Development of a tourism sustainability assessment procedure: a conceptual approach

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Abstract

The purpose of this paper is to develop a procedure for the assessment tourism sustainability. Twelve case studies on the basis of geographical backgrounds are analysed, and the issues of tourism sustainability assessment are discussed. A model development procedure is proposed, and combination of reductionist and holistic approaches to modelling is employed: identification of the systems, dimensions, and indicators; scaling of sustainability; gradations of sustainability; development of tourism sustainability assessment maps; extension of the maps over time; and evaluation. A conceptual framework is formulated to assess tourism sustainability with the above components. ‘Barometer of tourism sustainability’ (BTS) and ‘AMOEBA of tourism sustainability indicators’ (ATSI) are introduced as devices for the assessment of tourism sustainability. The proposed BTS model represents the comprehensive level of tourism sustainability in a given destination, combining human and natural indicators into an index of sustainable tourism development, without trading one off against the other. The ATSI model is introduced to complement the BTS analysis and to illustrate individual levels of sustainability of tourism indicators.

Keywords: Tourism sustainability assessment; Systems; Dimensions; Indicators; Tourism sustainability assessment maps (TSAMs); Barometer of tourism sustainability (BTS); AMOEBA of tourism sustainability indicators (ATSI)

1. Introduction—from theory to practice

Since the appearance of the World Conservation Strategy (International Union for Conservation of Nature and Natural Resources (IUCN), United Nations Environment Program (UNEP) & World Wildlife Fund (WWF), 1980) and Our Common Future (World Commission on Environment and Development (WCED), 1987), many academics, community groups, governments, non-government organisations (NGOs) and international organisations have been attempting to convert their theoretical intentions in relation to sustainable development into practice. Thus, considerable human resources and funds are being invested to develop practical policies and assessment models for sustainable development. In the case of tourism development, however, little practical methodology has been developed, although many researchers argue that tourism must contribute to sustainable development. Since the beginning of the 1990s, a number of arguments and debates concerning sustainable tourism development (STD) have been presented, mostly at a theoretical rather than a practical level (see Archer, 1996; Bramwell & Lane, 1993; Green, 1995; Hunter, 1995a, b; McIntyre, Hetherington, & Inskeep, 1993). Where most tourism academics measure sustainability in specific tourist destinations, they tend to depend on subjective judgments without reference to any standards or criteria supported by measurement (e.g. Driml & Common, 1996; Farrell, 1992; Gilbert, Penda, & Friel, 1994; Griffin, 2000; Haukins & Cunningham, 1996; Klemm, 1992; Knight, Mitchell, & Wall, 1997; Mak & Moncur, 1995; Owen, Witt, & Gammon, 1993; Sofield & Li, 1998; Tosun, 1998; Wilson, 1996). Some tourism academics (e.g. Middleton & Hawkins, 1998, p. 247) even argue that ‘sustainability in tourism is generally an aspiration or goal, rather than a measurable or achievable objective’. To sum up, the application of the concept of sustainable development as an achievable and practical objective for tourism has not yet matured.
for the assessment of tourism sustainability is a necessary feature of the idea of sustainable development. If sustainable development is one of the tourism industry’s major contemporary objectives, then the industry needs to be able to measure its performance and impacts in this area.

This study addresses a question that has arisen in the 1990s in tourism, namely: How can progress towards sustainable tourism development be measured? The question is based on the premise that if tourism contributes towards a sustainable society, then the extent to which it is doing so should be measured. The purpose of this study is to develop a procedure for assessing tourism sustainability in terms of system quality. The contribution of the current study is, therefore, to present a practical and useful model for the assessment of tourism sustainability. The major contributions of this paper are as follows: First, to incorporate systematically existing political, economic, socio-cultural and environmental impact studies (the supply side), and tourism service quality considerations (the demand side) into the sustainability assessment process. Thus, this research seeks to improve the utility of existing tourism impact and service quality studies. Second, to provide quantitative data on tourism sustainability assessment, enabling stakeholders to understand easily and clearly the viability of a tourist destination. Third, to propose a succinct and accessible presentation format in order to illustrate sustainability levels of tourism indicators. Finally, to encourage stakeholders to apply appropriate information in the process of tourism planning and development (e.g. decision on priorities in policy implementation and resource allocation, marketing and promotion strategy, and involvement of stakeholders).

2. Sustainability assessment review by case studies

This section examines 12 case studies of sustainability assessment in tourism. The purpose of this review is to determine whether the case studies used explicit sustainability assessment methods or models to evaluate the performance quality of STD. The main focus of the review is to examine whether or not specific criteria were selected to determine the possibility of sustainable tourism in a given destination. Twelve case studies, each of which arrived at a conclusion regarding whether a destination was ‘sustainable’ or ‘unsustainable’, were selected. Studies that did not determine whether a case-study area was ‘sustainable’ or ‘unsustainable’ were not included in this review. Tourism and environment journals and texts were used as information sources to identify suitable case studies. Initially, studies published in the period 1992–2000, which were concerned with sustainability, and which involved empirical study of a specific tourist destination, were identified. Those studies that presented a specific conclusion regarding the sustainability of a destination were then selected. In the process, it was found that few of the published studies utilised specific sustainability assessment methodologies; thus, 12 studies that presented more detail in their methodology than others, were finally selected for the present analysis. However, given the rapid development of the field, all relevant studies may not have been identified, especially more recent ones. It is, however, believed that the studies selected are suitably representative of studies conducted during the period.

This analysis also attempts to highlight whether the case studies employed an assessment process to arrive at their conclusions. The elements for the review are: assessment participants (who decides?); assessment components (what is examined?); indicator selection procedure (how are the indicators chosen?); data-gathering methods; and data-analysis methods (e.g. scaling of sustainability, gradations of sustainability, sustainability assessment maps (SAMs), and future scenarios of sustainability over time). These judgment/ issues in relation to sustainability were adapted from a previous study by Bell and Morse (1999). For example, a mapping component in sustainability assessment may be required for the general public to present a clear and simple system quality of a community, since one of the goals of sustainable development is to deliver current information easily to locals. Finally, overall findings from the review of literature are discussed at the end of this section.

From the examination of the 12 case studies mentioned above (Table 1), a number of issues are identified and discussed, as summarised in Table 2: (1) The indicators (issues, problems, and concerns) for STD vary from one tourist destination to another. (2) Most judgments about sustainability are arrived at by the authors themselves without the participation of stakeholders. (3) Generally only a small number of indicators are examined to arrive at the authors’ conclusions regarding the sustainability of given tourist destinations. (4) Indicator selection procedures are generally not presented. (5) Data-gathering procedures are also not presented, or not made clear in the case studies. (6) Scaling (quantification) of sustainability maintained by tourist destinations is not attempted in the case studies. Ideally, when the term sustainable in terms of system quality is mentioned, the state of system quality must be presented clearly (e.g. 80 out of health of 100% or 50 out of 100%). (7) None of the authors demonstrate gradations (sectors or bands of scaling) of sustainability. All authors, unconsciously and automatically, use two categories (sustainable and unsustainable) to define sustainability. However, the modes of sustainability may vary, as suggested by IUCN (1995, 1997) and Prescott-Allen (1997). (8) SAMs are not employed in the
### Table 1
Case studies on sustainable tourism development

<table>
<thead>
<tr>
<th>Authors</th>
<th>Date</th>
<th>Geographical location and types</th>
<th>Topic</th>
<th>Key points</th>
<th>Types of data gathering/analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Farrell</td>
<td>1992</td>
<td>USA (Maui, Hawaii), tourism development policy</td>
<td>Tourism as an element in SD</td>
<td>A tourism situation cannot be classified as SD if it does not consider the resulting quality of life of local residents</td>
<td>Not clear/descriptive</td>
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<tr>
<td>2. Klemm</td>
<td>1992</td>
<td>France (Languedoc-Roussillon), tourism development project</td>
<td>Importance of public sector involvement (or in partnership with private sector) for STD</td>
<td>STD is possible by a framework of public sector planning and control to provide protection for the natural and built environment while responding to the demand for mass tourism</td>
<td>Official statistics/descriptive</td>
</tr>
<tr>
<td>3. Owen et al.</td>
<td>1993</td>
<td>UK (Mid-Wales Festival of the Countryside), festival</td>
<td>STD in a festival of the countryside</td>
<td>The dependence of tourism on the quality of the environment places it in a very special position in the whole debate about sustainable tourism</td>
<td>Qualitative (personal experience)/ descriptive</td>
</tr>
<tr>
<td>4. Gilbert et al.</td>
<td>1994</td>
<td>Kenya and Cameroon, national park</td>
<td>Sustainability issues in the African national parks</td>
<td>An overall responsible tourism approach favouring appropriate development which maximises the welfare of the community, the environment and the visitor was wanted</td>
<td>Review of lit./descriptive</td>
</tr>
<tr>
<td>5. Mak and Moncur</td>
<td>1995</td>
<td>USA (Hanauma Bay, Hawaii), tourism management strategy</td>
<td>Evaluation of tourism management strategies for SD</td>
<td>STD is likely to require government intervention and regulation instead of industry self-regulation. Recreational resources can be rationed using price or non-price rationing methods</td>
<td>Review of lit./descriptive</td>
</tr>
<tr>
<td>6. Hauckins and Cunningham</td>
<td>1996</td>
<td>USA (Disney’s America project in Virginia), tourism development project</td>
<td>STD and public consultation</td>
<td>STD cannot be realised if local citizens are excluded from the planning process, regardless of the scope and potential economic benefits of development projects</td>
<td>Review of lit./descriptive</td>
</tr>
<tr>
<td>7. Wilson</td>
<td>1996</td>
<td>Barbados and St Lucia in the Caribbean, tourism development policy</td>
<td>Question of sustainability in Caribbean tourism</td>
<td>Development policies sustaining tourism growth rather than STD generate many problems and there is a striking gap between theory and practice of STD</td>
<td>Observation, interviews review of lit./ descriptive</td>
</tr>
<tr>
<td>8. Driml and Common</td>
<td>1996</td>
<td>Australia (the Great Barrier Reef world heritage area), world heritage</td>
<td>Ecological economics criteria for sustainable tourism</td>
<td>For STD, firstly, management agencies must have the information to manage so as not to deplete natural capital. Secondly, a non-declining stream of net-economic benefits must be maintained</td>
<td>Review of lit./descriptive</td>
</tr>
<tr>
<td>9. Knight, Mitchell and Wall</td>
<td>1997</td>
<td>Indonesia (Bali), tourism development project</td>
<td>Sustainable development, tourism and coastal management</td>
<td>For STD, an integrated approach is recommended to protect and rehabilitate linked coastal ecosystems within the context of cultural tourism policies</td>
<td>Observation/descriptive</td>
</tr>
<tr>
<td>10. Tosun</td>
<td>1998</td>
<td>Turkey (Urgup), tourism development project</td>
<td>Roots of unsustainable tourism development at the local level</td>
<td>Achieving STD at the local level in a developing country requires hard political choices, a confident decision-making process and the collaboration of international tour operators and donor agencies</td>
<td>Focus group, personal interviews, observation and personal experience in the tourism industry/descriptive</td>
</tr>
<tr>
<td>11. Sofield and Li</td>
<td>1998</td>
<td>China (Gokh Chin Festival), cultural festival</td>
<td>Historical methodology of assessment and sustainability</td>
<td>A judgement about sustainability in the absence of the historical perspective and/or a longitudinal study must be treated with caution</td>
<td>Participant observation and a situation analysis/descriptive</td>
</tr>
<tr>
<td>12. Griffin</td>
<td>2000</td>
<td>Ireland (Lough Derg), tour operators</td>
<td>A practical investigation of sustainable tourism in businesses</td>
<td>The tourism industry has to seek to explore the key principles of STD to transfer the implications of Agenda 21 to tourism planning</td>
<td>Questionnaire survey with the tourism industry/descriptive</td>
</tr>
</tbody>
</table>

SD: sustainable development; STD: sustainable tourism development
case studies. One of the policy objectives of STD is to present the current or past trends of the community’s quality situation clearly to the general public and other stakeholders. For this purpose, documents or written statements, which nobody understands except certain experts, are not appropriate. (9) Future scenarios of sustainability are not presented. In order to examine the trends of tourism sustainability in the community in a limited period (e.g. 5–10 years), the assessment requires monitoring the movement of sustainability.

These limitations can be summarised as presented in Table 2. To sum up, the methods of systemic sustainability assessment are not currently used in tourism, except in a recent study by Ko (2001) who argues that tourism sustainability can be measured with quantitative data, suggesting the barometer of tourism sustainability (BTS) model. However, the model includes a significant limitation, namely that the BTS fails to explain the level of sustainability of individual indicators, although it may be useful in presenting a comprehensive level of sustainability in a specific tourist facility or destination. This situation that lacks appropriate assessment tools leads to the development of a systemic sustainability assessment model to see if tourism is progressing towards a sustainable form of development and finally contributing to a sustainable community. In particular, in the area of sustainability assessment, practical implementation methodologies, rather than superficial approaches, are required. Without such a practical approach, the term STD is likely to become ‘propaganda’ or a ‘slogan’, which is a source of concern for many people.

### 3. Issues of Sustainability Assessment

There has been intense debate about the process of sustainability assessment. Some suggest that the issues come from the age-old question ‘What is the good life?’ evoked by the ancient Greeks (Hodge & Hardi, 1997). In recent years, questions such as how STD should be assessed, and who should evaluate its efficacy are increasingly being discussed around the world (Richardson, 1993; Forsyth, 1997; Mercer, 2000). Carpenter (1995) mentions measurement difficulties that are indicated in the real ecosystem context. Similar barriers can be seen to apply to sustainability assessment in the human system. Cocklin (1989) also discusses difficulties that are specific to the evaluation of the achievement of sustainable development, suggesting four broad methodological dilemmas: the boundary problem; single-resource analysis vs. integrated evaluation; the quantification problem; and the goal of sustainability and other goals. In addition, there are a number of unanswered questions, and a certain amount of skepticism, concerning the process of sustainability
assessment. The following questions indicate typical concerns:

How do we measure areas which constitute sustainable development? How do we put numbers or colours or other descriptors to these indicators of the quality of life or of well-being? One answer to that is, perhaps, do we need to? Another question we must address is: Are there indicators that are not amenable to quantification? And, if we do try to quantify them, do we fall into the same trap as economists have fallen into for the last one hundred and fifty years—that is, in believing that only things that have numbers mean anything? (Khosla, 1995, p. 9).

However, little progress in sustainable development can be expected until such pessimism is overcome. Such pessimism is manifested in overlooking the value of quantitative indicators like GDP/GNP as a means of economic estimation for the wealth of human beings. As argued by Pearce (1989) it should be noted that, despite their limitations, simple quantitative indicators have been very useful and powerful tools for comparison, and have been used by many nations and international organisations since the 1940s. Nobody guarantees the perfection of sustainability assessment models. The point is not to lose sight of the woods for the trees in trying to assess sustainability. One approach is to give the highest priority to discussing operational issues—practical applications of the concept of sustainable development. Thus, in considering sustainability assessment, the monitoring of the shift in people’s quality of development. Thus, in considering sustainability assessment, the highest priority to discussing operational issues—practical applications of the concept of sustainable development. Thus, in considering sustainability assessment, the monitoring of the shift in people’s quality of life and the natural environment over a selected time period, the natural environment over a selected time period (weak sustainability) rather than pursuing the idea of the indefinite continuation of a situation (strong sustainability) may be desirable. An approach in sustainability assessment is ‘to bring sustainability closer to becoming an operational guide for designing a better future’ (Khosla, 1995, p. 9). The key is to develop a protocol for assessing sustainability and to follow it consistently to ensure a comprehensive, careful, and deliberate decision-making process (Munro, 1995).

Approaches to overcoming these difficulties through improved monitoring and understanding of the structure and function of the human system and ecosystem are desirable. Given that truly sustainable tourism is an unattainable goal in the foreseeable future, an appropriate approach could be to concentrate on measuring improvement in tourism performance in terms of sustainability (Goodal & Stabler, 1997). Many practical trials have been undertaken in an attempt to overcome the complexity and difficulties faced in the assessment process. ‘The Bellagio Principles for Assessment’ is one recent contribution. In response to the need for improved assessment, the International Institute for Sustainable Development (IISD) produced a set of such principles (guiding vision and goals; holistic perspective; essential elements such as equity and disparity, ecological conditions, and human/social well-being; adequate scope in time and space; practical focus; openness; efficient communication; broad participation; on-going assessment; and institutional managing capacity). The principles serve as practical guidelines for the whole assessment process from system-design and identification of indicators to field measurement and compilation, and the interpretation and communication of results (Hodge & Hardi, 1997). These 10 principles can be used as guidelines for tourism sustainability assessment, and most are incorporated into the assessment process developed in this paper.

Much of the literature on ‘sustainability’ has different definitions. Given the different conditions of political, economic, socio-cultural, and environmental systems in which tourist destinations exist, the diversity is understandable. Thus, as mentioned by Bell and Morse (1999, p. 10), ‘having a single definition that one attempts to apply across this diversity could be both impractical and dangerous’. Nevertheless, a clear definition is needed in the initial stage of project implementation to avoid confusion or misunderstanding which is very common in this research area. Sustainability is a contingent term, that is, it is not just a static, descriptive term, like a colour. It implies that something is, or is not, happening. It could be said that sustainability is the ability to be sustained, that is, the ability to survive. With consideration of the current condition of system quality, Ten Brink, Hosper, and Colijn (1991), and Bell and Morse (1999) also emphasises the sequential process in assessing sustainability as discussed in Sections 3.1 and 4.7. Development is meant to improve human condition, and sustainable development should ensure the survival of a system at a higher level—otherwise, it is not worth doing. Tourism is a form of development, and therefore, the same criteria apply as for development generally. In these terms, this study would argue that: The sustainability of a system is the ability of the system to maintain a state of health necessary for survival. Sustainable development is development that enables the system in that it is located to maintain a state of health that is necessary for survival at a higher level of quality. STD is tourism development that enables the system in which it is located to maintain a state of health that is necessary for survival at a higher level of quality. In this case, the “state of health” is defined as the condition of a system that is regarded as a desirable and acceptable standard for survival for a living system.

3.1. Space, time, and system quality in sustainability

The spatial scale is very important in attempting to put sustainability into practice, or in gauging the level of sustainability in a tourist destination. In tourism, the spatial scale can be divided into five categories: a single
destination, local, regional, national, and international levels. However, although the administrative boundary may be defined clearly, there may still be problems in measuring sustainability. It is very common for one destination to be located over more than one political or administrative or environmental boundary. In addition, determining the spatial scale of a destination may be limited by budget, time and methodology or technology.

It is difficult to determine the time scale (e.g. 10, 50, or 100 years) as different systems may require different time scales. In ecology, Ten Brink et al. (1991), who firstly developed the AMOEBA model (AMOEBA is the Dutch acronym for "a general method of ecosystem description and assessment"), examine the ecological situation in the sea and a major river over 58 years (1930–1988). In agricultural sustainability, according to Bell and Morse (1999), pest problems are best looked at scales over 5–20 years, while land degradation requires scales of 20–100 years. Tourism sustainability requires a much shorter time scale (e.g. 5–10 years) as tourist destinations tend to be influenced very sensitively by internal (e.g. ecological base of many tourism enterprises) or external (e.g. terrors or SARS) factors.

Like spatial and time scales, system quality is also a key component in achieving STD. In this paper, system quality means 'the state of health in a tourist destination, sustaining the benefits of local community, satisfaction of tourist experience, and conservation of natural resources'. System quality involves judgments about the functionality/health of the tourism destination. Thus, where a destination meets the requirements of the two STD components mentioned above, the system quality of the destination would be necessarily high. A tourist destination means 'a tourist attraction (human-made or natural), including the human system and the ecosystem, influenced by tourism activities'. Therefore, to become a sustainable tourist destination, the two systems must be sustainable simultaneously. This is one of the most important assumptions in the assessment of tourism sustainability in this study. The Egg of Sustainability of Prescott-Allen (see IUCN, 1995, pp. 154–155) can be modified and applied to the context of tourism. Human societies form a sub-system within the ecosystem, just as the yolk of an egg is within the white. For an egg to be good and edible, both the yolk and the white have to be good. Similarly, a tourist destination is sustainable only if both the human condition and the condition of the ecosystem are satisfactory or improving. Human beings and ecosystems are seen as equally important. If the condition of either is unsatisfactory or worsening, the destination is unsustainable.

### 3.2. Approaches to sustainability assessment

There has been intense debate about how sustainability should be assessed. The debate on sustainability assessment may be broadly divided into two approaches (see Bell & Morse, 1999, pp. 77–103): a reductionist approach; and a holistic (systemic) approach. The reductionist approach can be seen as reflecting the scientific paradigm that has been dominant in the Western research tradition. However, this paradigm is challenged by one alternative described as a holistic or systemic approach. The approach to measuring sustainability in absolute, traditional, reductionist terms may be non-viable because sustainability is not determined by single components. Nor sustainability can be explained and measured by holism alone because, as identified even by some of the advocates of the holistic approach (e.g. Bell & Morse, 1999), the fundamental limitation of the holistic approach is that it has failed to suggest any acceptable analysis method in measuring sustainability. There is no doubt that the holistic approach has many benefits in formulating a conceptual framework for sustainability assessment procedure. However, in some part of the assessment procedure, particularly in data-analysis processes, traditional mathematical or technical method must inevitably be introduced if the holistic approach is to become an acceptable assessment tool. Therefore, this paper combines the two approaches.

### 4. A procedure for tourism sustainability assessment

This work builds on Ko (2001) and how holistic and reductionist approaches were combined. From the discussions mentioned in previous sections, this study aims to develop a practical approach to tourism sustainability assessment. Eight steps of sustainability assessment procedure are introduced in this section: identify the systems; identify dimensions; identify indicators; scale the indicators; determine gradations of sustainability; develop SAMs; extend sustainability over time; and evaluate the outcome (see Table 3).

#### 4.1. Identify the systems—the human system and ecosystem

The traditional Western intellectualism (dualism), whereby human beings and the natural environment are separated, and people have the right to develop or exploit the environment, has recently been the subject of criticism and change (Mannion & Bowby, 1992). Since the 1980s, alternative ideas about the relationship between human beings and the natural environment are becoming more widespread in the West (see Brown, 1981; IUCN et al., 1980; IUCN, UNEP, & WWW, 1991; the United Nations, 1992; WCED, 1987). These alternative ideas interpret human beings as part of the natural world, rather than as separate entities, with a responsibility to care for it, either for their own
long-term benefit or for the benefit of other organisms (Mannion & Bowlby, 1992). Recognising that human beings are an integral part of the ecosystem, a logical goal for society, including a tourist destination, is to improve and maintain the well-being of people and the ecosystem. To assess progress towards this goal, tourism sustainability assessment needs to simultaneously examine the human system and the ecosystem (see Table 3).

4.2. Identify the main dimensions—eight dimensions for sustainable tourism development

As the dimensions (sub-systems) of the two systems mentioned above, and as a mediator between the two systems and indicators, dimensions should be identified in sustainability assessment. It is widely accepted that tourism should contribute to sustainable development at the local, regional, and national level. In other words, STD is unlikely to be achieved unless the dimensions in a tourist destination are sustainable. In this study, eight dimensions are suggested. The human system includes the political; economic; socio-cultural aspects; and production structure (the quality of services and products for tourists), while the ecosystem assimilates general environmental impacts; ecosystem quality of water, land and air; biodiversity of flora and fauna; and environmental policy and management (see Table 3).

4.3. Identify the main indicators—indicators for sustainable tourism development

Indicators for sustainability assessment in tourism can be developed from the eight dimensions for STD. Each of the eight dimensions gives rise to a number of indicators as essential factors in assessing tourism sustainability. There is a considerable amount of literature on the various positive and negative impacts of tourism (see in particular, German Federal Agency for Nature Conservation, 1997, pp. 49–62; Pearce, Moscardo, & Ross, 1996, pp. 243–248). These accounts can be used as a basis for the development of tourism sustainability indicators (SIs). The indicators can also be derived from extensive literature on impacts. The WTO (1993, 1995, 1998) also has developed a group of indicators for STD, although they are focused on ecological dimensions. In relation to the assessment of

Table 3
Conceptual framework for tourism sustainability assessment

<table>
<thead>
<tr>
<th>Components for tourism sustainability assessment</th>
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<tr>
<td>Information requirements (to assess the three elements of STD objectives)</td>
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<tr>
<td>A tourist destination</td>
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<tr>
<td>a In this model, determining systems and dimensions is based on a systemic (holistic) approach, while selecting and scaling indicators are based on a reductionist approach.</td>
</tr>
<tr>
<td>b Dimensions, indicators and data gathering methods may vary from one tourist destination to another according to the type and characteristics. The indicators can be collected from a number of references in tourism, environment and ecology. Stakeholders should be involved in the indicator selection process.</td>
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</table>
the needs of tourists, factors impacting on tourist satisfaction can also be utilised.

These two systems, eight dimensions and a number of indicators mentioned above may be used as the core components in assessing tourism sustainability. It may not be necessary or possible to use all the indicators in all cases. Thus, it is important for a tourist destination to select a mostly appropriate group of dimensions and indicators for the assessment. Each dimension is composed of clusters of indicators in relation to tourism activities. The hierarchical structure of the indicators, dimensions, and systems is shown in Table 3. The table illustrates that to undertake a comprehensive assessment of the human system, such sub-systems of the human system as political, economic and socio-cultural aspects, and production structure should be evaluated. To assess the political sub-system, for example, a number of related indicators must be examined. To undertake a comprehensive assessment of the ecosystem, general environmental impacts, ecosystem quality, biodiversity and environmental management and policy as sub-systems of the ecosystem need to be examined. To assess the general environmental impacts, for example, a number of indicators must be measured. In this process, a large range of specific aspects can potentially be assessed. As Hodge (1996) argues, an assessment hierarchy is a powerful tool. It provides a map of the assessment process, and serves to show explicitly what factors are, or are not, being considered in the assessment process. The assessment process builds from specific measures from bottom to top, drawing on the best available knowledge.

4.4. Scale sustainability

The assessment process requires a clear scale in order to compare and evaluate one thing against another. For effective SIs, tourism planners need to translate tourism indicators, which stakeholders want to measure, into a measurable form. Lee-Smith (1997) points out that, in assessing sustainability, ordinal or interval scales are normally used. For example, Prescott-Allen’s Barometer of Sustainability uses an interval scale of 1–100, which can be mapped onto the ordinal scale: bad–poor–medium–OK–good (Prescott-Allen, 1997). Ordinal scales are relative, not absolute. In many cases, ‘especially where there is a lack of consensus as to what would constitute an adequate standard, ordinal scales may be the only ones available in the interim’ (Clayton & Redcliffe, 1996, p. 198). Ordinal scales could also be used to represent more subtle quality change regarding requirements of local residents, tourists, and the natural environments.

Assessment implies both something to measure and a method of measuring it. One major barrier to sustainability assessment is the lack of an acceptable analysis method, as mentioned in the discussion of the holistic approach. This difficulty in data analysis may justify the introduction of a reductionist approach that advocates quantitative data in the assessment. As a most vital element, the degree of progress towards sustainability is unlikely to be recognised without numerical sources, as in economic development forecasting. For example, without any standards in the numerical sources, how is it possible to see the extent to which a tourist destination is getting better or worse, even if the destination should move from one qualitative category to another? Furthermore, as far as system quality is concerned, it could be difficult to define and explain the gradations (sectors of scale) of sustainability without the provision of quantitative data. Numerically based assessments have certain advantages, and such a system is proposed here.

In this, the study of perceptions of main stakeholders (e.g. local residents, tourists, and environmental experts/groups) is suggested as the main scaling mode. For example, as shown in Table 3, the level of tourism sustainability can be presented by assessing sustainability of individual indicators, using the data-gathering methods with a 10-point rating scale. For the convenience of a questionnaire survey and easy adaptation of the survey results to the tourism sustainability assessment maps (TSAMs), in particular the AMOeba of tourism sustainability indicators (ATSI), the 1–100 scale of Prescott-Allen is transferred to 1–10-point scale. The adoption of this approach for tourism sustainability assessment may be justified by the following five arguments.

First, and most importantly, while existing general technical (social and scientific) data can be useful in measuring the general sustainability of a community, it cannot be used in examining tourism sustainability. This is because it is very difficult to identify the contribution of tourism activities to the technical data. For instance, regardless of the level of ecosystem quality in the community (e.g. 4.0 out of 10.0, where 10 = excellent and 1 = bad), it is not possible to determine the extent to which the tourism industry has contributed to this level of ecosystem quality. Ecosystem quality may be impacted by other industrial, daily living and commercial activities, as well as tourism activities. Regardless of the crime rate (e.g. 6.5 out of 10.0, where 10 = excellent and 1 = bad), it is very difficult to identify tourism’s contribution to the scale. The crime rate may be influenced by television commercials, industrialisation, drugs and alcohol, prostitution and the income gap between the haves and have-nots, as well as the introduction of tourists. Thus, even when these objective measures are available they generally must be mediated additional information to link them to tourism.

Second, perception study has been widely employed in examining tourism impacts and the quality of services or
products in marketing. The SERVQUAL model of Parasuraman, Zeithaml and Berry (1988) and SERV-PERF model of Cronin and Taylor (1992) are typical examples. In addition, there are many examples of gauging people’s quality of life and the impact on the natural environment through perception or attitude study in environmental areas (Fiallo & Jacobson, 1995; Gooch, 1995; Pelletier, Legault, & Tuson, 1996; Vogel, 1996). This may arise from the difficulty and uncertainty of interpretation of ‘quality of life’.

Third, as discussed above, participation of various stakeholders is one of the most important components for the achievement of STD (WCED, 1987). This suggests that from the initial stage of the assessment (e.g. questionnaire formulation), stakeholders should be involved. Therefore, the SIs should be centred, possibly through questions or interviews, on the perceptions of local residents, tourists, and environmental experts/groups, regarding the sustainability of a tourist destination. ‘Local people often have clear ideas of their own about what is sustainable from their own perspective and in their own terms without an expert’s view.’ (Bell & Morse, 1999, p. 80) The sustainability of a tourist destination might not be maintained if adverse reactions of these participant groups are significant and increasing. As stated by Faulkner and Tideswell (1997, p. 6), ‘the associated reciprocal reactions of the community influence the progression of stages by undermining the appeal of the area to tourists and thus reducing its viability as a tourist destination’.

Fourth, a perception study is one of the most appropriate methods to assemble the different opinions of various stakeholders and to suggest average scores for their opinions. This implies that a perception study is a relatively easy mechanism to measure diverse opinions. There are numerous tourism indicators which are difficult to measure in numerical form. In this case, the level of perception or attitude of stakeholders can provide information to measure the quality of the indicators. Thus, where technical data are unobtainable, as an alternative, a perception study may be a useful tool for tourism sustainability assessment.

Finally, the uncertainty issue of sustainability is another reason. In relation to the practice of sustainable development, the United Nations (1992) recommends as desirable for human society to use the best currently known way, until we create or develop a perfect method to cope with our current problems.

4.5. Determine gradations (sectors of scale) of sustainability

Graded levels of sustainability are necessary for convenience of communication. For instance, a two-sector (‘sustainable’ and ‘unsustainable’) mode is currently the most widely used. On the other hand, IUCN (1995) and Prescott-Allen (1997) have proposed a five-sector scale (1–20, bad; 21–40, poor; 41–60, medium; 61–80, OK; and 81–100, good) in the Barometer of Sustainability. Moreover, as the measurement process becomes more sophisticated, more detailed sectors may be required. Four possible models of sustainability gradation are suggested below. It is assumed that the ‘excellent’ condition of the state of health in system quality is likely to be more ‘sustainable’, while the ‘bad’ condition is likely to be defined as more ‘unsustainable’.

- **Five-point scale:** this is divided into five sectors of 20 points each, totaling 100. This model may be useful in explaining the very precise and complicated information to stakeholders, as the scales are divided into the most detailed sections among the four models below:
  - sustainable (excellent): 81–100%
  - potentially sustainable (good): 61–80%
  - intermediate (medium): 41–60%
  - potentially unsustainable (poor): 21–40%
  - unsustainable (bad): 1–20%

- **Four-point scale:** this is divided into four sectors of 25 points each, totaling 100. This model may be useful in explaining relatively precise and complicated information to stakeholders, as the scales are divided into relatively detailed sections among the four models:
  - sustainable (excellent): 76–100%
  - potentially sustainable (good): 51–75%
  - potentially unsustainable (poor): 26–50%
  - unsustainable (bad): 1–25%

- **Three-point scale:** this is divided into three sectors of 33.3 points each, totaling 100. However, for the convenience of calculation, and to avoid confusion in interpretation, these ranges are reorganised: 33% vs. 34% vs. 33%. This model may be useful in explaining relatively simple information to stakeholders, as the scales are divided into relatively simple sectors among the four models:
  - sustainable (good): 68–100%
  - intermediate (medium): 34–67%
  - unsustainable (poor): 1–33%

- **Two-point scale:** it is divided into two sectors of 50 points each totaling 100. This model may be useful in explaining very simple information to stakeholders, as the scales are divided into the simplest sectors among the four models:
  - sustainable (good): 51–100%
  - unsustainable (poor): 1–50%
In this paper, these four gradations of sustainability levels are used in developing SAMs, and where accurate data are lacking, only a two or at most a three-point scale may be appropriate. Although more detailed gradations (e.g. 10 divisions) could be introduced, they may be unrealistic in practice.

4.6. Develop tourism sustainability assessment maps

The outputs from a tourism sustainability assessment exercise, using scales of sustainability levels, can be presented in graph form. TSAMs are a graphic tool for displaying the system quality of a tourist destination. Their purpose can be summarised as follows: to help to identify the current situation in a community; to generate possible future scenarios from the situation; to clarify the trade-offs that are implicit in indicator selection; to make tourism issues or concerns more accessible to stakeholders; to assist stakeholders to define their goals and objectives; to make all parts of the sustainability assessment process clear and explicit; and to serve as an educational tool (adapted from Clayton & Radcliffe, 1996, p. 195). The functions of TSAMs vary according to the types of sustainability. Two types of TSAMs are introduced. For example, the BTS is useful to explain the comprehensive level of sustainability of individualised tourism indicators.

Barometer of tourism sustainability: As seen in Fig. 1, the Barometer of Sustainability (IUCN, 1995; Prescott-Allen, 1997) is applied in the context of tourism. The model is helpful when illustrating the comprehensive level of tourism sustainability in a tourist destination providing stakeholders with an immediate picture of where they are and where they are going (see Ko, 2001). The Barometer of Sustainability is a tool for measuring and communicating a society’s well-being and progress towards sustainable development (see IUCN, 1995, pp. 156–157). It provides a systemic way of organising and combining indicators so that users can draw conclusions about the conditions of people and the ecosystem, and the effects of people–ecosystem interactions. It presents those conclusions visually, providing everyone—from villager to head of state—with an immediate picture of human and ecosystem well-being. The Barometer combines indices of ecosystem well-being and human well-being into an index of sustainability, without trading one off against the other. Thus, the Barometer: treats people and the ecosystem together as one system; assesses the whole system as well as the parts; treats people and the ecosystem as equally important; allows each issue to be analysed using the most appropriate method; and, lets users choose their own indicators. If the number of tourism SIs are 32 (each 16 indicators for the human system and ecosystem, respectively) and the sustainability scale is given to each indicator (with a hypothetical 10-point scale), the average scores (e.g. 6.4 vs. 3.8) of the 16 SIs in the two systems can be produced, and the BTS map can be drawn as seen in Fig. 1. Four BTS models (BTS1: a five-point scale; BTS2: a four-point scale; BTS3: a three-point scale; and BTS4: a two-point scale) with the gradations, as introduced in Section 4.5, are suggested to overcome the limitations identified in the Prescott-Allen’s Barometer of Sustainability model (a five-point scale). Fig. 1 uses a matrix to illustrate the relationship of the human system and the ecosystem. Each system moves along a gradient of ‘unsustainable’ to ‘sustainable’, along the axis of the matrix. The conceptual matrix indicates that within the BTS there can be many different combinations of sustainability levels in a tourist destination.

AMOeba of tourism sustainability indicators: The BTS models mentioned above, which represent the comprehensive level of sustainability of the human system and the ecosystem, fail to demonstrate the
sustainability of individualised tourism indicators. Thus, in this section, the AMOEBA models (see Bell & Morse, 1999; Ten Brink et al., 1991) are applied to tourism, illustrating the sustainability levels of individualised tourism indicators, to overcome the shortcomings identified in the BTS models. Corresponding to the BTS1, 2, 3, and 4 models, four ATSI models (ATSI1–4) are suggested as shown in Fig. 2. If the number of tourism SIs are 32 (each four indicators for a dimension, and each 16 indicators for the human system and ecosystem, respectively), and a sustainability scale is given to each indicator (with hypothetical data), the ATSI maps can be drawn. The 32 SIs are represented in the sustainable bands of the ATSI, using a 10-point scale (see Fig. 3). The SIs can be placed in one of the eight sectors in the circle: political aspects; economic aspects; socio-cultural aspects; service (and product) quality; general environmental impacts; ecosystem quality; biodiversity; and environmental policy and management. The SIs can now be used to produce the AMOEBA. The connection of the maximum end of 32 SIs in the sustainable bands produces the AMOEBA (see Fig. 3). Data production procedures for these ATSI maps have been discussed in the previous Sections 1–5.

Implications of the ATSI models are as follows: (1) individual levels of sustainability are presented in a diagram; (2) the level of sustainability is represented by quantitative data; (3) the quantitative data may be obtained by primary or secondary sources; (4) the sector of the sustainability scale is clearly defined with numerical sources; (5) four types of sustainability gradations (ATSI1–4) are suggested; (6) in the process of data gathering and analysis, a holistic (systemic) and reductionist approach are adopted; and (7) the larger the AMOEBA, the more sustainable is the system, while the smaller the AMOEBA the less sustainable the system.

Applying the BTS and ATSI models: A number of points regarding the use of the BTS and ATSI models should be noted as follows. First, the model type and the usage of the figure should ideally be chosen according to characteristics of the tourist destination. The BTS1 and ATSI1 models present the most detailed information, while the BTS4 and ATSI4 illustrate the simplest features. More detailed models might be useful for policy decisions, while simpler models might be helpful for the general public. Second, the model numbers should be matched accordingly where they are used together (e.g. BTS1 vs. ATSI1, BTS2 vs. ATSI2, BTS3

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**THE HUMAN SYSTEM**

**THE ECOSYSTEM**

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Fig. 2. ATSI—hypothetical data. ATSI1 (sustainable: 8.0 < SI ≤ 10.0; potentially sustainable: 6.0 < SI ≤ 8.0; intermediate: 4.0 < SI ≤ 6.0; potentially unsustainable: 2.0 < SI ≤ 4.0; unsustainable: 0.0 < SI ≤ 2.0). ATSI2 (sustainable: 7.5 < SI ≤ 10.0; potentially sustainable: 5.0 < SI ≤ 7.5; potentially unsustainable: 2.5 < SI ≤ 5.0; unsustainable: 0.0 < SI ≤ 2.5). ATSI3 (sustainable: 6.7 < SI ≤ 10.0; intermediate: 3.3 < SI ≤ 6.7; unsustainable: 0.0 < SI ≤ 3.3). ATSI4 (sustainable: 5.0 < SI ≤ 10.0; unsustainable: 0.0 < SI ≤ 5.0).
vs. ATSI3, and BTS4 vs. ATSI4) to illustrate the relationship between the comprehensive level and individual levels of sustainability. Finally, statistical results from these models cannot be compared between one destination and another because the types and characteristics of the destinations and samples will differ. The main purpose of these models is not to see if a tourist destination is doing better than others but if it is doing well on its own. Nevertheless, the statistical results can be comparable if uniform sets of indicators are used. One of the benefits of modelling is being able to compare different destinations.

4.7. Extend BTS and ATSI over time

A single point assessment is not sufficient to arrive at a conclusion regarding sustainability as sustainability concerns process as well as outcome. Determining sustainability requires a sequential assessment process over a period of time (e.g. for 5 or 10 years). In practice, it is anticipated that data will be collected and that the BTS and ATSI models will be compiled from time to time, to monitor progress in achieving tourism sustainability. The system might be expected to move along the axes (in the BTS) and on the circular space (in the ATSI), with significant movement indicated by the tourism indicators. Periodic compilation of BTS and ATSI indicators would provide an on-going monitoring of the destination’s progress towards (or away from) sustainability and changing stakeholder perceptions. Because stakeholder perceptions are likely to develop or change over time, ‘progress’ might appear to be slower than technical indicators might otherwise show.

4.8. Evaluation

Evaluation of the outcomes of the assessment is important. It would be desirable to present findings to stakeholders and consider the effects on policy and practice (Simmons, 1994). Thus, consideration should be given to an ‘evaluative’ component of the research process. Evaluation can take two forms. First, the process can be evaluated technically, in terms of the effectiveness and efficiency of the data collection and analysis process. On the other hand, a model can also be evaluated in terms of its usefulness to stakeholders in a practical exercise. This would mean going back to the stakeholders, presenting them with the results of the analysis and asking whether this assists them in decision-making. This would clearly make sense, since...
one argument for the use of the models is that they present data in a format which is easy for stakeholders to understand.

5. Conclusions and recommendations

In relation to the study of the tourism sustainability assessment procedure, a number of conclusions and suggestions are provided: (1) Progress towards sustainable tourism development can be measured to see whether tourism contributes to sustainable development. Sustainable development requires cooperation of all economic activities to enhance the quality of life of the local community and the natural environment. As a sub-system of economic activities, the tourism industry should monitor its contribution to sustainable development. (2) A standard is needed to measure the progress towards (or regress away from) sustainable tourism development, as the assessment of progress cannot be judged and determined unless a standard is provided. The assessment necessarily demands comparison between the previous and current state of system quality.

(3) Qualitative or quantitative data can be used to produce information for the standard. However, quantitative data may include more advantages than qualitative data in making a sustainability assessment. This does not mean that quantitative data is more scientific or more advanced as a technique than qualitative data. They are complementary, and both incorporate merits and demerits. (4) A perception study, administered through questionnaire surveys or other surveys, is suggested to produce the quantitative data. Perception study is already used widely in many areas to measure the socio-economic impacts of tourism and the quality of service and products. In particular, this perception study is useful in assessing the sustainability of a particular tourist destination, where technical data, regarding tourism activities, are not available. (5) In order to produce quantitative data with the perception study, a 10-point rating scale survey is suggested. While rating scales typically range from 1 to 5, the 10-point rating scale can be introduced to facilitate the adaptation of the results to the tourism sustainability assessment maps (TSAMs). (6) Four kinds of gradations of sustainability are suggested. Although the two divisions (sustainable vs. unsustainable) are most commonly used, they may vary as measurement processes become more sophisticated.

(7) Two types of TSAMs are suggested. The comprehensive level of sustainability of the human system and the ecosystem can be defined and illustrated by the BTS. Following the four types of sustainability gradations mentioned above, four BTS models (BTS1–4) are suggested. The BTS models are very useful to present the current sustainability of a tourist destination to stakeholders. (8) The sustainability of individualised tourism indicators can be defined and illustrated by the AMOEBA of tourism sustainability indicators. Following the four types of sustainability gradations mentioned above, four ATSI models (ATSI1–4) are suggested. The ATSI models are used to complement the simplicity of the BTS models, and to explain the complexity and diversity of tourism aspects, by illustrating sustainability of individualised tourism indicators. (9) The BTS and ATSI analysis can be extended over time. They might move over the surface of the square (or the circle) with each significant movement indicated by the sustainability indicators (SIs) from the standpoint of stakeholders. (10) Where the TSAMs are used together, these model numbers must be matched accordingly (e.g. BTS1 with ATSI1, 2 with 2, 3 with 3 and 4 with 4). Thus, the comprehensive and individual level of sustainability in a tourist destination can be simultaneously presented by these BTS and ATSI models.

‘Models are servants, not masters’ (Clayton & Radcliffe, 1996, p. 211). Although the TSAMs (the BTS and ATSI) provide very useful information in understanding the system quality of a tourist destination, the information should be used not as an absolute solution, but as a reference. In addition to the intrinsic limitations of quantitative data (see Ko, 2001), there are a number of issues in the destination which cannot be explained by quantitative data. The wisdom and experience of stakeholders might be more valuable than these statistical data to cope with their issues.

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