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Eco-efficiency and its determinants at a tourism destination: A case study of Huangshan National Park, China

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HIGHLIGHTS

- Our study analyze the characteristics and evolution of eco-efficiency at an individual destination.
- Our study also empirically identifies the determinants of eco-efficiency.
- The results indicate that the evolution of eco-efficiency undergoes four stages.
- The determinants of eco-efficiency are in different directions and degrees.

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ABSTRACT

This study creates a comprehensive evaluation index system, including undesirable outputs and a Slacks-Based Measure-Data Envelopment Analysis model, to analyse the characteristics and evolution of eco-efficiency at an individual tourism destination. This study also empirically identifies the determinants of eco-efficiency. Huangshan National Park, one of the most iconic and highly visited national parks in China, was chosen as the study site. The study results indicate that eco-efficiency has improved continuously. Pure technical efficiency is higher than scale efficiency, while eco-efficiency is more relevant to scale efficiency than to pure technical efficiency. The evolution of eco-efficiency undergoes four stages: an initial inefficient stage, a rapid growth stage, a mature efficient stage and a downside risk stage. Moreover, tourism development, industrial structure and technical level have significantly positive impacts on eco-efficiency, but investment level displays the opposite trend. Environmental regulation emphasizing waste control does not effectively promote eco-efficiency. Finally, theoretical and practical contributions of the findings are discussed in the context of eco-efficiency at a tourism destination. For instance, an eco-efficiency analysis of a destination should treat the tourism destination as a macro-scale system with complex evolutionary rules and should combine this perspective with theory, such as the tourist area cycle of evolution proposed by Butler in 1980.

1. Introduction

Since the release of *Our Common Future* by the World Commission on Environment and Development in 1987, many studies have explored the meaning of sustainable development in an effort to guide the implementation of this important concept (WCED, 1987). Sustainable development has been a key policy objective at the global, national and local levels. Nonetheless, sustainable development is a goal, and it does not inherently provide much guidance as to how it should be achieved. To address this issue, new concepts such as eco-efficiency have been developed to promote the required changes.

The concept of eco-efficiency was first proposed by Schaltegger and Sturm (1990) and was launched worldwide in *Changing Course: A Global Business Perspective on Development and the Economy* (Schmidheiny & WBCSD, 1992). In essence, eco-efficiency prescribes reducing the amount of energy and natural resources used, as well as reducing the wastes and pollutants discharged in the

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production of goods and services (DeSimone & Popoff, 1997; Kelly, Haider, Williams, & Englund, 2007; Rashidi & Saen, 2015). Eco-efficiency has also been defined as generating more value in products and services while reducing resource consumption and environmental pollution. Moreover, eco-efficiency can be described using the ratio of an indicator of the value of products and services (numerator) to an indicator of environmental load (denominator), in which the value of products and services expresses the total output of a company, sector, economy, or region as a whole. Moreover, the environmental load includes the resource consumption and environmental pollution related to the production of the goods or services. As an effective tool for measuring the degree of coordination (Tang, 2015; Wang, Yuan, Cheng, Mu, & Zuo, 2014) between human economic development and environmental impact and for assessing the sustainable development of enterprises, products, industries and regions at different scales, eco-efficiency has emerged as a critical field in sustainable development studies.

As tourism continues to develop rapidly around the world, its economic and environmental impacts have increasingly attracted academic attention, and the study of tourism efficiency has become an emerging field. Despite a recent increase in the number of research papers on this topic, most of the literature remains focused on evaluating the economic efficiency or performance of hotels (Ashrafi, Seow, Lai, & Lee, 2013; Barros, 2005; Chiang, Tsai, & Wang, 2004; Corne, 2015; Hsieh & Lin, 2010; Oliveira, Pedro, & Rui, 2013; Yu & Lee, 2009), travel agencies (Barros & Matias, 2006a,b; Fuentes, 2011; Köksal & Aksu, 2007), scenic spots (Ma & Bao, 2009; Ma, Ryan, & Bao, 2009), destinations (Assaf & Tsionas, 2015; Kytzia, Walz, & Wegmann, 2011; Ma & Jin, 2015; Medina, Gómez, & Marrero, 2012), the tourism industry (Assaf & Josiassen, 2011; Assaf, 2012; Sigala, Airey, Jones, & Lockwood, 2004) and trade shows (Alberca-Oliver et al., 2015) from the perspectives of economics, marketing and management. However, few investigations have analysed eco-efficiency (ecological efficiency) while also considering resource consumption, environmental pollution and economic growth from the perspective of ecological economics.

The concept of eco-efficiency is particularly relevant to tourism destinations because these areas have traditionally been characterized by intensive use of energy, water, capital, and other natural materials and by substantial discharge of waste in the production of products and services (Becken & Simmons, 2002; Gössling et al., 2005; Hof & Schmitt, 2011). In China, local governments and enterprises located at tourism destinations are recognizing that the tourism industry can indeed promote economic growth (Tang & Tan, 2015). Driven by economic interests and by the erroneous view that economic growth should be their top priority, they often pay considerable attention to improving tourism-related economic growth while habitually ignoring the overexploitation of resources and the generation of environmental pollution (Gössling et al., 2012; Hall et al., 2015). Thus, in seeking balance between economic growth and the environmental loads of tourism destinations, scientifically measuring eco-efficiency, identifying associated determinants, and proposing corresponding managerial measures have become theoretical and practical problems that require urgent consideration.

2. Literature review

2.1. Eco-efficiency and tourism

The study of eco-efficiency began in the 1990s and mainly focused on basic theory (Moller & Schaltegger, 2005; UNCTAD, 2003; WBCSD, 1996), measurement methods (Egilmez, Kucukvar, & Tatari, 2013; Huppes & Ishikawa, 2005; Kielenniva, Antikainen, & Sorvari, 2012; Robaina-Alves, Moutinho, & Macedo, 2015; Zhu, Wang, & Zhang, 2014) and empirical studies at different scales or in different fields, such as studies of various products, enterprises and industries, and regions (Berkel, 2007; Campbell, Rogers, & Rezek, 2008; Munisamy & Arabi, 2015; Rudenauer, Gensch, Griesshammer, & Bunke, 2005; Seppäläa et al., 2005).

However, the existing body of research is inadequate in two general ways. First, numerous studies have conducted eco-efficiency evaluations from the perspective of productive activities (Berkel, 2007; Long, Zhao, & Cheng, 2015; Munisamy & Arabi, 2015; Rudenauer et al., 2005), as seen in industry- and product-based analyses. However, few studies have explored eco-efficiency from the perspective of tourists' consumption activities. Second, most studies focus on large- and medium-scale analyses, such as regional- and urban-scale cases (Yin, Wang, An, Yao, & Liang, 2014). Small regional-scale cases, especially tourism destinations, have yet to be explored.

In the sustainable tourism debate, the idea of eco-efficiency was introduced by Gossling et al. (2005) who provide an overview of a number of studies with a focus on tourism that use energy and carbon dioxide as indicators for eco-efficiency. In recent years, scholars have gradually paid more attention to this issue. Some studies have considered aspects of eco-efficiency in tourism, such as tourism itinerary products (Li, Yang, & Zheng, 2008), tourism waste (Zhang, 2008), tourism transportation (Brida, Deidda, & Pulina, 2014; Reilly, Williams, & Haider, 2010), tourism carbon emissions (Sun & Pratt, 2014), tourism water use (Charara, Cashman, Bonnell, & Gehr, 2011; Kelly & Williams, 2007), tourism land use (Kytzia et al., 2011; Tyrväinen, Uusitalo, Silvennoinen, & Hasu, 2014) and tourism energy consumption (Chan & Lam, 2003). However, to our knowledge, most studies regarding the eco-efficiency of tourism have only focused on a single resource or environmental factor, such as the consumption of water, land, or energy; waste; or carbon dioxide discharge and emissions. No systematic and extensive study has combined the various elements of resource consumption and environmental pollution.

2.2. Eco-efficiency measurement methods

Measuring eco-efficiency is the basis of eco-efficiency research. Recent publications have proposed a number of different approaches to the assessment of eco-efficiency based on model calculations and different types of indicators (Kytzia et al., 2011).

First, some approaches provide estimates for a single indicator, described by the ratio of an indicator representing the value of products and services to an indicator representing the environmental load. Life cycle assessments, material flow analyses, ecological footprints and energy value analyses can be classified in this category (Neto, Walther, Bloemhof, Van Nunen, & Spengler, 2009). For instance, Sun and Pratt (2014) measured eco-efficiency via per-dollar CO_2 emissions and per-dollar water consumption. Such a comparison is applicable to the analysis of a single project or technical object, not only by helping to determine the efficiency level required to generate an additional dollar from tourism but also by providing a guideline for prioritizing market segments in the future. However, these studies are often criticized for their limited scope.

The second type of approach is based on composite indices, which contain different aspects of indicators. For instance, Seppäläa et al. (2005) produced indicators for the environmental and economic dimensions of regional development and used them to measure regional eco-efficiency. Specifically, the environmental impact indicators include pressure indicators (e.g., emissions of CO_2), impact category indicators (e.g., CO_2 equivalents in the case of