scarcity	New market for biofuels. Opportunities for	Food price increases for both exports and imports.	Increasing fuel costs associated with mechanisation	Increased investment in land.	Land price increases as a result of growing demand for food		Increased demand for certification re: sustainable	Technologies (e.g. seeds, irrigation) to promote

	agricultural producers for cogeneration or waste-to-energy production. New markets for agroforestry products.		may favour more labour-intensive forms of production.	FDI into agriculture for export. Increased investment in local processing to avoid costs of transportation.	and biofuels etc. Increased pressure for land reclamation or increased use of arid land. Increased pressure on water resources.		agricultural practices, which could affect market access.	increased yield could spillover via FDI.
Climate change		Will affect global supply of different crops differentially, depending on impact on productivity. Likely to reduce yields in many cases in LICs and drive up prices on international markets.	Climate change likely to reduce yields and predictability of some crops.	May reduce investment in climate-affected agricultural products in particular locations.	May reduce water availability driving up water-related asset values. May drive up land prices by increasing arid land, and reducing productivity of existing agricultural land.			

Manufacturing

Manufacturing	New markets/dying markets	Changes in prices of exports/imports due to changes in global supply and demand	Changes in costs due to changes in input prices	FDI levels/location decisions	Asset values	Climate finance	New standards and labels	Tech transfer
Mitigation	New markets for renewable energy and energy-efficiency-related products and appliances.	Increased international demand for energy-intensive products from non-mitigating countries not subject to border tax adjustments.		Possible relocation of energy-intensive industries to non-mitigating countries not subject to border tax adjustments		May be available to support energy-efficiency measures and clean-energy technologies.	Energy-efficiency standards and labels imposed by other countries on imports.	Tech transfer from spillovers associated with FDI and donor projects.

Natural resource scarcity	Demand for new more energy- and water-efficient products. Waste products may generate revenue if can be recycled or have usable by-products, e.g. energy.	Higher oil prices drive up costs of transportation which may lead to vertical integration of value chains generating sector-specific opportunities and threats.	Higher oil prices drive up costs of transportation Higher energy prices undermine competitiveness of relatively energy-intensive firms.	Increased investment in local manufacturing production for local market to avoid costs of transportation.			Energy-efficiency standards and labels imposed by other countries on imports.	Tech transfer from spillovers associated with FDI and donor projects.
Climate change	Increased demand for products that assist with adaptation or resilience.							

Forestry

Forestry	New markets/dying markets	Changes in prices of exports/imports due to changes in global supply and demand	Changes in input prices	FDI levels/location decisions	Asset values	Climate finance	New standards
Mitigation	The development of new markets based on trees as 'carbon assets' for which benefits might be received by countries or forest dwellers has been anticipated				Demand for land for biofuels increases opportunity cost of protecting forests.	REDD+ could pay for improved forest management and help support the development of new livelihoods e.g. in non-timber forest products.	Sustainable forestry certification = threat until it can be obtained. Obtaining it would yield competitive advantage.

	globally, though this has failed to materialise to date, and progress towards the development of such a market is not promising.						
Natural resource scarcity		Increasing price of timber raises opportunity cost of protecting forest = threat to other forest-based industries and livelihoods.	Increasing price of timber reduces competitiveness of those sectors that are dependent on fuel wood.		Demand for land for food biomass or palm oil etc. increases opportunity cost of protecting forests. Threat to other forest-based industries and livelihoods.		
Climate change			More fires increase risk and reduce supply of forest-based livelihoods.		Reduction in agricultural productivity associated with climate change increases competition for land for agriculture.		

Tourism

Tourism	New markets/dying markets	Changes in prices of exports/imports due to changes in global supply and demand	Changes in input prices	FDI levels/location decisions	Asset values	Climate finance	New standards

Mitigation	If effective business models can be generated the possibility exists for expansion of ecotourism to support preservation of 'carbon sink' ecosystems.		Increased air travel costs arising from transport taxes may reduce long-haul flights affecting growth potential of tourism.			Support for ecotourism projects as a way to promote sustainable forest management.	Growth of green tourism certification schemes may drive water, energy and carbon footprinting etc.
Natural resource scarcity			Increased air travel costs arising from higher fuel prices may reduce long-haul flights affecting growth potential of tourism.		Value of areas high in biodiversity and wildlife may increase. Growing pollution and poor natural resource management may erode the value of tourism destinations.		Growth of green tourism certification schemes may drive water, energy and carbon footprinting etc.
Climate change	Drought, flood and temperature changes (including coral bleaching) may affect attractiveness and viability of certain tourist destinations.						

3 Next steps in developing the Low Carbon Competitiveness Diagnostic

In the next stage of this work, the impacts posited in the analysis above will be tested in particular country and sector contexts. In each country case study we will focus on three sectors, which will be selected on a case-by-case basis depending on existing patterns of production and potential. The energy sector is likely to be an area of focus in all countries, given its pivotal position both in determining overall country competitiveness and as a potential export industry. Other key sectors that are likely to be a focus in one or more countries include agriculture, forestry, manufacturing and tourism.

We envisage a four-step approach:

(1) Understanding the economic characteristics of the country, determining the key current trade patterns and growth sectors, and identifying the country's competitiveness and growth strategies.

This will involve reviewing relevant national statistics to determine key economic sectors – such as share of national GDP or of gross value-added accounted for by different sectors – and sectoral growth figures to build up a more dynamic picture of the economy and its potential future trajectory; identifying the main exports and imports; and reviewing labour statistics to see which sectors are important in terms of employment. It will also involve a review of government strategies and vision statements on national development, growth and competitiveness issues, including strategies for specific key sectors. We will also review available growth diagnostic studies to understand the binding constraints to growth.

In addition to reviewing existing information and data, we will carry out an in-country consultation process on these issues with a wide range of stakeholders, including government officials from various ministries, private sector representatives consulted through business associations, chambers of commerce, trade bodies and individual firms, relevant working groups or lobby groups, experts, researchers and academics, donors and development agencies, and civil society organisations such as environmental campaign groups and consumer groups.

(2) Undertaking interviews and reviewing any existing country strategies for adaptation, mitigation and low carbon growth to ascertain what opportunities and threats have already been identified, and whether policies are being put in place to respond. We will analyse these existing strategies through the lens of competitiveness impacts to assess the extent to which relevant issues have been considered, if at all.

There are a number of relevant frameworks and sources of information that we can draw on, including Low Emission Development Strategies (LEDS), National Adaptation Programmes of Action (NAPAs), Nationally Appropriate Mitigation Actions (NAMAs), Low Emission Climate Resilient Development Strategies (LECRDS), Technology Needs Assessments, and individual country climate or green growth strategies and vision statements. We will also review research studies on the impacts of climate change on particular sectors in focus countries, and we will consider the implications for future competitiveness and sources of growth. These issues will also be explored through the in-country consultation.

(3) Assessing the impact of a future carbon and resource constrained global economy on the competitiveness and growth of the country's key economic sectors, as well as the potential for new growth sectors, identifying opportunities and threats.

This will involve drawing on all the information collected in Steps 1 and 2 described above, as well as our analysis of the impact of the three drivers discussed, and assessing the implications for the competitiveness and trade opportunities of the country's key economic sectors, and its main sources of growth.

(4) Identifying implications for policy.

This will involve analysis of the extent to which businesses are already responding to the opportunities and threats, and the role that policy can play in supporting these efforts and stimulating the necessary action to take advantage of new opportunities and manage risks. It will also identify any important investment climate barriers or policy constraints which are undermining the necessary response, drawing on relevant data and indicators. Co-benefits and trade-offs will also be considered, along with the strategic questions that will need to be addressed when agreeing a way forward.

Much of the above analysis will be undertaken in a qualitative manner, based heavily on evidence obtained from in-country consultations, given the lack of data available and the complexity of trying to quantify many of these factors. However, we will use existing data and indicators to inform the analysis to the extent possible, such as the World Bank's Doing Business Indicators, Investment Climate Assessments where they have been conducted, the Global Competitiveness Index (GCI) produced by the World Economic Forum, and UNIDO's Competitive Industrial Performance Index.

We will also draw on the new indicators being collected as part of the Sustainable Competitiveness Index (a recent extension of the GCI), which seek to better capture the dimensions of a country's performance that are likely to determine the long-run sustainability of a country's competitiveness. We will also draw on the indicators underpinning the Climate Competitiveness Index - developed by the United Nations Environment Programme (UNEP) and the think tank AccountAbility, to assess how well a country is understanding and engaging with climate-change-related issues - the United Nations Sustainable Development Indicators and the Environmental Performance Index. A summary of the various indices we may draw on is provided in Box 2.

Box 2: Relevant Indices that will be drawn upon where available

Global Competitiveness Index (World Economic Forum): Yearly reviews of national competitiveness undertaken by the World Economic Forum (WEF).

Sustainable Competitiveness Index (WEF): A subsidiary to the Global Competitiveness Index, the Sustainable Competitiveness Index factors in longer-term drivers of competitiveness.

Ease of Doing Business (World Bank): Measures business regulation and its enforcement.

Climate Competitiveness Index (United Nations Environment Programme and AccountAbility): Measures **'**climate accountability', defined as how government creates a climate strategy that ensures long term, inclusive and sustainable growth; and 'climate performance', which is how well the country has demonstrated its capability to set incentives and effective systems aimed at reducing carbon intensity.

Change Readiness Index (Overseas Development Institute and KPMG): Ranks countries based on their ability to respond and manage risks and opportunities associated with economic and political changes and shocks.

Sustainable Development Indicators (United Nations Conference on Sustainable Development): A set of 50 indicators capturing many different aspects of sustainable development.

Environmental Performance Index (Yale University): Ranks countries on 22 performance indicators relating to environmental public health and ecosystem vitality.

Competitiveness Industrial Performance Index (The United Nations Industrial Development Organization): Benchmarks industrial activity at the country level, through the lens of liberalisation and globalisation.

Energy Indicators for Sustainable Development (International Atomic Energy Agency): Provides information on current energy-related issues.

The analysis and consultation will generate a set of conclusions about the main opportunities and threats faced by the country in the key sectors of focus, and the resulting business case for investing in low carbon solutions, and will generate recommendations for policy at national and sectoral levels. These recommendations will be discussed, validated and disseminated through in-country workshops, and then published.

The country engagement phase will provide the means through which the methodology will be refined and the Low Carbon Competitiveness Diagnostic developed. This will be taken forward by iterating between country diagnostic work, policy engagement, and diagnostic development in up to five case study countries. The final product – the diagnostic tool – should support the implementation of this type of analysis for the wider group of low-income countries, beyond the initial case study focus countries. The proposed structure for the diagnostic tool is set out in Box 3 below.

The diagnostic tool will be accompanied by the publication of a User Guide, which will run through worked examples of the implementation of the Diagnostic, taken from the country case studies conducted in the development of the Diagnostic, and will provide examples of the kinds of policy responses that have been adopted to address the opportunities and threats identified.

Box 3: The Low Carbon Competitiveness Diagnostic

A modular approach is envisaged for the diagnostic tool, which will guide policy-makers through a series of steps to help them apply low carbon logic to their economic decision-making in a given country.

Module 1: Sector Identification

Guidance on identifying key sectors that should be the focus for the next steps of the analysis, drawing on existing national growth, competitiveness and climate change policy and strategy documents.

Module 2: Analysing impacts of global trends

The matrix of issues set out in this working paper is utilised to examine potential impacts arising from each of the three drivers – climate change, mitigation policies, and natural resource scarcity – on the selected sectors. Different possible scenarios are laid out for how things could evolve internationally in that sector over the next decade, and key opportunities and risks generated are identified.

Module 3: Identifying country-specific opportunities and threats

Decision tree approach to assist in the analysis of how these opportunities and risks would affect the selected sector(s) in that country context. This will provide a detailed checklist of the key questions (and suggested sources of data) that need to be answered to enable policy-makers to explore the likely impact of these effects in their particular context. These questions will cover (but not be limited to) factors such as

- the specific products the country produces and exports;
- where they are located on the value chain and extent for upgrading;
- the country's main trading partners;
- the country's location and main trade and transport corridors utilised;
- the current mix of energy sources, and level of energy intensity of production;
- current main constraints on competitiveness and growth in the sector in question;
- the extent to which resource scarcity or climate change threats could constrain investment and expansion of that sector in that particular location.

The intended output of this module is a detailed table setting out the main opportunities and risks facing each of the selected sectors in that country.

Module 4: Assessing policy implications

Policy implications of each of the opportunities and risks will be identified, tailored according to the decision tree analysis undertaken in Module 3, and potential synergies and trade-offs between achieving competitiveness and low carbon growth objectives will be explored in relation to each of these.

By developing a Low Carbon Competitiveness Diagnostic that is grounded in existing evidence, practical implementation for individual countries, and market realities, we aim to provide an accessible tool to encourage the application of low carbon logic to low-income countries' competitiveness and growth strategies. This should help low-income countries better prepare themselves to cope with the transformational changes that are inevitable considering the serious environmental challenges the world now faces, and should thus promote their enhanced resilience and economic success in the increasingly carbon and resource constrained global economy of the future.

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