Journal of Sustainable Tourism

ISSN: 0966-9582 (Print) 1747-7646 (Online) Journal homepage: http://www.tandfonline.com/loi/rsus20

Developing environmental performance measures for tourism using a Tourism Satellite Accounts approach: a pilot study of the accommodation industry in Egypt

Ahmad Muhammad Ragab & Scott Meis

To cite this article: Ahmad Muhammad Ragab & Scott Meis (2016): Developing environmental performance measures for tourism using a Tourism Satellite Accounts approach: a pilot study of the accommodation industry in Egypt, Journal of Sustainable Tourism, DOI: 10.1080/09669582.2015.1107078

To link to this article: http://dx.doi.org/10.1080/09669582.2015.1107078

Published online: 12 Jan 2016.

JOURNAL OF SUSTAINABLE TOURISM, 2016
http://dx.doi.org/10.1080/09669582.2015.1107078

Routledge
Taylor & Francis Group

Developing environmental performance measures for tourism using a Tourism Satellite Accounts approach: a pilot study of the accommodation industry in Egypt

Ahmad Muhammad Ragab[a] and Scott Meis[b]

[a]Tourism Studies Department, Faculty of Tourism and Hotels, Minia University, El Minia, Egypt; [b]Tourism HR Canada, Ottawa, Canada

ABSTRACT

Considering the recognized pressures of tourism on the natural environment, it is important to quantify and understand those pressures. This paper adopts an approach based on the Tourism Satellite Accounts conceptual framework to measure selected environmental pressures of tourism. Egypt is selected for the case study and the accommodation industry group is used as a pilot test (reference year 2009) for the feasibility of the proposed methodology. Results show that each US$ 1 million of direct value added supported by tourists expenditure in the accommodation industry group requires 18.6 thousand m^3 of water, 51.1 tons of fuel, and 426 megawatt hours (Mwh) of electricity. Similarly, each US$ 1 million of the direct value added generated by tourists expenditure for accommodation creates directly about 464.3 tons of CO_2 emissions. It is estimated that serving inbound tourism is a higher user of energy resources than serving domestic tourism, which is higher in terms of water use. These environmental performance measures enable the Egyptian Government to examine the potential environmental pressures and financial costs of attracting new tourists.

ARTICLE HISTORY
Received 19 July 2014
Accepted 27 September 2015

KEYWORDS
Natural resources; accommodation; greenhouse gas; tourism satellite accounts; water; Egypt

Introduction

International tourism grew by 5.2% annually in the last decade recording 1.087 billion tourists in 2013, and generating: over US$ 1 trillion in exports for destinations, close to 6% of the world's exports of goods and services, 30% of exports if we consider services alone, and 9% of the global gross domestic product (GDP) (World Tourism Organization [UNWTO], 2014). Additionally, 1 in every 12 jobs worldwide is connected to the tourism sector directly or indirectly (UNWTO, 2014). By 2030, international tourist arrivals are projected to reach 1.8 billion (UNWTO, 2014). Despite the salient benefits and substantial importance of tourism to the economies of destinations all over the world, visitors' activities together with related tourism production activities may also have various negative impacts (Archer, Cooper, & Ruhanen, 2005; Dodds & Butler, 2009). Arguably, one of the most serious negative impacts of tourism is the one it exerts on the environment, as tourism productive activities are intensively energy and water consuming (United Nations Conference on Trade and Development [UNCTAD], 2013). It is estimated that tourism contributes to greenhouse gases (GHG) emissions in terms of approximately 5% of carbon dioxide (CO_2) emissions, primarily from tourist transport (75%) and accommodation (21%) (UNWTO & UNEP, 2012). As for the global level of water use attributed to

CONTACT Ahmad Muhammad Ragab ahmad.ragab@mu.edu.eg

tourism, it is relatively small (1%); however, the challenge is rather to be found at the individual destination level in terms of local competition for water (Gössling, 2002; UNWTO, 2013).

Although the environmental effects have been one of the least studied aspects of tourism in general (Mihalič, 2000; Sun & Walsh, 1998) and within the statistical and economic frameworks of tourism in particular (Briassoulis, 2000), "the increasing attention being paid globally to sustainable tourism and climate change has led to growing research and debate on the environmental issues of tourism, particularly over the last decade" (Song et al., 2012, p. 1670). That attention has been stimulated by the emergence and application of Tourism Satellite Accounts (TSA) in many countries since the beginning of the twenty-first century (Becken & Patterson, 2006; Frangialli, 2005; Hsieh & Kung, 2013). The TSA also opens the way to quantifying the environmental impacts of tourism from the demand and the supply sides at both national and regional levels of analysis. This current paper aims at using the TSA conceptual framework, which is designed on the basis of the System of National Accounts (SNA) in order to have a common international method for measuring mainly the economic importance of tourism in economies, and to measure selected environmental pressures of tourism.

Frangialli (2005, p. 16) argued that "the exploration of the development of links between environmental accounting and the TSA can reveal the potential for a new paradigm for tourism development that integrates the objectives of optimal economic development with environmental sustainability within a given territory". The TSA is an integrated framework with the SNA that provides the "tool" by which data from demand-side surveys in the national statistical system (e.g. international visitors surveys, household surveys on travel) are brought together and reconciled with data from various supply-side business surveys and administrative records (e.g. transportation, hotels, and restaurants) in the national statistical system (Meis, 2002). Frechtling (2013) argued that "the single most important analysis tool developed in the last several decades to measure tourism demand and its direct effects on a national economy is the TSA". Furthermore, one of the wide-ranging benefits of the TSA analysis is the use of ad hoc extensions which provide further understandings of the various other aspects of tourism in destinations (Eraqi et al., 2011). The TSA's extensions are formulated in order to analyze tourism performance beyond its regional or national economic importance. Examples of these extensions are: human resources module of the TSA (Martin, 2013; Meis, 2014; Organization for Economic Co-operation and Development [OECD], 2000); Government Revenue Attributable to Tourism in Canada (Morissette, 2013); linking TSA with Computable General Equilibrium (CGE) models (measuring indirect and induced impacts of tourism) (Dwyer et al., 2007; Rossouw & Saayman, 2011); forecasting models (Blake, Durbarry, Sinclair, & Sugiyarto, 2000); linking government strategies and the TSA (Statistics South Africa, 2007); and environmental impacts of tourism (Jackson et al., 2008). For the last instance, the UNWTO (2010a) reported that an increasing number of proposals have been developed to present statistics which analyze, monitor, or asses the environmental implications of tourism development in destinations. The UNWTO accentuates that estimating the links between tourism and the environment at the level of the national economy is recommended to be of a high priority.

A number of research papers have used the TSA approach as a conceptual measurement framework to quantify the environmental effects of tourism such as energy use and greenhouse gases attributed to tourism as a productive activity (Anzalone, 2014; Calderón et al., 2009; Costantino & Tudini, 2005; Dwyer et al., 2010; Forsyth et al., 2008; Hoque et al., 2010; Jackson et al., 2008; Jones, 2013; Jones & Munday, 2007; Lagerström & Rosenblom, 2010; Patterson & McDonald, 2004; Zhang & Brandt, 2010). One of the first and comprehensive attempts was initiated in New Zealand where Patterson and McDonald (2004) studied not only linking TSA with environmental accounts to measure the direct environmental effects of tourism but also moving beyond that to measure indirect and future environmental effects by using lifecycle assessment and scenario analysis, respectively. In that study, the TSA was extended to cover the use of natural resources (land, energy, and water) and the production of pollutants (water discharges, nitrate, biological oxygen demand, phosphorus, and carbon dioxide [CO_2] by the tourism sector. The results of Patterson and McDonald's study showed that the tourism sector in the base year 1997/1998 directly and indirectly accounted for energy use and CO_2 emissions equivalent to about 22%–25% of New Zealand's totals, respectively, for each indicator (including International air travel) and around 5% in terms of overall water use. These results have challenged the idea that New Zealand's tourism sector is sustainable, clean, and green.

In Canada, the environmental impacts of tourism industries resulting from both tourism consumption and non-tourism consumption have been examined by Jackson et al. (2008) who explored the possibility of linking the TSA and Environment Satellite Accounts (ESAs) as a means of estimating the tourism share of energy use and GHG emissions for two industries, air transportation, and food and beverage services. That has been done by applying tourism GDP ratios to the total energy use and GHG emissions for these two industries to obtain the portion attributable to tourism. The later method is considered the cutting-edge approach in most TSA's extension studies. The results of Jackson et al.'s study for the base year 2002 pointed out that tourism consumption of air transportation services amounted to approximately 1.5% of Canada's totals for each of energy use and CO_2 emissions, while food and beverages services accounted for 0.7% and 0.03%, respectively (Statistics Canada, 2002). In 2009, Calderón et al. proposed using an extended Social Accounting Matrix (ESAM) approach by including environmental indicators and considering tourism as a single specific industry in order to integrate the economic and environmental accounts for tourism in the UK. That proposed structure of the ESAM was based on four key sources of data: the UK TSA (production accounts of tourism industries and tourism consumption); Supply and Use tables; Family Expenditure Survey and Revenue & Customs data (household income and expenditure information); and the Environmental Accounts (water and energy use and waste, wastewater and CO_2 emissions). In Sweden, Lagerström and Rosenblom (2010) linked the TSA and the Environment Satellite Account with Input–Output Analysis to measure the share of the aggregated final demand of inbound tourism on energy use, CO_2 emissions, and CO_2 taxes. The aggregated results of that study reported that the production of goods and services purchased by foreign tourists in Sweden accounted for almost 3% of final demand for energy use, more than 3% of total CO_2 emissions, and near 5% of total CO_2 taxes paid in 2006.

Another approach to using the TSA data for environmental modeling in the area of tourism is to focus on and estimate a single particular environmental performance measure such as GHG emissions attributed to tourism. For example, Jones and Munday (2007) examined the environmental effects of tourism consumption on GHG emissions in Wales, demonstrating how data from the TSA for Wales (visitors consumption and gross value added of tourism industries) can be combined with data from ESAs (GHG and waste emissions of 43 industries) and input–output tables for Wales 2000 to explore selected environmental effects of different types of tourism consumption (Day visitors, UK tourists, and overseas tourists). It was revealed through that study that visitors to Wales contributed directly and indirectly 1.46 million tons of CO_2 emissions (912.5 tons CO_2 per £1m VA) by their regional consumption of goods and services inside Wales. Latterly, Jones (2013) updated that study and advanced further using scenario analysis to suggest policy approaches (using electric, biofuel, and hybrid technologies) aimed at reducing those emissions. Forsyth et al. (2008) studied the Carbon footprint of tourism in Australia using two approaches: production-based approach and expenditure-based approach. Those approaches showed that tourism contributes directly and indirectly between 3.9% and 5.3% of total industry GHG in Australia (Dwyer et al., 2010). That later study implicitly linked TSA data and environmental data sourced from the Department of Climate Change estimates of industry and household GHG emissions with the Monash Multi-Regional Forecasting database. The same methodology has been used by Hoque et al. (2010) to measure the carbon footprint of tourism in Queensland, Australia, as regional estimations.

Similarly, Zhang and Brandt (2010) measured the environmental impacts of tourism at regions and municipalities in Denmark. Their study focused on linking the regional TSA and the regional environmental accounts within the Danish regional economic input–output modeling framework to calculate the GHG emissions related to tourism intermediate consumption (backward linkage) as well as tourism private consumption (direct linkage). In those estimations, it is assumed that the same GHG coefficient applies to the tourism sector for all regions in Denmark stating that the total tourism impact (direct plus indirect) on the emissions accounted for 5% of the national total. Furthermore, at the regional levels, tourism consumption generated higher shares of CO_2 emissions and per capita levels on the islands and peripheral municipalities than in the urban regions, due to lower levels of emissions from non-tourism activities and less energy efficient forms of accommodation in the former regions.

In this context and from a broader perspective, other additional research has applied the TSA framework to evaluate the ecologically sustainable development of tourism using "hybrid flow accounts".[1] Costantino and Tudini (2005) used that approach proposing an accounting framework for ecologically sustainable tourism and conducted a preliminary feasibility assessment in the Italian context. For building the hybrid flow accounts for sustainable tourism, Costantino and Tudini explored firstly the link between TSA and the NAMEA (National Account Matrix including Environmental Accounts) industry classification; then they calculated the environmental pressures using the European System of Environmental Pressure Indices (ESEPI) framework; the last step was to demonstrate tourism shares from these total pressures by incorporating the data of the TSA-table 6 (total domestic supply and internal tourism consumption) (UNWTO, 2010b). In 2012, the London Group on Environmental Accounting[2] has discussed the previously mentioned study's methodology and supported it as an extension of the Integrated Environmental and Economic Accounting (SEEA) that connects SEEA data and the economic tourism data compiled within the TSA (Costantino, Anzalone & Tudini, 2013).

More recently, Anzalone (2014) depended on the general conceptual aspects drawn in the study of Costantino and Tudini (2005) to build hybrid environmental flow accounts for tourism inside the Driving Force–Pressure–State–Impact–Response (DPSIR) model which allows analyzing the environmental pressures emerged from tourism activities. These hybrid accounts include two modules: an economic module derived from the TSA (production, intermediate consumption, value added, and employment) and an environmental module derived from the environmental accounts (pollution – air emissions, water pollution, waste and intake of natural resources – fossil fuels, minerals, biomasses, water, etc.). That model suggested by Anzalone has been implemented empirically for air emissions related to tourism in Italy and the results showed that tourism contributed 5% of total CO_2 emissions in the Italian economy.

While measuring GHG emissions related to tourism have received considerable attention in recent research, no studies, that we are aware of, have been conducted to date on the basis of using the TSA approach for measuring water use ascribed to tourism. However, some studies based on field surveys have estimated the average water use by visitors using a demand side approach. For example, Gössling (2001) reported that every guest consumes directly between 100 and 2000 liters per day (685, the weighted average) at hotels and guesthouses in Unguja and Pemba Islands, Zanzibar; this average corresponds to around 15 times the daily per capita demand from the local population. Later, in 2012, Gössling et al. suggested that a tourist directly uses amounts of water ranging from 80 to 2000 liters per day. In Mallorca, the water use in hotels range from 156 to 2425 liters, with a mean value of 541 liters/guest/night (Tortella & Tirado, 2011). Statistical Office of the European Union (EUROSTAT, 2009) conducted a pilot study on "Water and Tourism" reporting that, in Tunisia, the average use per bed-night was estimated at 466 liters/bed-night in 2002; while in Morocco the same measurement ranged from 180 to 600 liters/bed-night. Also, according to surveys conducted in Cyprus and in Malta, the average daily amount of water consumed by a visitor is estimated about 465 and 300 liters, respectively, almost twice the local resident's average use in both countries (Charalambous, 2009; Mangion, 2013).

Beyond direct water use, Gössling et al. (2012) estimated that the direct water use by tourists as well as indirect use range between 2000 and 7500 liters/tourist/day. Similarly, using a water footprint (WF) methodology, Hadjikakou, Chenoweth, and Miller (2013) estimated the direct and indirect local water use associated with different holiday packages in five regions in the eastern Mediterranean; Paphos, Polis (Cyprus), Bodrum (Turkey) Mykonos (Greece), and Damascus (Syria). That estimation revealed that the range of daily WFs for tourism is between 5790 and 8940 liters/tourist. The most recent development in the context of measuring tourism use of water is the adoption of System of Environmental-Economic Accounts for Water (SEEA-Water) designed by The Department of Economic and Social Affairs of the United Nations Secretariat (DESA, 2012). The SEEA-Water is a subsystem of the SEEA that covers the physical and economic stocks and flows associated with water. Hence, formulating hybrid flow accounts for describing the relationship between tourism and water use becomes accessible once the TSA and the SEEA-Water are both available.

As mentioned previously, the central question to be answered in this current paper is: how can a country estimate environmental effects of tourism based on the TSA when it does not have environmental accounts? In what follows, we estimate the energy (fuel, electricity) use, CO_2 emissions, and water use of the "accommodation for visitors" industry in Egypt using the TSA as a conceptual framework for the economic measurement of the tourism sector and applying it to other non-integrated data sources.

Context of the study, Egypt

In recent years, the importance of tourism in Egypt has increased as one of the fundamental pillars of national economy, because of the relatively large value of its revenues, which are considered as a key source of foreign exchange; a crucial contributor to the balance of payments and to macroeconomic stability; as well as a creator of new jobs directly and indirectly. Inbound tourism to Egypt increased from almost a million tourists in 1982 to 5.5 million in 2000, then jumped to about 14.7 million in 2010, with an average annual growth rate during the last five years of 14.2%. The number of tourist arrivals to Egypt in 2010 was ranked as 18th among the worldwide destinations, and first in the Middle East and Africa. Since 2007, Russia has been the largest generating market for inbound tourists to Egypt. Before 2007, the largest generating market area was Western Europe; particularly Italy, Germany, and the UK. In terms of tourism supply, hotel capacity increased from 18,900 rooms in 1982 to about 113,600 in 2000, reaching over 153,000 rooms in 2010, with an additional 208,000 rooms under construction (Ministry of Tourism-Egypt [MOT-Egypt], 2011; CAPMAS, 2012). However, the political turmoil experienced in Egypt since 2011 has caused a sharp decline in tourism flows to about 9.8 million tourists in 2011, a decline of 33% compared to 2010 (MOT-Egypt, 2011; CAPMAS, 2012).

TSA in Egypt

Previously, before the development of a TSA for Egypt, official tourism figures for Egypt concealed many socioeconomic aspects of tourism development and hence failed to signal the real full economic contribution of tourism activities to the national economy (Sakr, 2005). That was due to the reliance on multiple data sources with inconsistent definitions, classifications, and coverage as argued by Ragab (2006). Consequently, there was a need to examine both tourism supply and tourism demand within the general framework of a national accounting system in Egypt in accordance with evolving international measurement standards (Ragab, 2009). From this sprang the compilation of a TSA in Egypt initiated in 2008 to overcome those pre-existed data limitations (Ragab, 2011). With the accomplishment of Egypt TSA project in 2010, Egypt now compiles the core TSA-tables 1−7 and 10, hence it can be said that it has a full-fledged TSA. Egypt publishes the TSA results on a regular annual basis starting with the base year 2009 (Ragab, 2013) (Table 1).

Energy and water use in Egypt

Currently, Egypt is considered to be in a state of an increasing energy supply crisis in terms of fuel and electricity. According to the Information and Decision Support Center (IDSC) (2008), oil and natural gas together generated about 94% of the energy consumed in Egypt in 2007, while hydroelectric power was third at 4.6% and coal was last at 1.4%. Generally speaking, Egypt suffers from a recognized gap between production and consumption of petroleum derivatives (El-ghitani, 2012). The latest available figures show that the domestic production of petroleum products has witnessed a consecutive decline since 1995, down by about 6.3% to reach 710,000 barrels per day in 2007

Table 1. TSA results in Egypt for the year 2009.

Indicators	2009	Indicators	2009
Tourism direct gross value added (US$ billions)	10.2	Other components of tourism consumption (US$ billions)	2.2
Tourism share of national gross value added (%)	5.4	Internal tourism consumption (US$ billions)	18.5
Tourism direct gross domestic product (US$ billions)	11.0	Outbound tourism expenditure (US$ billions)	2.7
Tourism share of gross domestic product (%)	5.7	Tourism balance of trade (US$ billions)	10.7
Inbound tourism expenditure (US$ billions)	13.3	Employment in tourism industries* (million)	1.4
Domestic tourism expenditure (US$ billions)	3.0		

Source: Prepared by authors based on TSA-unit Egypt (2011). A Report on the TSA results in Egypt 2009, Ministry of Tourism, Cairo.
*Total jobs in tourism industries serving tourism and non-tourism demand as well.

compared to about 758,000 in 2001, while the domestic consumption of petroleum has increased during the period 1981–2007 rising by 18.8% to reach 651,000 barrels per day in 2007 compared to about 548,000 barrels in 2001 (IDSC, 2008).

Petroleum fuel is the main source for generating electricity in Egypt with about 40% of electricity sourced from petroleum fuel in 2009/2010 (IDSC, 2012). As a consequence of fuel shortages, Egypt has experienced periodic electrical blackouts in recent years. Although, the production of electric power achieved approximately a double increase in the past decade, raising from 78 billion kilowatt-hours (kWh) in 2000/2001 to 157 billion kWh in 2012/2011; domestic consumption also doubled during the same period, reaching 136 billion kWh in 2011/2012 compared to about 65 billion kWh in 2000/2001 (Ministry of Electricity and Renewable Energy [MOEE], 2012). In the past three years, for example, according to the Electric Utility and Consumer Protection Regulatory Agency (EgyptERA, 2014), the electricity supply crisis peaked with electricity consumption exceeding production for 25 days during April 2014, and a maximum gap recorded during this month of around 3 million kWh. Overall, the amount of CO_2 emissions resulting from consumption of petroleum products and natural gas is estimated around 182 million tons in 2011/2012, with a compound annual growth rate of nearly 6% since 2003/2004 (CAPMAS, 2006, 2013).

Egypt also faces a significant emerging problem with regard to the issue of water and its future use and distribution (IDSC, 2006). Pouw (2012) argues that Egypt is presentably considered to be in a state of water scarcity. This is supported by Keith et al. (2013) who mention that Egypt experiences a water shortage at current resource levels and will encounter severe problems by 2020. According to the Egyptian General Authority for Investment (GAFI, 2013), the renewable water resources per capita in Egypt decreased in the previous decade from 2604 m^3/capita/year in 1947 to 860 m^3/capita/year in 2003. And, it is expected to continue declining to reach 582 m^3/capita/year by the year 2025. Such levels would place Egypt in the category of "absolute scarcity", according to the thresholds for water stress and scarcity, as defined by the United Nations (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2012).

Table 2. Estimating the physical quantities of energy and water use at hotels — a hypothetical example.

	5 Stars	4 Stars	3 Stars	2 Stars	1 Star	UC
Guests No.[1]	100	120	150	80	80	200
Nights No.[2]	500	600	800	400	400	900
Energy or water expenses (US$)[3]	10,000	11,000	10,000	4000	3000	4000
Unit price (US$)[4]	5					
Total energy or water use (units)	2000	2200	2000	800	600	800
Average energy or water use unit/guest/night	4	3.6	2.5	2	1.5	0.9

Source: Suggested by the authors.
[1, 2]These can be obtained from the administrative records.
[3]from the intermediate consumption reported by the CAPMAS Hotels survey.
[4]from the distributions companies/organizations.

As a result, it is argued that Egypt is one of the world's most vulnerable countries to climate change (Nakhla, Hassan, & El-Haggar, 2013). Key factors to that assessment are water scarcity and CO_2 emissions. Additionally, Nour El-Din (2013) demonstrated that water security is as a limiting factor for development in Egypt. Tutwiler (2012) also said that the potential for CO_2 emissions to decrease or at least reduce their rate of growth in Egypt is slightly lower than in other comparable developing economies.

Undoubtedly, the tourism sector in Egypt is one of the most negatively affected economic activities due to the significant fuel deficiency and power shortages. For example, the recent recurring national gas shortages continually lead to brownouts and blackouts across Egypt's cities and have forced hotels and resorts to bear the financial burden of generating electricity from alternative sources. Also, with the lack of fuel, a diesel fuel black market has appeared, with higher prices than normal official rates, and with cheating in the content of the diesel fuel by adding water, and this may cause at the end an overall poor service to tourists (Hanna, 2013). Accordingly, many potential tourism projects have been deferred or halted in mid-construction due to these problems (Ragab, personal communication, February 28, 2015). On the other hand, many concerns have been raised by the media arguing that the tourism sector is very energy-consuming in Egypt and this threatens the local population needs; that is to say, the trade-off between serving tourism demands versus domestic population's demands becomes pervasive and problematic in Egypt from a public policy perspective (Ragab, personal communication, February 28, 2015). Accordingly, it can be said that the Egyptian tourism sector is no longer facing only the challenge of energy efficiency but also the energy access in the first place.

Considering the aforementioned critical situation, we argue that Egypt needs to adopt supply and demand management policies with emphasis on the environmental issues at both macro and micro levels. However, before developing these policies, Egypt needs reliable environmental measurements that its policy-makers can depend on in order to track Egypt's performance in these terms and the effects of implementing such policies. To date, Egypt does not have environmental accounts to measure the aspects of energy and water use as an aid to managing existing and future challenges of the energy and water needs of its economic activities, its enterprises, and its people. The main focus of the present study is to develop a method providing disaggregated data on the environmental effects of tourism and to relate them to the economic data from the TSA as shown in the following section.

Study method

Once a country or a region has a TSA and environmental accounting, it is possible to investigate the links between them to measure the environmental-economic performance of tourism since they are both satellites to one accounting system; the SNA. The challenge occurs when there is an absence of environmental accounts or a lack of data in general as in the case considered in this paper. Three major environmental measures, energy (fuel, electricity) use, CO_2 emissions, and water use, of the "accommodation for visitors" industry in Egypt are presented. That industry has been chosen as a pilot test of the proposed methodology in the present study since it is the largest (40.4% of the total tourism direct gross value added in 2009 [TSA-unit Egypt, 2011]) of the identified industries within the tourism sector in Egypt. The methodology for these estimations is based on the following five analytical steps.

(1) Identifying the production boundary of the accommodation industry in Egypt:
 Egypt uses the same production boundary of the accommodation industry as it is in the TSA: RMF 2008 which is rooted from the SNA 2008 central framework (See: UNWTO, 2010b; TSA-unit Egypt, 2011). This includes mainly three sub-industries (a) Hotels and other accommodation facilities for visitors, (b) Vacation homes under full ownership (second homes), and (c) Vacation homes under other types of ownership (time-share properties and furnished apartments).

(2) Identifying relevant measures:
Four environmental-economic indicator measures are selected to assess the environmental stress aspects of tourism:
- Average water use (L/person/night)
- Average fuel (diesel) use (L/person/night)
- Average electricity use (kWh/person/night)
- CO_2 emissions attributed to production in the accommodation industry (ton CO_2)

(3) Tourism GDP ratio in the accommodation industry:
For the accommodation industry, the tourism share of output is the sum of the tourism share corresponding to each product component of its output. Then, it is possible to establish a ratio between the total value of tourism share and total value of output of the accommodation industry, which is called “tourism ratio” (expressed in percentage form) (UNWTO, 2010b).

(4) Identifying data sources:
As stated previously, there are no available data for the abovementioned four environmental measures for Egypt that are specific to tourism or the accommodation industry group in particular. Hence, the study depended on the results of a hotels and resorts survey conducted by the Central Agency for Public Mobilization and Statistics (CAPMAS) in 2009 (CAPMAS, 2010a). That survey provides detailed data on intermediate consumption by products for all hotels and resorts in Egypt, classified by both hotel ratings and region. In addition, the TSA-table 6 (domestic supply and internal tourism consumption) which provides the tourism GDP ratios in Egypt for the accommodation industry group was used in the analysis (See TSA-unit Egypt, 2011). These secondary data sources involved some limitations. Although the hotels and resorts survey is a kind of census, it included some missing values on intermediate consumption reported by surveyed units. Also, the Egyptian TSA-table 6 for the reference year 2009 did not include details on the production accounts of hotels by type (e.g. fixed and floating). Undoubtedly, this affects slightly the current study’s analysis. However, we treated the first limitation based on imputation approach, as illustrated later, and the second limitation still exists since the TSA-table 6 provides only a generic tourism ratio for the accommodation industry group.

(5) Calculations:
The calculations involved the following process for reference year 2009:
- Energy and water use
  (a) Hotels and resorts:
  In order to calculate the average guest use of energy and water in the travel accommodation services, the expenses on energy and water are divided by the unit price (see a hypothetical example in Table 2). The water unit price for all hotels connected to governmental utility is the same across all administrations (US$ 1.44/m^3) except for hotels which are located in Sinai and Red Sea where the water supply is self-generated via water desalination plants. The water unit price generated via water desalination plants at these hotels is amounted to US$ 1.44/m^3 (European Bank for Reconstruction and Development [EBRD], 2013). The diesel unit price as well as the average electrical energy unit price for all hotels in Egypt is the same as normal rates for other commercial activities. It is worth mentioning that, despite the fact that overall total physical quantities of water and energy can be obtained this way, due to poor reporting, some hotels do not report their annual expenses on energy and water use. Instead, we imputed the average of guest use of these inputs weighted by nights spent. Also, the above-mentioned estimation process has been made separately according to hotel type (fixed or floating), hotel rating (Under classification [UC] to 5 stars), and regions (27 governorates).
  (b) Other accommodation services associated with all types of vacation home ownership:
  This category includes second homes, timeshare properties and furnished apartments. Since these units are mainly used by Egyptians during short family domestic trips where they spend most of the day in outdoor activities (see TSA-unit Egypt, 2011), it is

assumed that the pattern of energy and water use per occupied-day of these visitors is less intensive, specifically approximately half that of resident households. The occupancy data of these vacation homes are sourced from The Household Income, Expenditure and Consumption Survey conducted by the CAPMAS (2009). Also, it should be noted that domestic tourists who visit and stay in their relatives' or friends' houses are not included in these estimations because the guest housing services provided to visitors within the main dwelling of a household are usually excluded from the production boundary of SNA 2008 (UNWTO, 2010b) as no commercial transaction is involved.

- Estimating CO_2 emissions:
  To obtain the quantities of CO_2 emitted per ton fuel (diesel) combusted and per Kwh electricity consumed, we depended on the conversion factors for CO_2 reported by the Intergovernmental Panel on Climate Change. These conversions amount to 3.32057 ton CO_2 per ton fuel (diesel) and 0.647 kg CO_2 per kWh electricity consumed (EBRD, 2013; Elfarra, 2010).

(6) Extracting tourism share from total environmental effects:
After estimating the mentioned environmental measures for total production in hotels and resorts, adjusted measures of estimates for the portions that are actually attributable to tourism internal consumption are determined by applying the tourism GDP ratio from the Egyptian TSA for hotels and resorts services. For the other accommodation services associated with all types of vacation home ownership (second homes, timeshare properties, and furnished apartments), since the TSA in Egypt considers their production the same as consumption, the tourism GDP ratio of these accommodation services is 100% (TSA-unit Egypt, 2011).

Results

This section reveals a summary of the main findings including the main results of the compilation process described above, as shown in Tables 3–8. Table 3 provides the environmental measures of water and energy use per guest/night in hotels and resorts in Egypt. It can be seen that the weighted average of water use in fixed hotels is 700 liters/guest/night while it is 300 in floating hotels. The average fuel (diesel) use is 2 liters/guest/night while for floating hotels it is much larger at 28.3 liters/guest/night. This is explained by the fact that floating hotels never turn off their engines whether moored or sailing as long as they have guests on board. The average electricity use in fixed hotels is 25.6 Kwh/guest/night; however, floating hotels generate electricity exclusively from fuel combustion. As shown in Table 4, in 2009 the total direct GVA of hotels and resorts activities in Egypt amounted to about US$ 4.4 billion of which around 67.9% (about US$ 3 billion) is attributed to tourists' expenditure on these activities. The tourism GDP ratio in hotels and resorts activities (67.9%) has been applied together with the aforementioned environmental measure to estimate the total use of water and energy in these activities for tourism purposes. The application of the tourism GDP ratio to the

Table 3. Environmental measures of hotels' guests by type and rating of hotels.

	Fixed hotels							
	5 Stars	4 Stars	3 Stars	2 Stars	1 Star	UC	Total average	Floating hotels
Average water use[1] (L/guest/night)	900	800	700	700	200	200	700	300
Average fuel (diesel) use[2] (L/guest/night)	2.6	1.8	1.8	1.0	0.6	0.3	2	28.3
Average electricity use[3] (Kwh/guest/night)	36.1	38.2	30.1	25.1	5.3	4.3	25.6	NA

Source: Calculated by the Authors.
[1]The water unit price for hotels connected to the governmental utility is rated at EGP 3 (US$ 0.54)/m^3. For the hotels in Sinai and Red Sea, the water supply is self-generated via water desalination plants. The homogenized price is equal to EGP 8 (US$ 1.44)/m^3 (adopted from: EBRD, 2013).
[2]There are very few hotels which are connected to the natural gas network. The diesel unit price is EGP 1.1 (US$ 0.2)/ liter.
[3]The average electrical energy unit price for hotels connected to the utility grid is 0.31 EGP/kWh including taxes (EBRD, 2013: p. 71).

Table 4. Tourism share in the production of hotels and resorts in Egypt 2009 (US$ million*).

	Output	Tourism share	Tourism ratio (%)
Total output	8047.7	5460.6	67.9
Total intermediate consumption	3674.9	2493.5	
Total direct gross value added	4372.9	2967.1	

Source: TSA-unit Egypt (2011). A Report on the TSA Results in Egypt 2009, Ministry of Tourism, Cairo.
*The values are converted to the US dollar based on the exchange rate in 2009 (US$ 1 = EGP 5.542) (MOF, 2012).

Table 5 . Tourism use of water and energy in hotels and resorts in Egypt, 2009.

	Hotels totals			
	Domestic	Inbound	Total	Tourism share
No. of guests	3,774,453	11,806,873	15,581,326	10,572,286
No. of nights	9,048,000	48,096,000	57,144,000	38,773,510
Total water use (million m^3/year)	4.27	21.65	38.21	25.93
Total fuel use (000 ton)	13.96	143.50	232.06	157.46
Total electricity use (Gwh)	156	759	1348	915

Source: Calculated by the Authors.

Table 6. Tourism use of water and energy in other accommodation services associated with all types of vacation home ownership in Egypt*, 2009.

	Second homes	Timeshare prosperities	Furnished apartments	Total
No. of units	357,000	7380	655,000	1,019,380
No. of persons**	1,428,000	29,520	1,637,500	3,095,020
No. of nights	19,992,000	5,579,280	147,375,000	172,946,280
Water use				
Average water use (L/guest/night)	183.5			
Total water use (million m^3/year)	3.67	1.02	27.04	31.74
Electricity use				
Average electricity use (Kwh/guest/night)	2.35			
Total electricity use (Gwh)	46.98	13.11	346.3	406.4

Source: Calculated by the Authors.
*It is supposed that users of such units would not consume fuel during their short accommodation in these units.
**The number of persons stayed in these types of accommodation was not available; thus, it is presumed that users of second homes and timeshare units are travelling in household groups (average size of a household in Egypt in 2009 is four persons (CAPMAS, 2010b). As for furnished apartments, it is assumed that half of users consist of household parties and the other half is made up of individuals.

Table 7. The contribution of tourism use of water and energy in the accommodation industry to the Egypt's total use.

		Accommodation use attributed to tourism			
Indicators	Egypt's total use	Domestic	Inbound	Total	(%)
Total water use (million m^3/year)	70,030	36.0	21.7	57.66	0.1
Total fuel use* (000 ton)	33,023	14.0	143.5	157.46	0.5
Total electricity use (Gwh)	111,714	562	759	1321	1.2

Source: Calculated by the Authors.
*Natural gas excluded.

Table 8. CO_2 emissions resulted from accommodation production attributed to tourism.

	Conversion factor*	CO_2 emissions attributed to tourism production in the accommodation industry (000 ton)		
		Domestic	Inbound	Total
Fuel	3.32057	46.3	476.5	522.8
Electricity	0.647	363.6	491.3	854.8
Total		409.9	967.8	1377.7
National total CO_2 emissions				166,600
(%)				0.01

Source: Calculated by the Authors.
*The conversion factors for CO_2 emissions are mainly dependent on the factors stated by the Intergovernmental Panel on Climate Change (IPCC – 2006).

hotels and resorts measures illustrated that while total nights spent in hotels and resorts in 2009 in Egypt recorded about 57 million nights, only around 39 million can be specified as tourists' nights. Correspondingly, the tourism use of water in hotels and resorts is estimated at 25.9 million m^3/year and the tourism use of fuel and electricity is estimated at 157,500 tons and 915 Gwh, respectively. Non-tourism use of water (12.28 million m^3/year), fuel (74,600 tons), and electricity (433 Gwh) accounted for 32.1% of the total use of hotels and resorts in the reference year.

For second homes, timeshare properties, and furnished apartments, the total values of all environmental indicator measures for the use of water and energy resources are attributed to tourism, since the production output of these forms of accommodation is estimated from the demand side in Egypt and thus the assumed tourism GDP ratio is 100% (see: TSA-unit Egypt, 2011). Table 6 shows that the total tourism-related water use for these sub-industries of accommodation totalled approximately to 31.74 million m^3/ year and the electricity use amounted at 406.4 Gwh.

Table 7 reveals that the tourism's use of water in all forms of accommodation accounts for 0.1% of Egypt's total while its use of fuel and electricity is around 0.5% and 1.2% of the Egyptian totals, respectively. The estimated quantity of CO_2 emissions attributed to tourism production in the accommodation industry in Egypt, based on the aforementioned conversion factors, totals about 1.4 million tons, less than 0.01% of the total CO_2 emitted in the Egyptian airspace (Table 8). Figure 1 illustrates the contribution of different forms of tourism (inbound, domestic) to water and energy use in the accommodation industry and its effects on CO_2 emissions. The environmental impacts associated

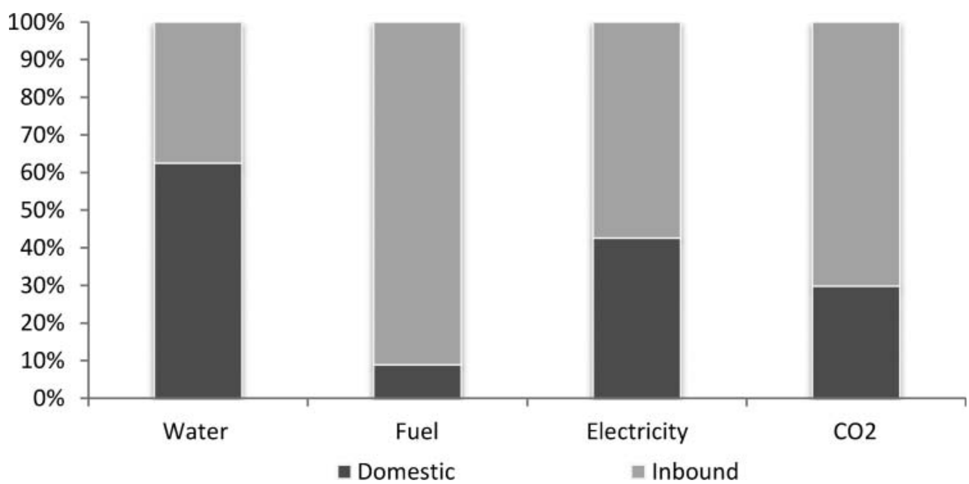

Figure 1. The contribution of inbound and domestic to water and energy use and CO_2 emissions in the accommodation industry. Source: Calculated by the Authors.

with the production of accommodation services purchased by inbound tourism are higher in terms of fuel use (91.1%), electricity use (57.5%), and emissions of CO_2 (70.2%) than for accommodation services produced for domestic tourism, which is higher in term of water use (62.4%).

Overall, it is estimated that production in the accommodation industries serving tourism demand (13.7 million tourists, 211.7 million nights) used around 57.7 million m^3 of water, 157.46 Kt of fuel, and 1321 Gwh of electricity to generate about US$ 3 billion as a part of tourism direct GVA in Egyptian national economy in 2009. Therefore, it can also be said that each US$ 1 million of direct value added supported by tourists expenditure in the accommodation industry required 18,600 m^3 of water, 51.1 tons of fuel, and 426 Mwh of electricity. Similarly, each US$ 1 million of the direct value added tourists expenditure in the accommodation industry group created about 464.3 tons direct CO_2 emissions.

Discussions and concluding remarks

Considering the often mentioned environmental pressures of tourism and the increasing concerns with the sustainability issues of tourism development, it is important to be able to quantify these pressures as a preliminary step towards managing natural resources and adopting innovative practices for mitigating the environmental impacts associated with tourism demand and supply. This paper indicates that linking TSA and environmental accounts has been initiated in a number of countries and regions (Jackson et al., 2008; Lagerström & Rosenblom, 2010; Patterson & McDonald, 2004; Zhang & Brandt, 2010) at different levels and scope of measurement (e.g. selected environmental measures, selected tourism industries, different types of tourism consumption, direct and indirect environmental impacts, and environmental sustainability of tourism). Furthermore, the TSA is considered to be the foundation for estimating the environmental impacts of visitor activities or tourism industries in destinations (Frangialli, 2005). The approach adopted in this paper allows countries that have not yet built environmental accounts to partially examine some environmental impacts of tourism. The key assumption of this approach is based on the underlying essence of the TSA approach which segregates tourism from non-tourism proportions of the domestic supply of industries which serve both visitors and non-visitors (Frechtling, 2010). Egypt is selected for the case study and the “accommodation for visitors” industry is used as a pilot test for the feasibility of the proposed methodology which used data on the intermediate consumption of the accommodation industry results from field surveys conducted by the Egyptian statistics office, CAPMAS, combined together with other secondary data to estimate the quantities of energy (fuel, electricity) use, CO_2 emissions and water use in that industry. Then the tourism GDP ratio, extracted from TSA-table 6 (domestic supply and internal tourism consumption), is applied to determine the tourism demand effects on the environment in terms of the aforementioned measures. To our knowledge, the estimates presented in this paper are the first in the Egyptian context illustrating the environmental-economic performance of tourism; in addition, the paper provides first estimates of tourism water use as a new environmental dimension to be measured on the basis of the TSA approach. It is important to note that due to absence of a full system of environmental accounts within the Egyptian statistical system, no comparable environmental performance information yet exists for other industries or sectors within Egypt.

It goes without saying that the limited availability of environmental data (e.g. detailed database on energy and water use by industries) in Egypt has constrained the main objective of this pilot study for the sake of demonstrating the feasibility of applying a mixed methodological approach in order to estimate macro-environmental performance effects of tourism industries in the absence of developed national environment accounts. Obviously, a more comprehensive view of the environmental economic performance of tourism would be desirable if more extensive environmental data sources were available that could be linked with the full set of industry groups within the tourism sector, including not only the accommodation industry group but also transportation, food and beverage, recreation and entertainment and travel services. Unfortunately, similar environmental performance data linked with other tourism industry groups was not currently available for Egypt. Similarly, a more comprehensive measurement approach would include estimation of indirect and full supply chain effects of tourism industry and market development in Egypt. That too was beyond the scope of tourism-related economic and environment resource measurement and estimation capacities of both official and non-official institutions within Egypt[3].

At a more granular level too, the estimation assumptions in the current study are affected by common field survey accuracy errors and limitations (missing values on intermediate consumption reported by surveyed units). Also, another limitation of the current study is the dependence on a generic tourism ratio for estimating the environmental performance of the accommodation industry group; however, the environmental profiles of hotel types are different. More specific ratios would lead to more precise and accurate estimates for particular accommodation industries with the general accommodation industry group.

Nevertheless, the approach developed in this paper offers potential preliminary information for stakeholders within the Egyptian tourism sector about the direct environmental impacts of tourism production in the accommodation industries of the sector. According to this study's results, with the increase of each additional million inbound and domestic tourists to the Egyptian destinations, the accommodation industry would need 4.04 million m^3 of water, 11.5 thousand tons of fuel, and 96.7 Gwh of electricity, with a total cost around USD 12 million. Also, the accommodation industry would create 100.8 thousand tons direct CO_2 emissions with an estimated social cost (the economic damage caused by a ton of CO emissions) of USD 5.5 million (Foley, Rezai, and Taylor [2013] stated that the social cost of carbon is \$55/tCO_2). Hence, when the Egyptian government puts in place strategies for attracting more domestic and inbound tourists, it should also use such environmental measures in order to examine the potential environmental pressures and financial costs of attracting new tourists. These environmental measures could stimulate and inform the development of policies to rationalize energy and water use in these industries by setting up new managerial procedures such as helping hotels and resorts to go green and to use innovative energy solutions as well as imposing CO_2 emission' taxes. They could also stimulate other more extensive and rigorous measurement studies, which would ultimately provide a basis for assessing the relative accuracy of the various estimates. Undoubtedly, developing such procedures would not be possible for the tourism sector in Egypt without having environmental economic measures such as presented in the current study.

This paper provides environmental estimates of tourism production by form of tourism that explain the environmental pressure of inbound and domestic tourists as well. The results presented are conceptually broadly comparable with the results of other studies conducted on this topic (Anzalone, 2014; Calderón et al., 2009; Costantino & Tudini, 2005; Dwyer et al., 2010; Forsyth et al., 2008; Hoque et al., 2010; Jackson et al., 2008; Jones, 2013; Jones & Munday, 2007; Lagerström & Rosenblom, 2010; Patterson & McDonald, 2004; Zhang & Brandt, 2010). However, close cross-national comparison with results of other similar studies in more developed countries and regions, such as Canada and Europe, is not yet appropriate, as neither the measurement methodologies nor the contexts can be considered equivalent. In addition, this approach should not be considered as a definitive remedy for the lack of environmental accounts. Countries have to develop their own environmental accounts and investigate possible links with the TSA in this area of measurement. Egypt is no exception; it needs to have a full system of environmental accounts that enables it to estimate the macro-environmental performance effects of tourism industries in a more robust way for international comparability and across industries.

As a final point, as noted earlier, this approach could be further developed to measure the energy and water use intensity of other tourism industries (passenger transport, food and beverages, recreation, and sport). Yet another possible further focus of future studies is measuring the indirect environmental effects of tourism industries which undoubtedly add significant incremental effects to the direct ones (for example, water use for electric generation, agricultural crops that serve tourism activities). Moreover, estimates could also be broken down by hotel types as well as by activities within the industry to explore the relative weight of these activities in terms of environmental pressure (e.g. water use distribution at hotels for gardens, swimming pools, kitchens, laundry, and toilets). Still, another development requiring future attention is to understand and test the causal linkages between the tourism economy and environment pressures within sustainability frameworks such as the DPSIR model, besides conducting comparative studies of the environmental performance of tourism among national and international destinations, tourism and non-tourism industries, and tourism and non-tourism consumption within a single industry.

These studies are critically important to an understanding of the demands and pressures that tourism development processes impose upon limited natural resources, and how these pressures can be measured and managed in the interests of equity and sustainability.

Notes

1. Hybrid Flow Accounts are defined as "a single matrix account containing both national accounts in monetary terms and physical flow accounts showing the absorption of natural resources and ecosystem inputs and the generation of residuals" (OECD, 2005, p. 252)
2. The London Group on Environmental Accounting is a city group created in 1993 to allow practitioners to share their experience of developing and implementing environmental accounts linked to the System of National Accounts. It convened its first meeting in March 1994 in London, England. The name derives from the city of its first meeting.
3. In addition to requiring a much broader coverage of basic environmental resource data, such as one finds in countries with fully developed set of national environment accounts, another prerequisite of extending the scope of analysis to include the indirect supply chain effects of tourism development is the existence of a fully developed I-O based tourism impact models. This supplementary extension of the national system of tourism statistics is also beyond Egypt's current technical tourism measurement system capacities.

Acknowledgment

The authors acknowledge the helpful comments made by Professor Stephen Smith from the School of Hospitality, Food, and Tourism Management, University of Guelph, Canada.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Ahmad Muhammad Ragab is a lecturer at the Faculty of Tourism and Hotels, Minia University, Egypt. He took his PhD in Tourism Satellite Accounts in 2010. He is also working as a tourism statistics consultant for the Egyptian Ministry of Tourism and the Saudi Commission for Tourism and National Heritage. His research interests include tourism statistics, tourism satellite accounts, and tourism market analysis.

Scott Meis is a special advisor on labor market information and research at the Tourism HR Canada (formerly Canadian Tourism Human Resource Council). In addition, Scott provides consulting services to external client organizations on tourism statistics capacity development and research issues relating to the tourism industries. Prior to his arrival at the THRC, Scott worked at the Canadian Tourism Commission as Executive Director of Research. In 2006, the Travel and Tourism Research Association recognized his industry research contributions through a Lifetime Achievement Award.

References

Anzalone, M. (2014). *Tourism and sustainability: Macro−accounting approach for measuring the links between tourism and environment*. Paper presented at the 12th Global Forum on Tourism Statistics, Prague. Retrieved November 10, 2015, from: http://www.tsf2014prague.cz/assets/downloads/Paper%204.4_Massimo%20Anzalone_IT.pdf

Archer, B., Cooper, C., & Ruhanen, L. (2005). *The positive and negative impacts of tourism*. In W. F. Theobald (Ed.), *Global tourism* (3rd ed., pp. 79−102). Burlington, MA: Elsevier.

Becken, S., & Patterson, M. (2006). Measuring national carbon dioxide emissions from tourism as a key step towards achieving sustainable tourism. *Journal of Sustainable Tourism, 14*(4), 323−338.

Blake, A., Durbarry, R., Sinclair, T., & Sugiyarto, G. (2000). *Modelling tourism and travel using tourism satellite accounts and tourism policy and forecasting models* (Discussion Paper: 2001/4). Nottingham: Tourism and Travel Research Institute. Retrieved April 20, 2014, from http://fama2.us.es:8080/turismo/turismonet1/economia%20del%20turismo/economia%20del%20turismo/modelling%20tourism%20using%20satellite%20account%20tourism.pdf

Briassoulis, H. 2000. Environmental impacts of tourism: A framework for analysis and evaluation. In H. Briassoulis, and J. van der Straaten, (Eds.), *Tourism and the environment. Regional, economic, cultural and policy issues*. Dordrecht: Kluwer Academic Publishers.

Central Agency for Public Mobilization and Statistics. (2006). *Statistical year book 2005*. Cairo: Author.

Central Agency for Public Mobilization and Statistics. (2009). *The household income, expenditure and consumption survey 2009*. Cairo: Author.

Central Agency for Public Mobilization and Statistics. (2010a). *Hotels and resorts survey results for 2009*. Cairo: Author.

Central Agency for Public Mobilization and Statistics. (2010b). *Statistical year book 2009*. Cairo: Author.

Central Agency for Public Mobilization and Statistics. (2012). *Statistical year book 2011*. Cairo: Author.

Central Agency for Public Mobilization and Statistics. (2013). *Statistical year book 2012*.Cairo: Author.

Charalambous, K. (2009). *The impact of climate change on water use in the tourism sector: Adaption*. Energy, Environment and Water Research Centre, the Cyprus Institute. Retrieved April 20, 2014, from http://uest.ntua.gr/cypadapt/wpcontent/uploads/presentations/ErgastiriAdaptationPresCharalamboustourismwaterquestionnaires.ppt

Costantino, C., Anzalone, M., & Tudini, A. (2013). Presentation of environmental-economic accounts data for tourism. In C. Obst, (Eds.), *System of environmental economic accounting, extensions and application's*: *Presentation of environmental-economic accounts data for tourism* (pp. 100–104). London: The London Group meeting on Environmental Accounting. Retrieved April 20, 2014, from http://unstats.un.org/unsd/envaccounting/londongroup/meeting19/LG19_BK_1.pdf

Costantino, C., & Tudini, A. (2005). *How to develop an accounting framework for ecologically sustainable tourism*. In A. Lanza, A. Markandya, & F. Pigliaru (Eds.), *The economics of tourism and sustainable development: How to develop an accounting framework for ecologically sustainable tourism*. Northampton: Edward Elgar.

Department of Economic and Social Affairs of the United Nations. (2012). *System of environmental-economic accounting for water*. ST/ESA/STAT/SER.F/100. New York, NY: Author. Retrieved November 10, 2015, from: http://unstats.un.org/unsd/publication/seriesf/Seriesf_100e.pdf

Dodds, R., & Butler, R. (2009). Barriers to implementing sustainable tourism policy in mass tourism destinations. *TOURISMOS: An International Multidisciplinary Refereed Journal of Tourism, 5*(1), 35–53.

Dwyer, L., Forsyth, P., & Spurr, R. (2007). Contrasting the uses of TSAs and CGE models: Measuring tourism yield and productivity. *Tourism Economics, 13*(4), 537–552.

Dwyer, L., Forsyth, P., Spurr, R., & Hoque, S. (2010). Estimating the carbon footprint of Australian tourism. *Journal of Sustainable Tourism, 18*(3), 355–376.

Egyptian General Authority for Investment. (2013). Investment Monitor, Quarterly Economic Report Series, Q1 [July–September- FY2013/2014]. Cairo: Author.

Electric Utility and Consumer Protection Regulatory Agency. (2014). *Electricity consumption observatory (Monthly Report No. 8)*. Electricity Consumption Observatory Series. Cairo: Author.

Elfarra, K. (2010). *The identification of CDM projects in the industrial sector of Egypt: Energy efficiency based projects*. Cairo: Egyptian Environmental Affairs Agency. Retrieved April 20, 2014, from http://www.eeaa.gov.eg/english/reports/cdmapu/studies/industrial%20sector-Final%20Report_Rev01.pdf

El-ghitani, I. (2012). *Fuel crisis in Egypt: Supply and demand analysis*. Cairo: Almasry Studies and Information Centre. Retrieved April 20, 2014, from https://www.academia.edu/2905597/_

Eraqi, M., Kasem, A., Hassan, S., & Ragab A. (2011). Towards a comprehensive human resources module for tourism satellite accounts in Egypt. *Tourism Review, 66*(4), 30–44.

European Bank for Reconstruction and Development. (2013). *Review of sustainable energy opportunities in the hotel sector of Egypt: Red Sea and Sinai region*s. London: Sustainable Energy Support for Built Environment Projects. Retrieved April 20, 2014, from http://www.ebrd.com/downloads/sector/eecc/energy-hotels.pdf

Eurostat. (2009). Statistical Office of the European Union. *Water and tourism: Pilot study*. MEDSTAT II, Luxembourg: European Commission.

Foley, D.K., Rezai, A., & Taylor, L. (2013). The social cost of carbon emissions: Seven propositions. *Economics Letters, 121*(1), 90–97.

Forsyth, P., Hoque, S., Dwyer, L., Spurr, R., Thiep, T., & Pambudi, D. (2008). *The carbon footprint of Australian tourism*, Sustainable Tourism Cooperative Research Centre (STCRC), Technical Report Series, Gold Coast: CRC for Sustainable Tourism Pty Ltd. Retrieved April 20, 2014, from http://www.sustainabletourismonline.com/awms/Upload/Resource/bookshop/100072%20Forsyth%20Carbon_FootprintWEB.pdf

Frangialli, F. (2005). *The TSA's relevance for policy-makers*. Paper presented at the UNWTO Conference: The Tourism Satellite Account (TSA): Understanding Tourism and Designing Strategies, Iguazu Falls, Argentina/Brazil/Paraguay.

Frechtling, D. (2013). *The economic impact of tourism: Overview and examples of macroeconomic analysis*. Statistics and TSA Issue Paper Series, STSA/IP/2013/03, Madrid: UNWTO. Retrieved April 20, 2014, from http://s3-eu-west-1.amazonaws.com/staticunwto/IP_Economic_Impact.pdf

Frechtling, D.C. (2010). The tourism satellite account: A primer. *Annals of Tourism Research, 37*(1), 136–153.

Gössling, S. (2001). The consequences of tourism for sustainable water use on a tropical island: Zanzibar, Tanzania. *Journal of Environmental Management, 61*(2): 179–191.
Gössling, S. (2002). Global environmental consequences of tourism. *Global Environmental Change, 12*(4), 283–302.
Gössling, S., Peeters, P., Hall, M., Ceron, J., Dubois, G., Lehmann, L., & Scott, D. (2012). Tourism and water use: Supply, demand, and security. An international review. *Tourism Management, 33*(1), 1–15.
Hadjikakou, M., Chenoweth, J., & Miller, G. (2013). Estimating the direct and indirect water use of tourism in the Eastern Mediterranean. *Journal of Environmental Management, 114*, 548–556.
Hanna, M. (2013). *The tourism crisis in post January 25th Egypt* (A master thesis). School of Global Affairs and Public Policy, The American University in Cairo, Cairo.
Hoque, S., Forsyth, P., Dwyer, L., Spurr, R., Thiep, T. & Pambudi, D. (2010). *The carbon footprint of Queensland tourism*. Sustainable Tourism Cooperative Research Centre (STCRC), Technical Report Series. Gold Coast: CRC for Sustainable Tourism Pty. Retrieved April 20, 2014, from http://www.crctourism.com.au/wms/upload/resources/STCRC_CEP_CF_Queensland_WEB.pdf
Hsieh, H.J., & Kung, S.F. (2013). The linkage analysis of environmental impact of tourism industry. *Procedia Environmental Sciences, 17*, 658–665.
Information and Decision Support Center. (2006). *Reality future water Egypt*. Future Studies Series, January 2006, Cairo: Author.
Information and Decision Support Center. (2008). *Map of petroleum consumption subsidies all over the world- Where is Egypt*? (Report No. 19). Information Reports Series, July 2008. Cairo: Author.
Information and Decision Support Center. (2012), *Reality and the future of electricity in Egypt and the world* (Report No. 62). Information Reports Series, February 2012. Cairo: Author.
Jackson, C., Kotsovos, D., & Morissette, C. (2008). *Linking the Canadian tourism satellite account and the canadian system of environmental and resource accounts to measure the environmental impact of tourism in Canada: An exploratory study for two pilot industries*. Paper presented at the 9th international Forum on Tourism Statistics, Paris.
Jones, C. (2013). Scenarios for greenhouse gas emissions reduction from tourism: An extended tourism satellite account approach in a regional setting. *Journal of Sustainable Tourism, 21*(3), 458–472.
Jones, C., & Munday, M. (2007). Exploring the environmental consequences of tourism: A satellite account approach. *Journal of Travel Research, 46*(2), 164–172.
Keith, B., Enos, J., Garlick, C., Simmons, G., Copeland, D., & Cortizo, M. (2013). *Limits to population growth and water resource adequacy in the Nile River Basin: 1994–2100*. Vicksburg: Environmental Laboratory, Engineer Research and Development Center. Retrieved April 20, 2014, from http://web.mit.edu/12.000/www/m2017/pdfs/nilegrowth.pdf
Lagerström, M., & Rosenblom, T. (2010). *A study of linking the swedish tourism satellite account (TSA) and the Swedish environment satellite account (ESA)*. Paper presented at the 10th international Forum on Tourism Statistics, Lisbon.
Mangion, E. (2013). Tourism impact on water consumption in Malta. *Bank of Valletta Review*, 47 61–85. Retrieved April 20, 2014, from https://www.bov.com/News/bov-issues-47th-edition-of-the-bov-review-
Martin, T. (2013). *Human resource module of the tourism satellite account 2012*. Income and Expenditure Accounts Technical Series. Ottawa: Statistics Canada.
Meis, S. (2002). *A case study of the Canadian experience the tourism satellite account*. Ottawa: Canadian Tourism Commission.
Meis, S. (2014). *Measuring employment in the tourism industries beyond the tourism satellite account: a case study of Canada* (Working Paper 5). Geneva: International Labour Organization.
Mihalič, T. (2000). Environmental management of a tourist destination: A factor of tourism competitiveness. *Tourism Management, 21*(1), 65–78.
Ministry of Electricity and Renewable Energy. (2012). *Egyptian electricity holding company*: *Annual report 2011*. Cairo: Author.
Ministry of Tourism. (2011). *Tourism in figures*. Annual Report 2010. Cairo: Author.
Morissette, C. (2013). *Government revenue attributable to tourism 2012*. Income and Expenditure Accounts Technical Series. Ottawa: Statistics Canada.
Nakhla, D., Hassan, M., & El-Haggar, S. (2013). Impact of biomass in Egypt on climate change. *Natural Science, 5*(6), 678–684.
Nour El-Din, M. (2013). *A Proposed climate change adaptation strategy*. Joint Programme for Climate Change Risk Management *in Egypt*. Cairo: UNESCO-Cairo Office. Retrieved May 5, 2014, from http://www.eeaa.gov.eg/English/reports/CCRMP/7.%20CC%20Water%20Strategy/CC%20Final%20Submitted%208-March%202013%20AdptStrtgy.pdf
Organization for Economic Co-operation and Development. (2000). *The OCED manual on tourism satellite accounts and employment*. Retrieved April 20, 2014, from http://www.oecd.org/dataoecd/31/15/2401928.pdf
Patterson, G., & Mcdonald G. (2004). *How clean and green is New Zealand tourism? Lifecycle and future environmental impacts*. Lincoln: Manaaki Whenua Press. Retrieved December 5, 2010, from http://www.mwpress.co.nz/__data/assets/pdf_file/0010/70498/LRSS_24_How_Clean_and_Green_NZ_Tourism.pdf
Pouw, K. (2012). *Towards good governance for sustainability: Egyptian capacity for environmental economics*. Engineering and Public Policy Program. Hamilton: McMaster University. Retrieved April 20, 2014, from http://msep.mcmaster.ca/epp/publications/student/Kristin%20Pouw%20-%200361066%20-%20MEPP%20Inquiry%20FINAL.pdf

Ragab, A.. (2009). *Tourism satellite account (TSA) unit: Egypt*. Paper presented at the UNWTO Committee on Statistics and Tourism Satellite Accounts, Bali.
Ragab, A. (2006). *The economic impact of applying tourism satellite account on the Egyptian tourism sector* (Unpublished master's thesis). Cairo: Faculty of Tourism and Hotels, Helwan University.
Ragab, A. (2011). Tourism Satellite Account as a tool for enhancing labour market statistics in tourism industry: Applied to tourism sector in Egypt (Doctoral dissertation summary). *European Journal of Tourism Research, 4*(2), 233–236. Retrieved April 20, 2014, from http://ejtr.vumk.eu
Ragab, A. (2013). *Tourism satellite accounts (TSA): An analytical study of countries experiences*. Amman: The Arab Institute for Training and Research in Statistics.
Rossouw, R., & Saayman, M. (2011). Assimilation of tourism satellite accounts and applied general equilibrium models to inform tourism policy analysis. *Tourism Economics, 17*(4), 753–783.
Sakr, M. (2005). *Action plans for employment promotion and working conditions improvement in the Egyptian tourism sector*. Retrieved (20/04/2014) from http://www.ilo.org/public/english/dialogue/sector/ap/note4.pdf
Song, H., Dwyer, L., Li, G., & Cao, Z. (2012). Tourism economics research: A review and assessment. *Annals of Tourism Research, 39*(3), 1653–1682.
Statistics Canada. (2002). *Energy supply and demand 2002*. Canadian Socio-Economic Information Management System (CANSIM). Retrieved April 20, 2014, from http://www5.statcan.gc.ca/cansim/home-accueil?lang=eng accessed on April, 2014.
Statistics South Africa. (2007). *Linking government strategies and the tourism satellite account in South Africa* (Discussion Paper No. D0405.6). Pretoria: Author.
Sun, D., & Walsh, D. (1998). Review of studies on environmental impacts of recreation and tourism in Australia. *Journal of Environmental Management, 53*(4), 323–338.
Tortella, B., & Tirado, D. (2011). Hotel water consumption at a seasonal mass tourist destination: The case of the Island of Mallorca. *Journal of Environmental Management, 92*, 2568–2579.
TSA-unit Egypt. (2011). *A report on the TSA results in Egypt 2009*. Cairo: MOT-Egypt.
Tutwiler, R. (2012). *Our carbon footprint*. The Desert Development Center. Cairo: The American University in Cairo.
United Nations Conference on Trade and Development. (2013). Sustainable tourism: Contribution to economic growth and sustainable development. Issues note presented at the Expert Meeting on Tourism's Contribution to Sustainable Development, Geneva.
United Nations Educational, Scientific and Cultural Organization. (2012). *Managing water under uncertainty and risk*. United Nations World Water Development Report, 1, Paris: Imprimerie Centrale S. A.
UNWTO & UNEP, United Nations Environment Programme. (2012). Tourism in the Green Economy: Background Report, Madrid. Retrieved November 10, 2015, from: http://www.unep.org/greeneconomy/Portals/88/documents/ger/ger_final_dec_2011/Tourism%20in%20the%20green_economy%20unwto_unep.pdf
World Tourism Organization. (2010a). *2008 International recommendations for tourism statistics (IRTS 2008)*. Madrid: Author.
World Tourism Organization. (2010b). *2008 Tourism satellite account: recommended methodological framework* (TSA: RMF 2008). Madrid: Author.
World Tourism Organization. (2013, September 27). *Tourism and water: Protecting our common future*. Background Paper presented at the World Tourism Day. Retrieved April 20, 2014, from http://wtd.unwto.org/en/WTD13backgroundpaper
World Tourism Organization. (2014, January 12). *World Tourism Barometer*. Madrid: Author.
Zhang, J., & Brandt, C. (2010). *Regional environmental impact of tourism: Linking the regional tourism satellite accounts and the regional environmental accounts within the Danish regional model framework*. Paper presented at the 10th international Forum on Tourism Statistics, Lisbon.