

THE RELEVANCE OF THE CONCEPT OF CAPACITY FOR THE MANAGEMENT OF A TOURIST DESTINATION: THEORY AND APPLICATION TO TOURISM MANAGEMENT IN VENICE

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1. Introduction

Tourism is usually seen as a local and regional development driver, but its growth could imply an excessive pressure on the environment or the cultural heritage of a destination, altering the social and economic conditions and modifying the quality of life for the local population. Moreover, the negative impacts of tourism could have an effect on the attractiveness and competitiveness of a destination.

In this context, the management of tourism flows becomes a central policy issue. This issue is often dealt with through the concept of tourist carrying capacity, or capacity “tout court” which expresses how many visitors can be acceptable in a given destination (Coccosis H., Mexa A., 2004). The UNWTO - World Tourism Organisation has defined the tourism carrying capacity as the maximum number of people that may visit a tourist destination at the same time, without causing destruction of the physical, economic, socio-cultural environment and an unacceptable decrease in the quality of visitors' satisfaction (1981).

The purpose of this article is to investigate how tourism management can help in achieving a sustainable touristic development considering a significant case study: Venice. In order to shed light on this issue, we first consider how the notion of capacity can be helpful (or instead misleading) to evaluate the consequences of tourism. Second, we examine how the concepts of tourist capacity and tourism management actually fit with the Venice context. Third, we present a tool actually implemented in Venice based on an original definition of capacity and early booking discounts to avoid peak loads. We also, discuss the potential and limitations of such a system.

2. The notion of tourism capacity: a problematic concept

We first review the different concepts and definition of tourism capacity, and subsequently discuss the limits and critics to the notion.

2.1. A multifaceted concept

There are many definitions of the concept: Middleton and Hawkins (1998) define carrying capacity as a measure of the limit beyond which an area may suffer from the adverse impacts of tourism. Chamberlain (1997) defines it as the level of human activity an area can accommodate without the area deteriorating, the resident community being adversely affected, or the quality of visitors experience declining. Clark (1997) defines carrying capacity as a certain threshold level of tourism activity beyond which there will occur damage to the environment, including natural habitats (Trumbic I., 2001 in EC, 2002).

The three most commonly known and used definitions of carrying capacity are the physical one, the economic one and the social one. However Pearce (1989) suggested the existence of two other concepts of carrying capacity: environmental and perceptual or psychological. Related to the concept of carrying capacity is the process of tourism planning which defines it as the maximum acceptable level of tourist development in an area.

The physical dimension involves defined capacity in terms of limits to the pressure an area is able to support, involving all components of the natural environment as well as the infrastructure systems (for example, the number of users per unit of time that can visit a particular resource). From an operational point of view, the physical capacity is implemented through specific institutional and legal limits applied in relation to the kinds and the characteristics of the resource.

The economic dimension primary refers to all the economic measures employed to stimulate or to manage the tourism development and it determines the capacity of a resource - or of a system as a whole - using as only parameters costs, benefits and income. In operational terms, this dimension of capacity is difficult to determine for the entire system (a tourism destination) due to the lack of information and data. The social dimension aims at quantifying the optimal tourist flow by measuring the impacts of tourism on the local community (individuals and public institutions) from different points of view (for example available manpower or trained personnel, the sense of identity of the local community or the tourist experience) and it relates to the negative socio-cultural impacts of the tourism development: the local tolerance for tourism, the visitor enjoyment and the increase of crime.

From a more pragmatic point of view, the determination of a carrying capacity often mixes the several dimensions defined below. Beyond any definition and any categorization, in fact, the carrying capacity approach involves a set of issues which include the three basic dimensions cited above: physical-ecological, socio-demographic, political-economic. These dimensions reflect also the range of issues considered in practice (EC, 2002).

It is the case of the socio-economic carrying capacity that may be defined as the total number of visitors that can be allowed without hindering the other functions that the city performs. This dimension is closely linked to the phenomenon of crowding out (Van der Borg J., 2001 in EC, 2002).

The physical-ecological dimension comprises both fixed (the capacity of natural systems expressed occasionally as ecological capacity, assimilative capacity, etc.) and flexible (the infrastructure systems and their characteristics, like water supply, sewerage, electricity, transportation, postal and telecommunication, health services, law and order services, banks, shops and other social services) components of the natural and built-cultural environment as well as infrastructure.

The socio-demographic dimension refers to those social aspects which are important for the local communities in relation with the tourism development: for example, available manpower or trained personnel, the local community sense of identity, the tourist experience, etc. The political-economic dimension refers to the impacts of tourism on the local economic structure, and activities, including competition to other sectors.

As can be observed, the notion of capacity, or its more specific form of carrying capacity, is used with a variety of definitions. This ambiguity, together with other limitations have generated critics which are discussed more in detail in the next section.

2.2. *A criticized notion*

The notion of tourism carrying capacity has been criticized both from a conceptual and a practical point of view (Buckley, Wagar, Washburne, McCool, and Stankey).

A first critique is that the elements on which the carrying capacity of a tourism destination is based are often taken as stable, while they are often mutable. Another critique relates to the fact that the level of tourist experience quality is subjective, which makes any quantification of the touristic experience vain. A third critique relates to the feasibility of management measures: the level of control necessary to manage an area with the rules based on carrying capacity is likely to be impossible in the "real world".

UNESCO warns that the practical application of the concept of tourism carrying capacity can give the wrong signal, pointing out that that the whole site may be below carrying capacity while a part of it may be crowded (Pedersen A., 2002).

McCool and Lime (2001) pointed out that the concept of recreation carrying capacity relies on a number of assumptions that often are unsupported from an operational point of view and this raises questions about the objectives of tourism and protected area management actions. The conditions required to compute a carrying capacity are rarely achieved: there may be specific and infrequent situations where a capacity estimated in terms of economic variables may be appropriate but these economic variables are usually not to be thought as “binding” constraints but rather as the outcome of an equilibrium (consider for instance the capacity of restaurants or the sewage system of an area), that can thus be changed through investment.

McCool and Lime also stress the fact that continuing attempts to quantify carrying capacities of tourism destinations in presence of largely untested and often implicit assumptions compel a critical assessment of both the scientific foundations of quantified carrying capacities and their practical implementation.

One of the paradigms developed to respond to the limits of the carrying capacity approach relies on the limits of acceptable change. Based on the visitor management concept, this framework recognizes that any tourist activity has an impact and that the local authority has to monitor constantly the area and implement a process in which, according to its objectives, a limit to the number of visitors is just one among the tools available.

Another framework developed is the visitor impact management approach which focuses on the impacts of visitors, and is usually location specific. The visitor impact management technique establishes what are considered to be unacceptable visitor impacts, determines the likely cause of these impacts and sets in motion a series of actions to address the problems (Glasson et al., 1995 in EC, 2002), implemented through an iterative process of monitoring, with a comparison between indicators and standards and the identification of alternative management options if standards are not met..

2.3. Evolution of tourism capacity concepts

The focus of carrying capacity approach has shifted from the idea of determining a maximum number of users towards the achievement of desirable conditions and the identification of limits of acceptable change (Coccosis H., Mexa A., 2004) and from the measurement of a phenomena toward its perception. This change puts the carrying capacity approach in a process that does not aim at providing a unique number, but the definition of many different capacities, each

one corresponding to a given management goal. Another change of the original theory is the shift from the maximum number of visitors to the optimal one, aiming at the maximisation of net benefits.

However, the correct measurement of tourism carrying capacity raises some other issues: carrying capacity is easier to define in delimited areas; its effective implementation depends on different factors, such as the role of actors, the consensus of the stakeholders and other cultural elements; it needs to be flexible and “tailor made” for the area under consideration, moreover it has to be monitored constantly.

Carrying capacity often translates into operative actions (EC, 2002): traffic regulation, limits to free access, limits to specific activities, concentration or dispersion of tourist flows and pressures, land use/spatial planning measures, economic tools such as pricing, taxes and incentive schemes, organizational tools such as booking system, information management, education, training and market control

To conclude the concept of tourism capacity in general, and the more specific concept of tourism carrying capacity, have gone through a process of refinement from a single criteria measurement toward a multidimensional definition. Taking into account this evolution, one may now analyse how it can be helpful to assist for the design of touristic flow management policy in a specific context. We elected Venice as an emblematic case, in that it combines a delicate built environment with a intensive touristic flows.

3. Tourism pressure and impacts in Venice

We first provide quantitative evidence on the impact of tourism in Venice. Subsequently, we analyze different estimates of Venice touristic capacity and finally we explore the measures that have been proposed or taken to cope with this issue.

3.1. The pressure of tourism in Venice

Visitor arrivals have developed dramatically in Venice: in 1949, less than 400.000 tourists were coming to Venice corresponding to 1 million overnights in the city. With a progressive and constant growth, by 1977 these figures had risen to 1 million tourist arrivals and 2 million overnights; by 1994, it reached 1,4 million arrivals and 3 million overnights; by 2004, 1,7 million arrivals and 4,4 million

overnights. Nowadays (2011) the center of Venice hosts 2,5 million of tourist arrivals and more than 6 million of overnights¹.

Moreover the tourists staying overnight in Venice center's accommodations are only part of the total visitors' number: in addition to the ones staying in the mainland or Lido, the visitor pressure is increased by excursionists staying in other parts of the north-east of Italy. In 1991, excursionists were estimated to be 6 million (Canestrelli and Costa, 1991). In 1996, COSES estimated the number of excursionists² as 7,4 millions. COSES also conducted a survey for the years 2006, 2007 and 2008 on visitor's transit in the city terminal discovering that the global number of visitors (excursionists + tourists) grew to 20-22 millions³.

Currently, the historic city has an average of 50-60.000 visitors a day which is nearly the resident population (COSES, 2007-2009) and, in some respects, the recent growth in cruise-ship traffic (short-term high-volume excursionists) has also placed additional strains on the city's tourist infrastructure.

3.2. *Problems of overcrowding in Venice?*

The increasing pressure of tourism, in particular of day-tripping which seems to be more costly and/or less beneficial than tourists, is progressively de-qualifying Venice as a tourist destination. Russo (2002) highlighted that the tourists' motivations for visiting cultural attractions of Venice puts the city in the latter stage of the resort life cycle - nearing stagnation and decline.

Montanari and Muscara (1995) recognized that Venice was saturated at key times in the year, most of all in the Easter and Summer periods, when more than 60.000 persons/day (with peaks of 100.000) visit Venice. Moreover, Montanari and Muscara (1995) recognized an increasing competition between inhabitants and visitors in the use of space within the historic city: up to 34% of the public space in the main itineraries and squares is used by visitors and 49% by residents, but during special events, the use by visitors increases to 56%. Since 1987, in some particular days of the year, the bridge connecting Venice to the mainland (Ponte della Libertà) has been closed to visitors as an extreme form of flow management.

¹ Source: www.comune.venezia.it

² This also includes the so-called « fake excursionist » who actually stay overnight on the mainland.

³ The global visitor market is segmented in tourist as guest of accommodations the in historic city and excursionist as visitor of Venice who does not spend a night in its accommodations; moreover, this second group is composed by day tripper as visitor of historic city who comes from and goes back home in a day, false excursionist as guest of accommodation elsewhere whose stays' motivation is to visit Venice, indirect as visitor who are on holiday elsewhere and has a day trip to Venice and in transit as visitor who are travelling to-or-from holiday destination and has a short stop in Venice.

Yet, Russo (2002) noticed that the city did not manage visits effectively (and it is likely to be still true nowadays): the time tourists spent on queuing at most attractive venues leads to lost opportunities to see lesser-known cultural attractions, increasing the congestion in the city's main points of interests. Russo (2002) highlighted that the average duration of day-trips was eight hours and many tour operators promoted day trips rather than overnight stays. The "socio-economic impact" of tourism in Venice was calculated by Costa, Gotti, van der Borg (1996) through the visitor-resident ratio in comparison with a number of other European heritage cities. In the historical centre of Venice the ratio was calculated in 89:1 while for the wider Venice municipality⁴ this dropped to 27:1.

The existence of such a pressure and the consequent conflicts between local and touristic needs have pressed for the definition of an adequate capacity and have urged for the implementation of adequate measures to manage the flows.

3.3. Evaluation of Venice touristic capacity

However, it was not until 1988-1991 that the first quantitative study on measuring the carrying capacity was performed proposing the linear programming method to quantify the carrying capacity of Venice. Unlike other models which are not systemic and analyse single aspects separately, the Venice's carrying capacity model takes into account all the constraints that characterize the carrying capacity: the physical one, the economic/financial one and the social one.

To estimate the carrying capacity of the historical centre of Venice, Costa and van der Borg (1988) and Canestrelli and Costa (1991) set up a mathematical model that includes the parameters of a future visitor management plan. These authors translated the conflict between tourism and other functions into a fuzzy linear programming model that maximises the income from tourism under capacity constraints. These constraints take into account, for example, the availability of accommodation, catering facilities, parking facilities, intra-urban transportation, waste disposal services and the space available in Saint Mark's Cathedral.

The maximisation program defined by Canestrelli, Costa and van der Borg for the city of Venice is recognized as the only one that estimates different capacities and condenses them into a single measure. Although there is a large body of literature on sustainable tourism, most of it relates to rural and coastal rather than urban areas (Felziani and Miarelli, 2012). Van den Berg, van der Borg and van der Meer (1995) within their comparative investigation into the role and function of tourism in eight European cities approached sustainability of tourism pointing out the existence of a "minimum limit", while Costa, Gotti e van der Borg studied the

⁴ Which also comprises some mainland areas and other islands.

impact of tourist flows on various medium-sized cities of art in Europe ("Visitor flows in cities of art" research programme 1990-1996, Ciset and UNESCO) and provided guidelines on how to intervene effectively to manage tourist flows.

Canestrelli, Costa and van der Borg found that in the case of Venice, the historical city can support about 25.000 visitors per day, of which about 15.000 tourists and 10.000 excursionists (the model tends to give priority first to tourists and then - if there is still capacity available - to excursionists): the optimal carrying capacity for the historic city of Venice would be to admit 9.780 tourists who use hotel accommodation, 1.460 tourists staying in non-hotel accommodation and 10.857 day trippers on a daily basis, than rounded (by excess) to 25.000 visitors⁵.

Research quoted by Costa and van der Borg (1993) showed that every day in August the city hosted around 37.800 day trippers alone in the late 1980s, while even in 1987 the 25.000 capacity was already being exceeded on 156 days. On 6 days they found the number even exceeded 50.000 visitors. Furthermore van der Borg forecast that by the year 2000 the figures of 25.000 would be exceeded 216 days a year, while on 7 days the number would exceed 100.000 tourists, four times the supposed maximum capacity. According to an estimate of Ciset, in 2000, the global number of visitors (tourists + excursionists) in Venice amounted to 11 million with a daily average of 30.000, indicating that the prospect indicated by van der Borg was substantially confirmed.

Moreover, the model indicated that the optimal visitor mix differed from the one hosted by Venice and that the overall pressure from tourism exceeded the capacity of the system. As Costa, Gotti and van der Borg (1996) observed that the negative external effects connected with the overloading of the carrying capacity were rapidly increasing and tourism was becoming increasingly ineffective for Venice: excursionists, who contribute less to the local tourism economy than staying visitors, were twice as much as the tourist overnights.

Glasson et al. (1995) summarized the problem of seeking to manage visitors and their environmental impact in Venice: every city must be kept as accessible as possible for some specific categories of users, such as inhabitants, visitors to offices and firms located in the city, and commuters studying or working in the city. At the same time, the authors claim, the art city needs to be kept as inaccessible as possible to some other user categories (the excursionist/day-trippers in particular).

⁵Also if the environmental carrying capacity (concerned with preservation) and the economic carrying capacity (concerned with economic gain) have different values, the 25.000 figure could represent a useful benchmark.

3.4. Tourism pressure in Venice: some possible solutions

Faced with tourist flow exceeding the different possible capacity definitions, one has to consider which management tools could effectively be used to cope with this issue.

Montanari and Muscara (1995) argued that Venetian water transport plays a major role in tourism within the city and could be used to manage visitors, while Russo (2002) argued that the better matching of tourism demand with the available supply of attractions through improved marketing and information would bring some economic benefits to the city.

Since 2000, a number of measures have been enacted to address the saturation of the historic city by day visitors including denying access to the city by unauthorized tour coaches through restriction in the access to the main coach terminal. Moreover, differential pricing was implemented in public transport and parking to discourage excursions.

Finally, the introduction of the Venice Card in 2004 to give pre-booked visitors priority access to attractions has been another move toward touristic flow management. This card should have been free of charge and facultative, giving considerable discounts and offering visitors access to museums and attractions that would otherwise remain closed to them. In the original idea, the card should have been turned into a sufficiently strong incentive to stop people making last minute travel decisions and to start planning their visit to the city. The number of cards available should have been equal the Venice's carrying capacity and residential tourists should automatically have received a card with the reservation of hotel accommodation. However, in order for such a system to work, a high amount of cooperation, coordination and public-private partnership was and is still necessary between the different stakeholders of the system.

Unfortunately, many of the systems proposed and set up to manage tourist flows in Venice were put aside few years later, principally for political reasons, even to give them the time to face a real start up period. Moreover, one of the evidence is that not just a system but a coordinate set of tools could better manage tourism in Venice.

4. A model for the management of tourist flows in Venice

In this section, we present a model for the evaluation and management of touristic flows in Venice. While answering to all the limitations of carrying capacity concept is out of the scope of this article, we posit the proposed approach is a progress compared to pre-existing studies in that: it relies on a univocal

quantification of capacity based on the notion of physical throughput of the different paths toward city center⁶ and on the safety criteria for the number of persons simultaneously present in Saint Mark Square. This approach reflects the peculiar geography of tourism in Venice that combines a strong attraction toward Saint Mark square and constrained access through a network of (sometimes narrow) accesses.

In its basics, the approach relies on the definition of two cordons conditions. First, the flow toward the centre cannot exceed the sum of the capacity of the different itineraries toward the centre. To implement this condition, information on the network geography and on the tourists' behaviour has been gathered. It allowed the identification of:

- 3 itineraries for people reaching the centre coming from the railway/bus/parking terminals area.
- 1 itinerary from San Marco east side mainly dedicated to people staying overnight in Venice and using water coaches coming from two secondary terminals (Tronchetto and Punta Sabbioni).
- 1 itinerary for people using waterway navigation to reach the area.

While one may argue that there are some other itineraries available to reach city centre, interviews with expert, systematic recognition of possible itineraries and direct field recognition confirm that the fraction of tourists using other itineraries is negligible.

Thus, summing these different itineraries sets a limit to the number of people that physically can access the centre.

$$K^{\text{center}} = \sum_{i=1}^I K_i \quad (1)$$

where K^{center} denotes the capacity (people per unit of time) of the access to city center and, K_i the capacity of each access.

The second constraint relies on the occupancy rate of Saint Mark's square. The relevant criteria here cannot be based on merely physical limitations: people could be massed up to virtually 6 persons/m², but would this make sense? A more reasonable approach is to take inspiration from safety regulations in use in public venues, which relate the maximum occupancy of a given venue with the size and number of accesses. Regulation (Decree 19 August 1996) state that the maximum occupancy of an open air venue, depend on the number access (considering how many 0,6 "module" exist in each access). Then, one can count the different

⁶City center is defined here as the area including and surrounding Saint Mark square for a few hundred meters. It does not adhere to the local tradition of calling "centro città" the insular part of Venice city that also expands to the mainland. We choose to do so to make the concept more understandable to non venetian.

accesses to the area and apply the ratio provided by regulation to obtain the number of people that can simultaneously occupy the area.

$$k^{sm} = \sum_{a=1}^A k_a \quad (2)$$

with k^{sm} , capacity (number of people simultaneously present) of Saint Mark's square, k_a is the capacity provided by each access to the San Marco area.

This number can subsequently be translated into a number of visitors per period of time by taking into account the average duration of stay in the square (derived from information given by the tour operators). Thus:

$$K^{sm} = k^{sm}/\delta \quad (3)$$

With K^{sm} , capacity in Saint Mark's square (number of person per unit of time), δ average duration of stay in the area.

While we recognise that safety conditions is only one among the different aspects of touristic flow management, it constitutes a bidding and univocal criteria that is, in our view, helpful to decision makers.

4.1. Residual capacity

Once a satisfactory estimate of the capacity is available one has to make a provision for use of the capacity by local population. Even if Venice centre has a strong touristic focus, it should still allow for the use by residents. In its most extreme form, that will be adopted here because of its adherence to policy maker view, this means that only capacity in excess to local population needs should be made available to tourists. Taking into account that the "tourist" vs. "local" population is too coarse we use the categorization proposed in the table below.

Table 1 –Population categories for the management of touristic flows

Category	Population
Local population (priority):	Inhabitants
	Owners of holiday homes
	Students
	Commuters
Touristic population:	Tourist
	Excursionists

Thus, when taking into account the various populations, one can use a relation as follows:

$$K_t = \text{Min} \left(K^{\text{center}} - \sum_{p=1}^R C_p^{\text{Center}}; K^{\text{sm}} - \sum_{p=1}^R C_p^{\text{sm}} \right) \quad (5)$$

with K_t is the capacity available for tourists, C_p^{Center} and C_p^{sm} are the capacities consumed by the local population in the access to city center and Saint Mark. This calculation results in a residual capacity of 110 000 tourists for the peak 6 hours. The different results obtained are detailed on Table 1.

Table 2 – definition of the residual capacity for the touristic use

	Access to city Center	San Marco
Total Capacity (6 h./ day)	170 000	150 000
Used by local population	60 000	10 000
Residual capacity:	110 000	130 000

4.2. Management of tourist flows

Once an estimate of capacity available for tourists is computed, one needs to set up operational measures to manage the flow. In our application this relies on the use of discount for tourists booking outside of the peak periods. More in detail, the model entails two sections: First a forecast of the number of tourist that would arrive in Venice in the “no policy” situation; second, a booking tool that offers discount for trips outside the forecast peak. We subsequently review these two different parts of the management tool.

The no policy flows are forecast based on two factors: calendar and special events (like Carnival, Architecture Biennale, Art biennale). Based on an archive of 50 years of tourist flows, one can disentangle the effect of these two factors and propose an estimated number of visitors for each day. Subsequently, one can classify the days according to whether the no policy flow would exceed the touristic capacity. In order to provide extra flexibility another threshold is considered where the touristic capacity is not exceeded but where it is approached⁷. Together these two thresholds define three tariff classes.

The pricing policy is implemented through discounts offered on a number of products mainly related to public amenities and services (public transport). The prospect, is, in a later stage, to enlarge the scope of the booking policy to other, non public, operators.

⁷This second threshold is defined by the average flows of the days that do not exceed the capacity.

5. Conclusions

In this paper we have reviewed the use of tourism capacity (whether carrying capacity or capacity tout court) for the management of tourism flows in Venice.

As far as conceptual issues are concerned, we find that the notion of capacity conveys a number of controversial aspects. While the recognition of the multidimensional aspects of the capacity certainly makes the concept richer and more relevant it also tends to weaken it and creates an indeterminacy: one needs to choose among the different dimensions or to create aggregation rules which will arguably appear discussible.

The concept also involves some weaknesses in terms of its use by the policy maker. Apart from the obvious objection that the indeterminacy of the concept opens the door to potential misuse (not to say manipulation), the more fundamental issue is that tourism flow management usually have strong negative outcomes for a limited number of stakeholders while it has limited/indirect benefits for a large number of stakeholders (and/or the environment). In these conditions, there is a consubstantial weakness in the political feasibility of tourism management, as strong interest could easily create coalition against.

Bearing this in mind, we have constructed a tool for the management of tourism flows in Venice that is based on the access to the city center and Saint Mark Square. This instrument can be, and is actually, used to implement booking policies that allow to shift some of the demand to non peak periods.

While this instrument is an advance toward a better management of tourism flows, our analysis suggested us that tourism management policy should have a global vision of the tourism system and could take inspiration as well from other tools of the economists. This relates mainly to the interest of using “compensatory” approaches to flow management, while the concept of capacity is, by nature, non compensatory. Thus, one could consider how the application of evaluation techniques, for instance Cost-Benefit Analysis could be of major relevance for tourism policy.

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SUMMARY**The relevance of the concept of capacity for the management of a tourist destination: theory and application to tourism management in Venice**

Tourism is usually seen as a local and regional development driver, but its growth could imply an excessive pressure on the environment or the cultural heritage of a destination, altering the social and economic conditions and modifying the quality of life for the local population. Moreover, the negative impacts of tourism could have an effect on the attractiveness and competitiveness of a destination.

In this context, the management of tourism flows becomes a central policy issue. This issue is often dealt with through the concept of tourist carrying capacity, or capacity “tout court” which expresses how many visitors can be acceptable in a given destination

The purpose of this article is to investigate how tourism management can help in achieving a sustainable touristic development considering a significant case study: Venice.