

An assessment of green export opportunities for Barbados

Winston Moore

ABSTRACT

Transitioning towards a green economy —one that focuses on reducing environmental risks and resource scarcities, while also improving well-being— has been put forward as one possible path towards sustainable development. While the potential advantages of pursuing a green development path are clear, moving forward on the green agenda requires guaranteed support for emerging businesses and industries. Consequently, the policy agenda will have to be tailored to these new green business areas. This study assesses various green businesses and their potential suitability for the small island State of Barbados.

KEYWORDS

Economic policy, environment, economic development, sustainable development, business, exportstrade in services, Barbados

JEL CLASSIFICATION

013; Q37; Q56

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I

Introduction

With a fixed exchange rate, Barbados depends on its foreign exchange earnings from the export of goods and services to finance its imports. These imports are used in virtually every aspect of production, from tourism to manufacturing. In 2010 total merchandise exports amounted to US\$ 429 million, equivalent to less than 1% of total world exports. As table 1 shows, these exports were concentrated in a few key areas, mainly agricultural products and manufactures. Most of the country's exports go to the United States (25%) and the European Union (20.4%). Meanwhile, total exports of services in 2010 came to US\$ 1.6 billion, representing about 0.04% of total world exports. These trade patterns reflect not only geographical factors (such as the proximity of the United States), but also historical precedent (for example, the export of sugar to Europe under preferential trading arrangements). Travel accounted for the bulk of these export receipts (67%), with other commercial services making up most of the remainder.

Given the relatively high concentration of the island's exports (both goods and services) in a few key

areas, the export of green goods and services could provide opportunities for diversification into higher value added areas. Indeed, in 2011 Prime Minister Freundel Stuart¹ noted that one of the development objectives for the island over the medium to long term would be to become "the most environmentally advanced, green country in Latin America and the Caribbean". In pursuit of this objective the island completed a Green Economy Scoping Study (Moore and others, 2012), assessing the potential opportunities for pursuing a green growth strategy. One of the recommendations of the study was that an assessment of the trade in environmental goods and services in Barbados should be carried out in order for the island to fully harness the potential of the green economy.

¹ Address given at the launch of the Government of Barbados and United Nations Environment Programme (UNEP) Partnership for a Resource-Efficient Green Economy in Barbados, held at the Faculty of Medical Sciences, University of the West Indies.

TABLE 1

Barbados: main imports and exports, 2010
(United States dollars)

Goods	Trade value
Imports	
Mineral fuels, mineral oils and products of their distillation	484 333 718
Machinery and mechanical appliances; parts thereof	146 735 448
Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	110 024 097
Vehicles other than railway or tramway rolling stock	73 323 026
Pharmaceutical products	64 181 655
Other commodities	896 805 458
Exports	
Mineral fuels, mineral oils and products of their distillation	202 756 058
Pharmaceutical products	72 023 763
Beverages, spirits and vinegar	45 661 270
Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; clocks and watches; musical instruments; parts and accessories thereof	17 622 731
Animal or vegetable fats and oils	12 702 310
Other commodities	157 680 270

Source: World Trade Organization (WTO), *Report by the Chairman, Ambassador Manuel A.J. Teehankee, to the Trade Negotiations Committee*, Geneva, Committee on Trade and Environment, 2011.

This paper therefore attempts to identify potential green export opportunities for Barbados, assessing both goods and services. For goods, the World Trade Organization (WTO) draft list of the universe of environmental goods (WTO, 2011) is employed to identify areas where the island has comparative advantages and, for services, an assessment is undertaken of how well potential green business opportunities match the business environment in Barbados. The results of the study could be used as an input for the development of industrial, fiscal and trade policies. In relation to trade policy, this exercise could be used as a case study of the potential implications of accepting the WTO draft list of the universe of environmental goods. Where potential comparative advantages are identified, policymakers could spur growth in these areas through incentives² and with the support of an appropriate industrial policy framework.

² This could be done through education and training, access to credit for entrepreneurs, mentoring and access to trade shows. Many of these incentives are already available in Barbados, but are not specifically targeted at green goods.

The most similar studies found in the existing literature on the topic are those by Huberty and Zachman (2011) and Ernst and Young (2008). Unlike Huberty and Zachman (2011), however, the present study does not attempt to identify green goods, but uses the WTO draft list of environmental goods to identify potential comparative advantages. This analysis could be relevant to trade negotiators examining the potential impact of accepting this list on trade in Barbados (and, to some extent, the Caribbean as a whole). The paper also differs from both Huberty and Zachman (2011) and Ernst and Young (2008) because it considers potential opportunities in both merchandise trade and services.

The remainder of this paper is structured as follows. After the introduction, section II discusses the concept of green goods and services and attempts to show the relationship between the various definitions currently being employed. Section III outlines the methodological approach used in this study to assess potential green export opportunities and section IV presents the results. Section V summarizes the main findings and puts forward some recommendations for future policy changes.

II

Identification of green goods and services

The terms “green goods and services” and “environmental goods and services” are used interchangeably in the relevant literature. The Organisation for Economic Cooperation and Development (OECD/EUROSTAT, 1999) identifies the environmental goods and services industry as one that is largely made up of activities that produce goods and services to measure, prevent, limit, minimize or correct environmental damage to water, air and soil, as well as problems relating to waste, noise and ecosystems. The definition categorizes goods and services according to whether they involve pollution management, cleaner technologies and products or resource management. In each of those categories, activities are further classified into three subgroups: (i) production of equipment and specific materials; (ii) provision of services, and (iii) construction and installation of facilities (see figure 1).

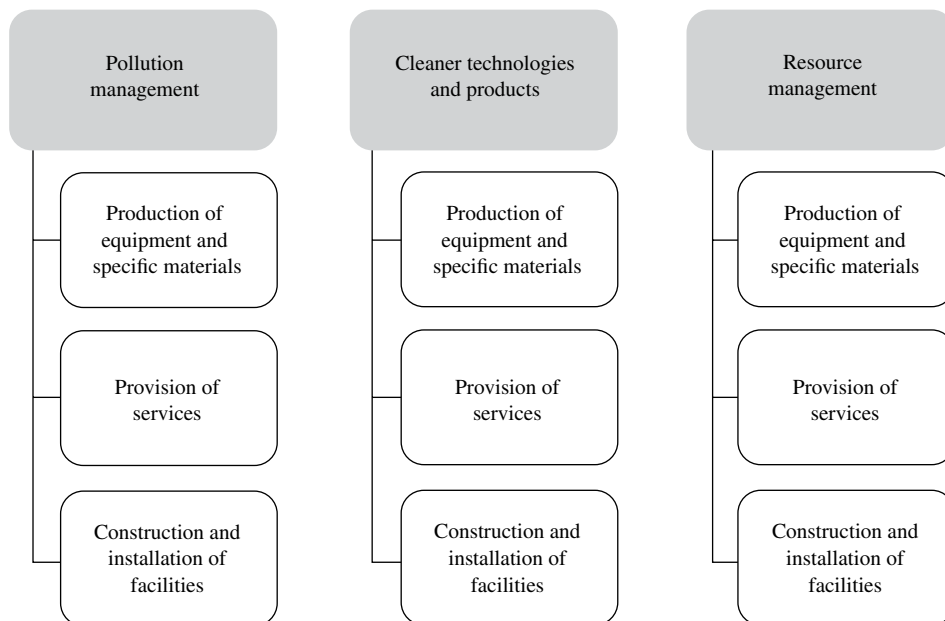
The definition of the environmental goods and services industry is, however, still somewhat contentious and, according to Sinclair-Desgagné (2008), it encroaches on other better-known industrial classifications. For example, rather than including solar cells, windmills

and ethanol in the energy sector and ecotourism as a subcategory of tourism, they would be classified under the environmental goods and services industry. The distinction between environmental and non-environmental goods and services is also somewhat ambiguous. For example, it is not clear if all resource-efficient technological and managerial enhancements should result in an environmental goods and services classification.

Building on this early work, the Bureau of Labor Statistics of the United States Department of Labor uses a similar definition to that developed by OECD/EUROSTAT (1999), identifying green businesses as those that are engaged in the production or provision of services that enhance the environment or conserve natural resources (Bureau of Labor Statistics, 2012). However, it seeks to address some of the criticisms levelled at OECD/EUROSTAT (1999) by providing clear guidance in relation to environmental services companies and natural resources conservation. Figure 2 presents the various green goods categories identified by the Bureau of Labor Statistics along with their subcategories.

FIGURE 1

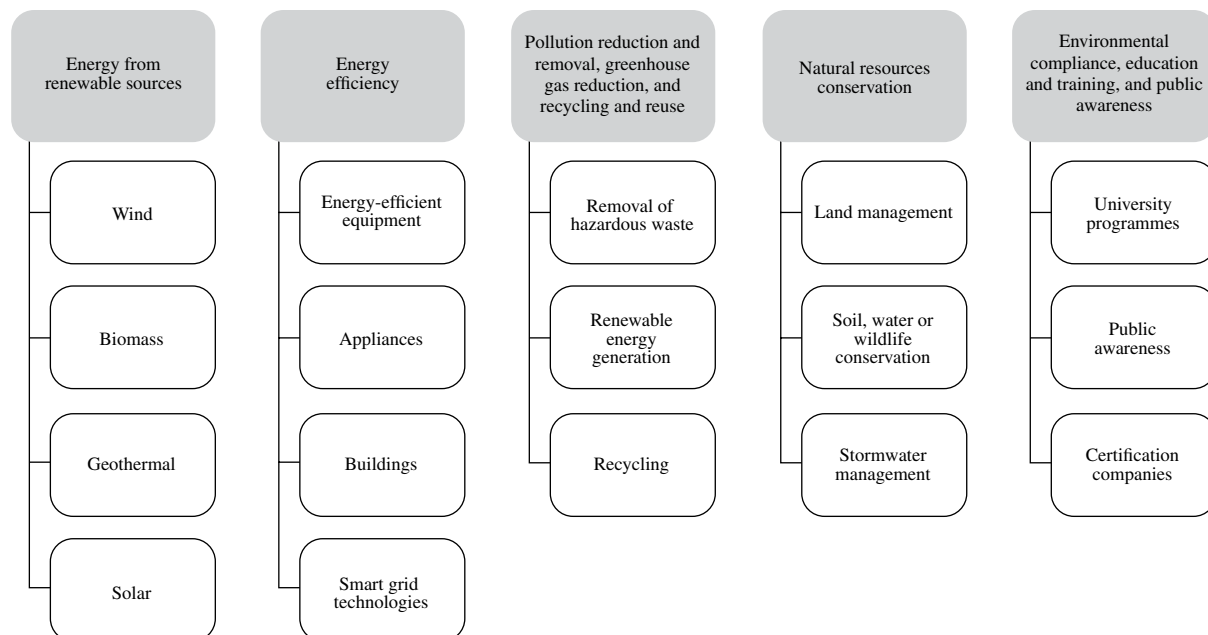
Organisation for Economic Cooperation and Development and Statistical Office of the European Communities: categories of environmental goods and services



Source: Organisation for Economic Cooperation and Development/Statistical Office of the European Communities (OECD/EUROSTAT), *The Environmental Goods and Services Industry: Manual for Data Collection and Analysis*, Paris, OECD Publishing, 1999.

FIGURE 2

Bureau of Labor Statistics: categories of green goods and services



Source: Bureau of Labor Statistics, "Green Goods and Services", Department of Labor of the United States, 2012 [online] <http://www.bls.gov/ggs/ggsoverview.htm>.

The Bureau of Labor Statistics distinguishes green goods and services from other similar goods or services by their use of either federal standards (for example, organic certification by the United States Department of Agriculture or the Energy Star programme run by the United States Environmental Protection Agency) or widely used industry standards (such as the Leadership in Energy and Environmental Design (LEED) programme). While the use of these industry and national standards addresses the criticism of the relatively arbitrary classification scheme used by OECD/EUROSTAT (1999), the approach still fails to resolve the underlying threshold question: at what point is a business or a good considered green?

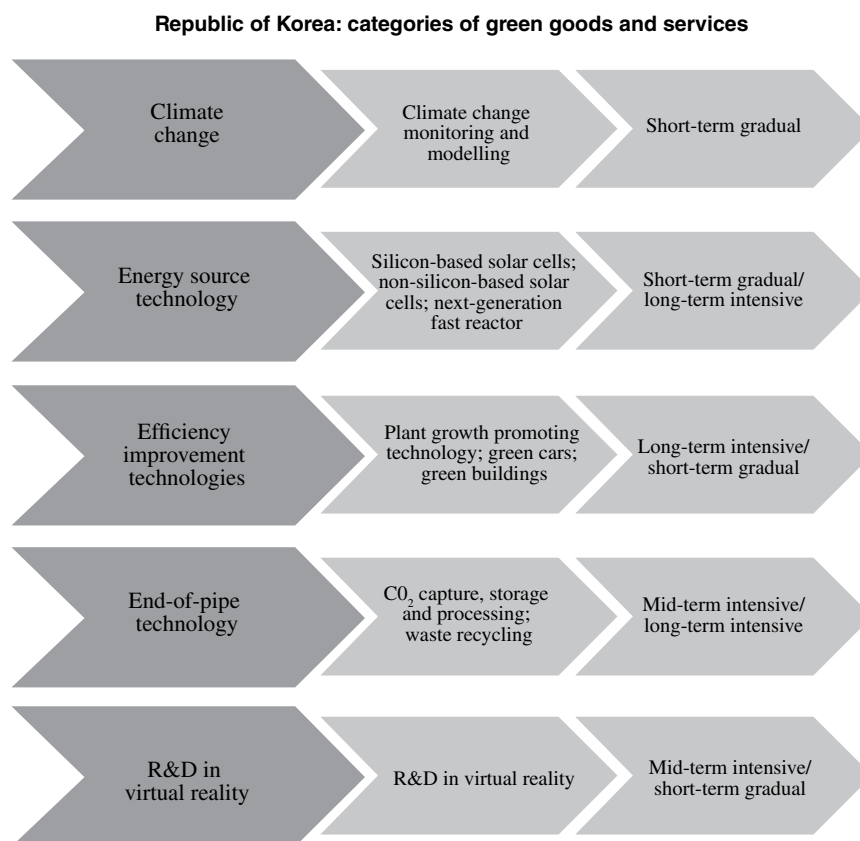
Rather than adopting a broad definition of green goods and services, the Republic of Korea has focused its Green New Deal³ on 27 core high-technology areas.

The plan aims to build a resource-efficient economy with an enhanced long-term potential output. Each investment is ranked according to its associated time frame: (i) short-term gradual; (ii) medium-term intensive; and (iii) long-term intensive (see figure 3). Figure 3 shows the main export categories, the type of goods and services targeted and the nature of the investment depending on whether it relates to a short-, medium- or long-term objective. While the selection of industries identified for support under the Korean Green New Deal seems somewhat limited, it sends a clear message to the private sector on the areas where there is likely to be current and future government support; and although these 27 core areas were not developed for the purposes of measurement, they leave no doubt as to the sectors that the government considers green.

³ The Green New Deal in the Republic of Korea is a stimulus plan introduced in 2009 in response to the recession, to stimulate growth

in the short run and reorient the economy in the medium to long term towards more resource-efficient areas.

FIGURE 3



Source: World Bank, “Lessons from the Implementation of Republic of Korea’s Green Stimulus”, INFRA Update, 2010 [online] http://siteresources.worldbank.org/INTSDNET/Resources/5944695-124775731647/INFRA_Korea_Newsletter.pdf.

R&D = research and development.

An alternative definition of the concept of green goods can be obtained from the international trade arena. The central objective of the Doha Development Agenda launched at the fourth World Trade Organization (WTO) Ministerial Conference is to enhance support for trade and environmental policies. At present, negotiations are taking place in three main areas:

- (i) The relationship between WTO rules and multilateral environmental agreements;
- (ii) The collaboration between WTO and secretariats of those multilateral environmental agreements;
- (iii) The elimination of tariffs and non-tariff barriers on environmental goods and services.

In relation to the third area, WTO members are currently holding negotiations on the identification of environmental goods, but have not yet addressed the definition of services. A number of proposals have been put forward in relation to goods: one calls for the use of broad criteria as the basis for their identification; another suggests introducing a request-and-offer process, with members proposing the items to be included and for which they are prepared to assume liberalization commitments. Under a third proposal two lists would be prepared, one for developed countries and another for developing countries, drawn from a single universe of goods; or

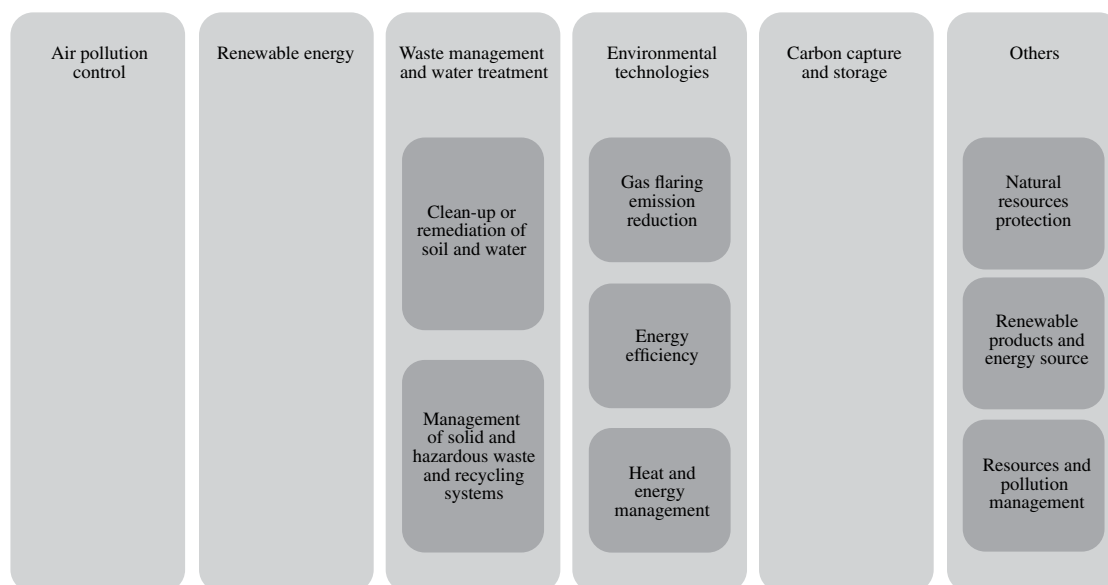
alternatively, a common list could be prepared for all members and a second list would comprise only those products specifically selected by developing countries for exemption or a lower level of tariff treatment. Figure 4 contains an aggregated version of the proposed reference universe of environmental goods and services.

The reference universe is based on the 2002 revision of the Harmonized Commodity Description and Coding System (HS2002) classification at the six-digit level and is available in WTO (2011). A sample core list of goods has been proposed as the starting point for discussion (see table 2).

Without international agreement, these green goods and services will continue to be subject to the same tariff and non-tariff barriers to trade as other less resource-efficient goods and services. Nevertheless, the Green Economy Scoping Study (Moore and others, 2012) for Barbados notes that, given the environmental constraints faced by the island and the demand for decent employment opportunities, a green growth strategy would have significant potential as a means of generating sustainable growth and development. The next section therefore identifies a potential approach to ranking the various green export opportunities that policymakers should consider for future policy support.

FIGURE 4

Proposed reference universe of environmental goods



Source: World Trade Organization (WTO) (2011), *Report by the Chairman, Ambassador Manuel A.J. Teehankee, to the Trade Negotiations Committee*, Geneva, Committee on Trade and Environment, 2011.

TABLE 2

Sample core list of environmental goods

HS2002 code	Description	Category and subcategory
4601	Plaits and similar products of plaiting materials, whether or not assembled into strips; plaiting materials, plaits and similar products of plaiting materials, bound together in parallel strands or woven, in sheet form, whether or not being finished articles	
460120	- Mats, matting and screens of vegetable materials	Waste management and water treatment: - Waste management, recycling and remediation
7308	Structures (excluding prefabricated buildings of heading 94.06) and parts of structures (for example, bridges and bridge sections, lock gates, towers, lattice masts, roofs, roofing frameworks, doors and windows and their frames and thresholds for doors, shutters, balustrades, pillars and columns), of iron or steel; plates, rods, angles, shapes, sections, tubes and the like, prepared for use in structures, of iron or steel	
730820	- Towers and lattice masts	Renewable energy Other: - Renewable products and energy source
7321	Stoves, ranges, grates, cookers (including those with subsidiary boilers for central heating), barbecues, braziers, gas-rings, plate warmers and similar non-electric domestic appliances, and parts thereof, of iron or steel	
732111	- Cooking appliances and plate warmers: for gas fuel or for both gas and other fuels	Environmental technologies: - Cleaner or more resource-efficient technologies and products
7324	Sanitary ware and parts thereof, of iron or steel	
732490	- Other, including parts	Waste management and water treatment: - Waste water management and potable water treatment Carbon capture and storage Environmental technologies: - Efficient consumption of energy technologies
8402	Steam or other vapour generating boilers (other than central heating hot water boilers capable also of producing low pressure steam); super-heated water boilers	
840290	- Parts	Carbon capture and storage Environmental technologies: - Efficient consumption of energy technologies Waste management and water treatment: - Management of solid and hazardous waste and recycling systems - Waste management, recycling and remediation
8404	Auxiliary plant for use with boilers of heading 84.02 or 84.03 (for example, economisers, super-heaters, soot removers, gas recoverers); condensers for steam or other vapour power units	
840410	- Auxiliary plant for use with boilers of 84.02 or 84.03	Waste management and water treatment: - Waste management, recycling and remediation - Management of solid and hazardous waste and recycling systems Carbon capture and storage Environmental technologies: - Efficient consumption of energy technologies
8405	Producer gas or water gas generators, with or without their purifiers; acetylene gas generators and similar water process gas generators, with or without their purifiers	

Table 2 (continued)

HS2002 code	Description	Category and subcategory
840510	- Producer gas or water gas generators, with or without their purifiers; acetylene gas generators and similar water process gas generators, with or without their purifiers	Air pollution control Renewable energy Waste management and water treatment: - Waste water management and potable water treatment Carbon capture and storage Environmental technologies: - Efficient consumption of energy technologies
8406	Steam turbines and other vapour turbines	
840681	- Turbines for marine propulsion: of an output exceeding 40 MW	Renewable energy
8409	Parts suitable for use solely or principally with the engines of heading 84.07 or 84.08	
840999	- Other: other	Air pollution control Environmental technologies: - Efficient consumption of energy technologies - Noise and vibration abatement Carbon capture and storage
8410	Hydraulic turbines, water wheels, and regulators therefor	
841011	- Hydraulic turbines and water wheels of a power not exceeding 1 000 kW	Renewable energy Environmental technologies: - Efficient consumption of energy technologies Carbon capture and storage
841012	- Hydraulic turbines and water wheels, power 1 000-10 000kW	Environmental technologies: - Efficient consumption of energy technologies Carbon capture and storage
841090	- Hydraulic turbines, water wheels, and regulators; parts, including regulators	Renewable energy Environmental technologies: - Efficient consumption of energy technologies Carbon capture and storage
8411	Turbo-jets, turbo-propellers and other gas turbines	
841181	- Other gas turbines of a power not exceeding 5 000 kW	Renewable energy Environmental technologies: - Efficient consumption of energy technologies Carbon capture and storage Others: - Environmentally preferable products based on end-use or disposal characteristics
841182	- Other gas turbines of a power exceeding 5 000 kW	Renewable energy Environmental technologies: - Efficient consumption of energy technologies Carbon capture and storage Others: - Environmentally preferable products based on end-use or disposal characteristics
8418	Refrigerators, freezers and other refrigerating or freezing equipment, electric or other; heat pumps other than air conditioning machines of heading 84.15	
841861	- Other refrigerating or freezing equipment; heat pumps: compression-type units whose condensers are heat exchangers	Renewable energy
8419	Machinery, plant or laboratory equipment, whether or not electrically heated (excluding furnaces, ovens and other equipment of heading 85.14), for the treatment of materials by a process involving a change of temperature such as heating, cooking, roasting	
841919	- Instantaneous or storage water heaters, non-electric: other	Renewable energy

Table 2 (continued)

HS2002 code	Description	Category and subcategory
841950	- Heat exchange units	Renewable energy Environmental technologies: - Gas flaring emission reduction - Efficient consumption of energy technologies - Heat and energy management Carbon capture and storage
8479	Machines and mechanical appliances having individual functions, not specified or included elsewhere in this chapter	
847989	- Other machines and mechanical appliances: other	Air pollution control Waste management and water treatment: - Management of solid and hazardous waste and recycling systems Renewable energy Others: - Renewable products and energy source
8502	Electric generating sets and rotary converters	
850231	- Other generating sets: wind-powered	Renewable energy Others: - Renewable products and energy source
8504	Electrical transformers, static converters (for example, rectifiers) and inductors	
850410	- Ballasts for discharge lamps or tubes	Environmental technologies: - Efficient consumption of energy technologies Carbon capture and storage
8537	Boards, panels, consoles, desks, cabinets and other bases, equipped with two or more apparatus of heading 85.35 or 85.36, for electric control or the distribution of electricity, including those incorporating instruments or apparatus of Chapter 90, and numerical control apparatus, other than switching apparatus of heading 85.17	
853710	- For a voltage not exceeding 1 000V	Renewable energy
8541	Diodes, transistors and similar semiconductor devices; photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes; mounted piezo-electric crystals	
854140	- Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes	Renewable energy Others: - Renewable products and energy source
9001	Optical fibres and optical fibre bundles; optical fibre cables other than those of heading 85.44; sheets and plates of polarising material; lenses (including contact lenses), prisms, mirrors and other optical elements, of any material, unmounted, other than such elements of glass not optically worked	
900190	- Other	Renewable energy
9002	Lenses, prisms, mirrors and other optical elements, of any material, mounted, being parts of or fittings for instruments or apparatus, other than such elements of glass not optically worked	
900290	- Other	Renewable energy
9027	Instruments and apparatus for physical or chemical analysis (for example, polarimeters, refractometers, spectrometers, gas or smoke analysis apparatus); instruments and apparatus for measuring or checking viscosity, porosity, expansion, surface tension or the like; instruments and apparatus for measuring or checking quantities of heat, sound or light (including exposure meters); microtomes	

Table 2 (concluded)

HS2002 code	Description	Category and subcategory
902730	- Spectrometers, spectrophotometers and spectrographs using optical radiations (UV, visible, IR)	Environmental technologies: - Environmental monitoring, analysis and assessment equipment
9032	Automatic regulating or controlling instruments and apparatus	
903210	- Thermostats	Environmental technologies: - Environmental monitoring, analysis and assessment equipment - Gas flaring emission reduction - Efficient consumption of energy technologies Carbon capture and storage

Source: World Trade Organization (WTO) (2011), *Report by the Chairman, Ambassador Manuel A.J. Teehankee, to the Trade Negotiations Committee*, Geneva, Committee on Trade and Environment, 2011.

HS: Harmonized Commodity Description and Coding System.

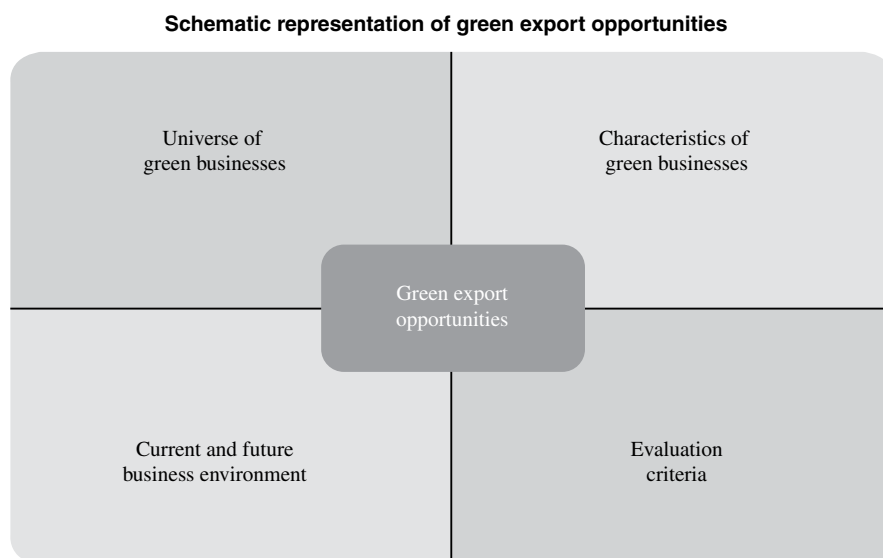
III

Methodological approach

As discussed in the previous section, the list of potential green goods and services is long and contentious. To avoid providing an arbitrary list of possible business areas or, even worse, an exhaustive list that is not necessarily relevant to the situation in Barbados, an analytical approach for evaluating business areas is employed. A schematic representation of that approach is presented in figure 5. The approach adopted

must take into account a universe of green business opportunities and, given the focus of this paper on export opportunities, the list proposed in WTO (2011) is a good starting point. However, as that list excludes services—an area in which Barbados is likely to have a comparative advantage—the study also uses the Bureau of Labor Statistics (2012) lists to generate a comprehensive database of green businesses.

FIGURE 5



Source: prepared by the author.

One means of identifying potential green business export opportunities is to calculate indices of revealed comparative advantage (Balassa, 1986 and 1989). These indices provide a simple measure of the extent to which a country or regional group is more specialized in a particular area of goods relative to another. The most popular comparative advantage index is the revealed export advantage (*REA*):

$$REA = \frac{X_{ij} / \sum_{j=1}^J X_{ij}}{\sum_{n=1}^N X_{nj} / \sum_{n=1}^N \sum_{j=1}^J X_{ij}} \quad (1)$$

where X_{ij} are the exports of good j by country i and X_{nj} are the exports of the same good by country group n . The country is assumed to have a revealed comparative advantage if $REA > 1$ and a revealed comparative disadvantage if $REA < 1$.

Vollrath (1991) proposes three alternative indices: (i) relative trade advantage (*RTA*); (ii) the logarithm of the relative export advantage ($\ln REA$), and (iii) revealed competitiveness (*RC*). These three indices are calculated as follows:

$$RTA = \frac{X_{ij} / \sum_{j=1}^J X_{ij}}{\sum_{n=1}^N X_{nj} / \sum_{n=1}^N \sum_{j=1}^J X_{ij}} \quad (2)$$

$$RC = \frac{M_{ij} / \sum_{j=1}^J M_{ij}}{\sum_{n=1}^N M_{nj} / \sum_{n=1}^N \sum_{j=1}^J M_{ij}}$$

$$\ln REA = \ln \left(\frac{X_{ij} / \sum_{j=1}^J X_{ij}}{\sum_{n=1}^N X_{nj} / \sum_{n=1}^N \sum_{j=1}^J X_{ij}} \right) \quad (3)$$

$$RC = \ln \left(\frac{X_{ij} / \sum_{j=1}^J X_{ij}}{\sum_{n=1}^N X_{nj} / \sum_{n=1}^N \sum_{j=1}^J X_{ij}} \right) - \ln \left(\frac{M_{ij} / \sum_{j=1}^J M_{ij}}{\sum_{n=1}^N M_{nj} / \sum_{n=1}^N \sum_{j=1}^J M_{ij}} \right) \quad (4)$$

For all three indices, positive values would indicate that the country has a revealed comparative advantage. It should be noted that all the indices outlined above can be distorted by government policies and other

interventions. This caveat should be considered when interpreting the results. All values for commodity exports and imports are obtained from the United Nations Commodity Trade Statistics Database (COMTRADE) using the six-digit HS2002 classification and trade data for 2005-2010.⁴

Owing to the limited data available on international services, a similar analysis could not be carried out for service exports. Instead, a SWOT (strengths, weaknesses,

4 The Harmonized System (HS2002) codes for the universe of green goods are: 250300, 271011, 271019, 271111, 271112, 271113, 271114, 271119, 271121, 271129, 281810, 281820, 28183, 290911, 290919, 290920, 290930, 290941, 290942, 290943, 290944, 290949, 290950, 290960, 291411, 291412, 291413, 291419, 291421, 291422, 291423, 291429, 291431, 291440, 291450, 291461, 291469, 291470, 382490, 390210, 390220, 390230, 390290, 390799, 390910, 390920, 390930, 390940, 390950, 391110, 391190, 391211, 391212, 391220, 391231, 391239, 391290, 392010, 401699, 450410, 460120, 470710, 470720, 470730, 470790, 530310, 530410, 530490, 560314, 560710, 560721, 560811, 560890, 630510, 691010, 701931, 730300, 730410, 730421, 730431, 730439, 730441, 730449, 730451, 730459, 730490, 730511, 730512, 730519, 730520, 730531, 730539, 730590, 730610, 730620, 730630, 730640, 730650, 730660, 730690, 730711, 730719, 730721, 730722, 730723, 730729, 730791, 730792, 730793, 730799, 730820, 730900, 731010, 731021, 731029, 731100, 732111, 732190, 732490, 732510, 732690, 761100, 761290, 761300, 840211, 840212, 840219, 840220, 840290, 840310, 840390, 840410, 840420, 840490, 840510, 840590, 840610, 840681, 840682, 840690, 840790, 840890, 840991, 840999, 841011, 841012, 841013, 841090, 841111, 841112, 841121, 841122, 841181, 841182, 841191, 841199, 841210, 841221, 841229, 841231, 841239, 841280, 841290, 841311, 841319, 841320, 841330, 841340, 841350, 841360, 841370, 841381, 841382, 841391, 841392, 841410, 841430, 841440, 841459, 841480, 841490, 841510, 841581, 841610, 841620, 841630, 841690, 841780, 841790, 841810, 841821, 841830, 841840, 841861, 841869, 841919, 841939, 841940, 841950, 841960, 841989, 841990, 842010, 842091, 842099, 842119, 842121, 842123, 842129, 842131, 842139, 842191, 842199, 842220, 842290, 842833, 842940, 846291, 846596, 846599, 846694, 847130, 847160, 847170, 847410, 847420, 847431, 847432, 847439, 847480, 847490, 847710, 847720, 847730, 847740, 847751, 847759, 847780, 847790, 847920, 847982, 847989, 847990, 848110, 848120, 848130, 848140, 848180, 848190, 848210, 848220, 848230, 848240, 848250, 848280, 848291, 848299, 848340, 848360, 850161, 850162, 850163, 850164, 850231, 850239, 850300, 850410, 850421, 850422, 850423, 850431, 850432, 850433, 850434, 850440, 850450, 850490, 850511, 850519, 850520, 850530, 850590, 850610, 850630, 850640, 850650, 850660, 850680, 850690, 850720, 850740, 850780, 850790, 850980, 851140, 851150, 851180, 851190, 851410, 851420, 851430, 851440, 851490, 851629, 851711, 851721, 851730, 851750, 851840, 852090, 852190, 852210, 852390, 852540, 852691, 852812, 852821, 852830, 853661, 853710, 853949, 854140, 854389, 854390, 870210, 870290, 870321, 870322, 870323, 870324, 870331, 870332, 870333, 870390, 870410, 870421, 870422, 870423, 870431, 870432, 870490, 870510, 870520, 870530, 870540, 870590, 871110, 871120, 871130, 871140, 871150, 890790, 900190, 900290, 901510, 901520, 901530, 901540, 901580, 901590, 902410, 902480, 902490, 902511, 902519, 902580, 902590, 902610, 902620, 902680, 902690, 902710, 902720, 902730, 902740, 902750, 902780, 902790, 902810, 902820, 902830, 902890, 903010, 903020, 903031, 903039, 903040, 903082, 903083, 903089, 903090, 903110, 903120, 903130, 903140, 903149, 903180, 903190, 903210, 903220, 903281, 903289, 903290, 903300, 940510, 940520, 940540 and 950720.

opportunities, threats) analysis was undertaken to determine how well the green business characteristics match the current and projected future business environment. Thus, elements of the business environment, such as whether there is an adequately trained labour force and the situation regarding licences and permits, infrastructure and finance, reflect the constraints on new businesses that are likely to influence their viability. This aspect of the model is complicated somewhat by the fact that a particular characteristic might be a constraint in the current business environment, but if it were eliminated by future policy changes, it could ultimately incentivize businesses in this area.

Following the approach outlined by Porter (2000), simple evaluation criteria were developed to examine how well each potential green export area matches the local business environment. For each goods or services category a score of 1-11 was obtained by answering the following questions:

- Is some proprietary technology needed? (Yes=0, No=1)

- Does Barbados have access to distribution channels? (Yes=1, No=0)
- Does Barbados have access to raw materials and other inputs (e.g. labour)? (Yes=1, No=0)
- Are there cost advantages independent of scale? (Yes=1, No=0)
- Are there modest capital requirements for start-ups? (Yes=1, No=0)
- Do product or technological standards already exist? (Yes=1, No=0)
- Are there regulatory barriers that potential start-ups would encounter? (Yes=0, No=1)
- Are there likely to be diseconomies of scale in production? (Yes=1, No=0)
- Does government support exist? (Yes=1, No=0)
- Are there a small number of potential substitutes or competitors? (Yes=1, No=0)
- Are there low exit barriers? (Yes=1, No=0)

The final score for each product group was the sum of the scores for each of these individual questions.

IV

Ranking potential green export opportunities

In order to assess the consistency of the revealed comparative advantage indices, pairwise correlation statistics between the four indicators were calculated. In general, the indicators are all positively correlated: if one comparative advantage index suggests that the country has an advantage for a particular good, the other indicators are also likely to provide a similar result. In addition to the positive relationship, all of the bivariate

correlation statistics were greater than 0.7, indicating a high level of consistency in the results.

Given the consistency of the results, only the revealed competitiveness (RC) indices are provided in table 3, averaged over the 2005-2010 period. The results suggest that Barbados holds a revealed competitiveness advantage in relation to 24 goods across various green goods categories (see table 3).

TABLE 3

Indices of revealed comparative advantage for green goods

HS2002 code	Good	Category and subcategory of green goods	Revealed competitiveness index (RC)
847780	- Other machinery	Environmental technologies: - Efficient consumption of energy technologies Carbon capture and storage	5.545
470790	- Other, including unsorted waste and scrap	Renewable energy Others: - Renewable products and energy source	4.802
731029	- Of a capacity of less than 50 litres: other	Waste management and water treatment: - Waste water management and potable water treatment	3.429
841960	- Machinery for liquefying air or other gases	Air pollution control	3.071

Table 3 (concluded)

HS2002 code	Good	Category and subcategory of green goods	Revealed competitiveness index (RC)
847730	- Blow moulding machines	Environmental technologies: - Efficient consumption of energy technologies Carbon capture and storage	2.857
271129	- Other in gaseous state	Environmental technologies: - Gas flaring emission reduction - Efficient consumption of energy technologies Carbon capture and storage	2.515
841919	- Instantaneous or storage water heaters, non-electric: Other	Renewable energy	2.458
850660	- Primary cells & primary batteries, air-zinc	Renewable energy Others: - Renewable products and energy source	1.974
840290	- Parts	Environmental technologies: - Efficient consumption of energy technologies Carbon capture and storage	1.924
841940	- Distilling or rectifying plant	Waste management and water treatment: - Management of solid and hazardous waste and recycling systems	1.762
850162	- AC generators (alternator), of an output exceeding 75 kVA but not exceeding 375 kVA	Renewable energy	1.729
291421	- Cyclanic, cyclic or cycloterpenic ketones without other oxygen function: camphor	Environmental technologies: - Gas flaring emission reduction - Efficient consumption of energy technologies Carbon capture and storage	1.702
841340	- Concrete pumps	Environmental technologies: - Efficient consumption of energy technologies Carbon capture and storage	1.666
730459	- Other, of circular cross-section, of other alloy steel: Other	Waste management and water treatment: - Waste water management and potable water treatment	1.516
841382	- Liquid elevators	Environmental technologies: - Efficient consumption of energy technologies Carbon capture and storage	1.483
846291	- Other: Hydraulic presses	Waste management and water treatment: - Management of solid and hazardous waste and recycling systems	1.345
392010	- Of polymers of ethylene	Waste management and water treatment: - Management of solid and hazardous waste and recycling systems	0.681
530310	- Jute and other textile bast fibres, raw or retted	Others: - Environmentally preferable products based on end-use or disposal characteristics	0.473
732690	- Other	Waste management and water treatment: - Waste water management and potable water treatment	0.442
850239	- Other generating sets: other	Renewable energy	0.331
847432	- Mixing or kneading machines: machines for mixing mineral substances with bitumen	Environmental technologies: - Efficient consumption of energy technologies Carbon capture and storage	0.240
731100	- Containers for compressed or liquefied gas, of iron or steel	Environmental technologies: - Efficient consumption of energy technologies Carbon capture and storage	0.120
841319	- Other pumps fitted or designed to be fitted with a measuring device	Environmental technologies: - Efficient consumption of energy technologies Carbon capture and storage	0.058
560811	- Of man-made textile materials: made-up fishing nets	Others: - Natural resources protection	0.016

Source: prepared by the author.

HS: Harmonized Commodity Description and Coding System.

On the basis of this analysis, Barbados has a comparative advantage in just 6% of the green goods included in the WTO draft universe of environmental goods. Given the island's size, it is unlikely to be a major producer of a diverse set of goods. Nevertheless, the limited extent to which the island is exploiting opportunities in relation to the export of green goods suggests that there remains significant room for growth. This finding is further substantiated by the recent trends in the export of green goods. To assess the extent to which the island has been exploiting these advantages, figure 6 plots the value of green goods exports for Barbados in the period 2007-2009. The figures show that green goods exports still represent just a small share of overall merchandise exports from the island: between 3% and 4%. In addition, the contribution of green goods exports to total merchandise exports has not changed appreciably. To fully leverage the global demand for green goods, export promotion in these areas will be key over the coming years.

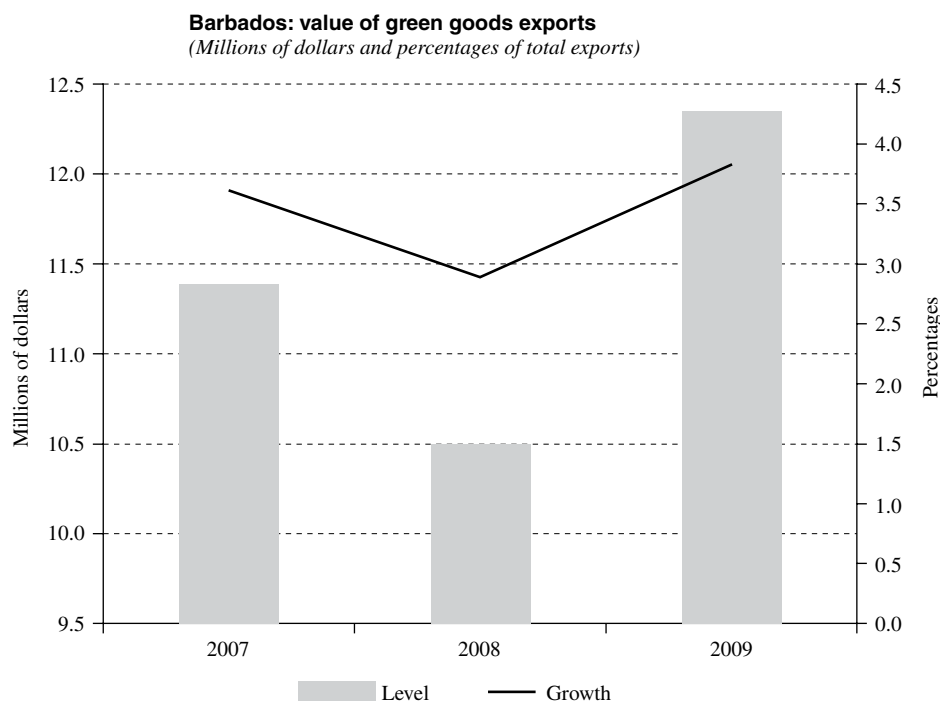
The list in table 3 was limited to green goods, however, since services account for the majority of goods and services exports from Barbados, the island is likely to have comparative advantages in that area as well. Using the questions in section III, each of the

categories in the database was assessed and the final results are provided in figure 7.

The results point to potential opportunities in the following areas (figure 7):

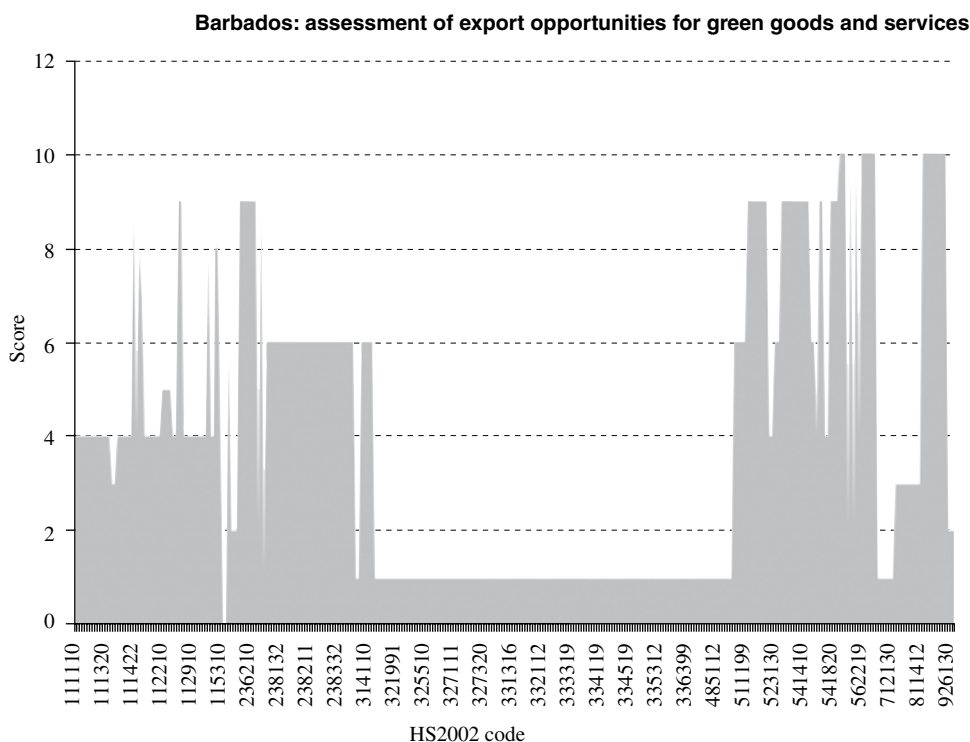
- Environmental education (curriculum for green jobs)
- Environmental conservation organizations
- Air, water and waste programme administration
- Waste management services
- Remediation services (waste management)
- Tour operators (green tours)
- Landscaping services (energy efficient landscaping services)
- Advertising and public relations agencies
- Architectural services (LEED-specific architecture services)
- Engineering services (engineering services for renewable energy projects)
- Testing laboratories (environmental testing services)
- Graphic design services (graphic design services for environmental awareness products)
- Contractors (LEED-certified buildings)
- Residential remodelers (weatherization)
- Commercial building construction (LEED-certified buildings)

FIGURE 6



Source: United Nations Commodity Trade Statistics Database (COMTRADE).

FIGURE 7



Source: prepared by the author.

HS: Harmonized Commodity Description and Coding System.

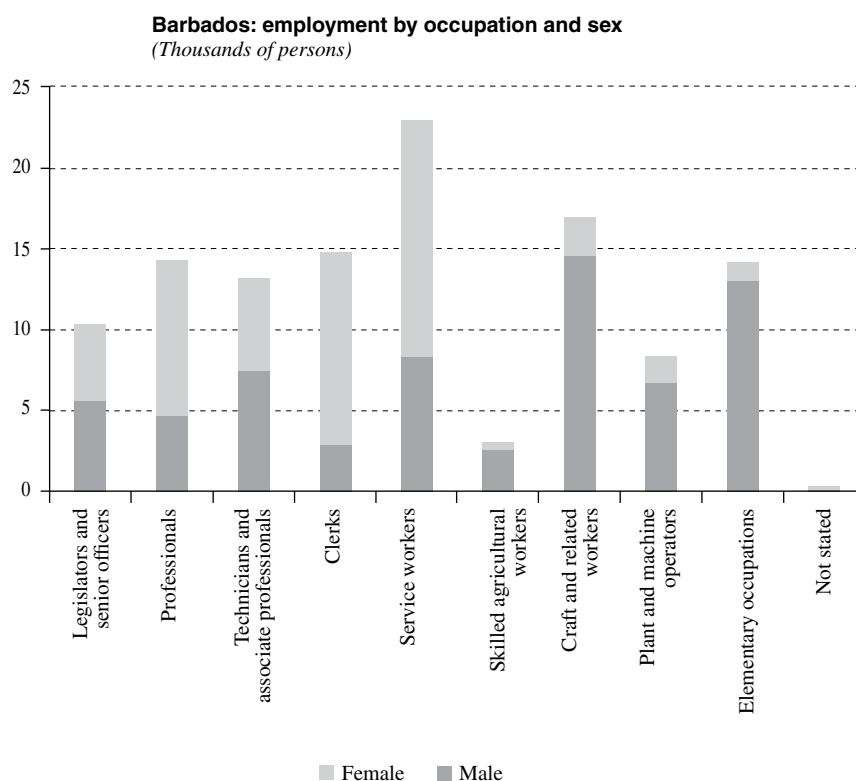
Barbados already has a large workforce of trained individuals in the service industry, however, their skills must be enhanced to take advantage of available opportunities. Figure 8 shows the breakdown of employment by occupation and sex at the end of 2011: of an employed population of 127,800, about 59% can be classified as service workers, with a large number of those individuals engaged in higher level service professions (for example, technicians and associated occupations).

At present, the Samuel Jackman Prescod Polytechnic provides diploma-level training in mechanical engineering, electrical engineering, construction and architectural studies, among other subjects, while undergraduate and graduate qualifications are available

from the University of the West Indies at the campuses in Mona, Jamaica, and Saint Augustine, Trinidad and Tobago. Qualified Barbadian students are eligible to enter the University of the West Indies to pursue studies with full government sponsorship.

Barbados will, however, need to address some training gaps if it is to fully leverage the potential benefits of exporting green services. For example, there is currently no local or regional council to allow skilled service professionals to pursue LEED certifications for their projects; and despite the incentives in place enabling companies and individuals to write off part of the cost of ISO certification, the upfront costs for many small companies can still be prohibitive.

FIGURE 8



Source: Barbados Statistical Service.

V

Conclusions and recommendations

Barbados has adopted ambitious targets in relation to pursuing a green economy. These targets are largely based on the recognition that the island faces significant resource constraints and a vulnerability to price shocks from imported resources (Moore and others, 2012). This paper assesses the potential green export opportunities for the island, analysing both green goods and green services. Using disaggregated trade data at the six-digit level (HS2002 system of classification), the study calculates indices of revealed comparative advantage in order to identify areas that the island should consider targeting for support. Given the importance of services to the Barbadian economy, opportunities in green services are also examined.

The results of the study suggest that Barbados has a revealed comparative advantage in about 16 green export areas. The total value of these exports, however, is still quite small (less than 4% of total exports) and has grown at the same rate as total exports in recent years. In relation to services, the number of potential business areas that could leverage the skills and resources of the island was larger. Some institutional support would be needed, however, to help professionals achieve international certification. It should also be noted that developing economies may be able to introduce new goods or services exports, but sustaining that trade is more difficult, with many firms struggling to maintain their market share. These firms need to focus on research

and development in order to keep their market share and enhance efficiency.

While green goods and services might help to diversify the island's export base, many of these goods and services can build on existing industries. For example, green tours can use existing tourism infrastructure and help the island to enhance the earnings from that industry, while providing a more fulfilling experience for visitors. Barbados has a long history in the manufacture of solar technologies (Moore and others, 2012) and, with

sufficient investment, these companies could penetrate a larger number of markets around the world. These are but a few examples, yet they illustrate the potential advantages that can be gleaned from building on the country's knowledge and experience. There would also be potential advantages to pursuing a regional capacity-building strategy on the export of green goods and services. For example, rather than setting up individual certification institutes on each island, a regional initiative could be pursued in this respect.

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