Tourism development: a game-theoretic policy kit

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L'idea dell' Osservatorio per il Turismo Sostenibile, elaborata e disegnata all'interno del progetto Parcopiù realizzato per il Parco Naturale della Maremma e co-finanziato dal Ministero dell'Ambiente, nasce dalla necessità di creare un luogo virtuale di discussione e confronto nonché di dotare quel territorio di uno strumento di monitoraggio e studio dei fenomeni turistici in un'ottica di sostenibilità. Il Parco è un punto di vista privilegiato a partire dal quale l'Osservatorio promuove lo sviluppo di un approccio ed una metodologia generali, di analisi come di policy.

I rapidi cambiamenti che stanno investendo il settore, insieme alle incertezze ed alle contraddizioni della situazione corrente, rendono necessario disporre di conoscenze adeguate e di strumenti tecnici e metodologici per una corretta pianificazione territoriale. L'applicazione dei principi della sostenibilità al turismo impone, inoltre, il coinvolgimento di professionalità diverse ed un approccio profondamente interdisciplinare, ancora tutto largamente da pensare ed articolare. Proprio per questo, l'Osservatorio nasce come struttura flessibile, aperta ai contributi di quanti operano e/o sono interessati allo sviluppo del territorio e che sono investiti della responsabilità di progettarne il futuro.

Questa collana di quaderni ed il sito web rappresentano i primi prodotti concreti dell'Osservatorio. L'obiettivo è che col tempo la collana ed i vari materiali raccolti nel sito diventino lo specchio di un vero e proprio forum interdisciplinare nonché uno strumento atto a diffondere informazione e conoscenza utile per l'attività di quanti, amministratori, studiosi, operatori, sono interessati allo sviluppo compatibile e di lungo periodo dei flussi turistici e delle attività ad essi connesse.

L'Osservatorio nasce su un capitale accumulato nella pluriennale esperienza di insegnamento e ricerca connesse al Corso di Studi in Economia dell'Ambiente e del Turismo Sostenibile, Università di Siena a Grosseto, nonché in esperienze come la redazione dei Piani Pluriennali di Sviluppo Socioeconomico del Sistema di Riserve Naturali della Provincia di Siena, del Parco Regionale della Maremma e dalla partecipazione al processo per la certificazione ISO 14001 di quest'ultimo.

Abstract

In this paper we give a special definition of tourism sustainability that is founded upon the idea of tourism being the encounter of two often internally structured populations. In such a definition, a path of sustainable tourism development may or may not result depending as to whether they share an interest in the sustainable exploitation of local resources (hence, they cooperate over commons), or else their respective interests are in conflict, thus leading to over-usage and in the longer run the destruction of local broadly defined environment and culture. This interaction situation can be naturally framed in simple and well known game theoretic settings, which make clear under what conditions any given outcome may result. As is well known, a key role is played by the possibility of repeating the game, a condition that with tourism takes up a peculiar aspect. The same setting permits to introduce policy considerations going beyond the conventional short run horizon of (demand oriented) tourism development.

Keywords: tourism sustainability; population dynamics; cooperative game theory; structural policies for sustainability.

1 The background[1]

Tourism development is commonly looked at as a set of economic activities all of them contributing to the welfare and economic development of the so called tourist destinations. In a more technical jargon, one could say that a Keynesian-type view is prevailing in the corresponding theoretical support of the economics of tourism, emphasis being on demand, employment and current income generated. Even infrastructures are taken into account for their induced effects on investment demand. The supply side of tourism is mandated to the theory of the tourist firms, or absorbed entirely into the theory of local development with an international trade extension. What is usually missing is the consideration of the tourism-specific agenda, the analysis of the structural impacts of tourism upon local conditions, all within the more appropriate long run time horizon.

Sustainable tourism can be provisionally defined as a long run path of sustainable utilization of local natural and man-made resources which minimizes the potential conflict between the involved communities. While the former is mainly exogenously defined, the latter depends on the specific characteristics of each destination and, therefore, is locally defined. As a consequence, we may have a bunch of outcomes, depending on the way the two parts combine themselves, only one of them producing sustainable tourism. Therefore, although sustainable tourism may share some issues of the broader sustainable development and dynamics with structural change and innovation, it presents some specificity one does not encounter in other fields which need to be considered.

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The main point we would like to stress in this paper is that tourism is the encounter of at least two communities, a temporary as opposed to a permanent one (Bimonte and Punzo [1]), whose needs, interests, and expectations are not necessarily convergent (Hardy *et al.*, [2]). This implies the sharing of local resources by the visitors and the pre-existing local community, whose home is being transformed into somebody else's destination. These resources are almost always local resources, with a historical record of local usages, which at one point have drifted into the area of interests of leisure visitors.

Sustainability in tourism is therefore about a development path that should emerge from the agreement among its various stakeholders, the residents, the tourists, the industry (Bimonte [3]). In this paper, we will tackle the issue of the various settings and forms of interaction between residents and tourists from the narrow viewpoint of an economist: to her, the programme of tourism as total social science, can only be realised via game theory, and in particular the theoretical setting of evolutionary game theory, where actors are whole populations, often internally structured (Bimonte and Punzo [1]). In the sequel we propose a *game theoretic kit* to re-examine tourism sustainability in this light.

2 The resident as a host

Since the seventies' a growing attention has been devoted to the perception and attitude of the resident with respect to the impact of tourism development upon their own welfare (Butler [4]; Doxey [5]). One of the main reasons for such interest is of course the increasing evidence that next to positive effects, like any other form of development, tourism development is not free from negative implications on social cohesion, cultural heritage, social values and the like (Liu and Var [6]; Robinson [7]). Huang e Stewart [8], for example, point out that tourist development alters the relations among residents and, more generally, between the individual resident and the community to which she belongs. Thus, the perception and the attitude of residents should be considered as crucial elements for the success of any tourism-driven plan of local development (Ap [9] [10]). The arrival of the tourist changes the rules of social co-existence with local resources: tourism is associated with a deep form of structural shock, first initialising a process of search for a new nature-society equilibrium.

According to a variant of one of the leading theories (the life cycle theory of tourism product), the history of a typical tourist destination is told as a deterministic passage through an orderly chain of phases (Cooper *et al* [11]). This is characterised by an adaptation of local

conditions to tourists' demand (Cohen [12]) through a process that tend to skip over the social and environmental impacts and costs of tourism, with a widening of the gap between private and social costs and benefits (Sinclair [13]). In fact, what this model considers and takes into consideration is only the number of tourist.

There is not much new in the above story, where we are practically recalling a tragedy of commons type of setting. The difference, though, is in that here the commons belong to one side of the contending populations. As a result the contention ignites a process of "negotiation" between the two parties, and therefore the product life cycle story could be better told within the frame of an evolutionary bargaining process with uncertain exits. A number of studies (see e.g. De Kadt [14]; Mathieson and Wall [15]; Font [16]; Snaith and Haley [17]) highlight the potential for conflict over the use of local resources between hosts and guests. To the authors' knowledge none investigates it within such a frame.

The uncertainty of exits relates to a number of factors, only some of them of a clear and deterministic influence (i.e. diversity across populations, other general cultural factors, location specificities, and the like). However, even in the presence of clearly delimited set of influencing factors the blending of those same ingredients in different locations at different times can yield altogether different outcomes. This makes more interesting a theoretical setting where several different equilibrium outcomes are explicitly allowed (as in the pioneering work of Axelrod [18]). While in such a situation we loose the value of firm prediction, we gain a fuller understanding of the various mechanisms and the complexity of the social situation, and encounter an appropriate frame for an *adaptive* approach to policy design.

In tourism there is a compelling case for policy linked with the need to coordinate individual choices over commonly shared resources that have also alternative uses. In fact, tourism not only generates an increased pressure upon the local resources, *but also,* at least in principle, a demand of different type and levels compared to that of the locals. Normally, unless restrained in some way, the tourists will tend to over-use local resources that are not theirs. They, on the other hand, may be met by a local population jealous of its ancient values with the implied rules of environmental preservations. However, we may also have cases where locals are willing to sacrifice them to the short term results of intensive exploitation whereas the tourists are eager to preserve them (just think to the case of the Eolie islands).

The outcome of the interaction between these two populations is crucial. It may be a sort of social agreement (if they share the same view over the administration of territorial resources) or disagreement. The former case will generate the stable social support for a path of tourism-

driven or tourism-related development, which may or may not be sustainable in strictly natural terms (depending upon the shared view), but which minimizes the costs of the potential conflict between the involved communities. In case of disagreement, we have an unstable situation of opposing views, igniting an evolutionary dynamics hunting for a stable equilibrium in order to minimize the conflict and its related costs. Knowing the scenarios of all these likely outcomes is therefore a key issue, both analytically and in the designing of any policy, an issue all too often played down when most needed.

3 Tourism as a social dilemma

The tourism entails the meeting between a stable and an unstable population with likely different discount rates. The key to sustainability is in devising policy schemes that make the two converge towards each other.

The game setting we are going to introduce belongs to the wide category of the social dilemmas, whereby the working of individual rationality ends up generating a collectively irrational outcome (see Olson [19]). One such dilemma arises whenever due to the free riding option, rational actors end up with an outcome that is socially sub-optimal. Social dilemmas show at least one inefficient equilibrium: it is an equilibrium, because it represents a situation where nobody has incentives to unilaterally modify her behaviour; it is inefficient as there is at least another outcome where everybody would be better off. Being aware of facing a social dilemma, a group of people might still find it impossible to avoid collective disaster due to uncoordinated choices.

Often the inefficient equilibrium is associated with the presence of a dominating strategy (i.e. a strategy such that it is the best for any single agent whatever the choices of the opponents). The perverse nature of the dilemma implies that the social welfare would be prejudiced by all actors implementing the dominating strategies.

The peculiarity of the tourist context descends from the very characteristics of some of the goods and services entering the so-called tourist product. These are economic goods, both tangible and intangible, whose conservation is threatened by the very development of the activity that generates its valorisation, tourism as such. They may often have critical tapping values, beyond which their use and often economic values dramatically diminish, or disappear altogether.

Unfortunately, unlike the classic example, their sustainable use implies the simultaneous cooperation of the two users, the resident and the tourist. These latter are normally in the

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practical impossibility of establishing reciprocal long run commitments. Therefore, even though both might prefer sustainability to overexploitation, they may find convenient not to contribute to its preservation. Over exploitation of the common resource will be the outcome of a joint, perverse cooperation between hosts and guests, unless an agreement otherwise be reached and signed between the two. The political engineering of how to reach and enforce such an agreement is the real challenge of devising policies for sustainability. Contents and aims of the latter are otherwise well understood in this game theoretic formulation.

4   The rules of the game(s)

Being clear the previous specifications, we will deal with the issue by the way of a game theoretic setting. This has many advantages in the representation of the social encounter of distinct players with possibly conflicting interests, as we are depicting tourists and residents. Among such advantages is the fact that the pay off matrix of the game, in extensive form, shows in an immediate way the structure and characteristics of situations of social dilemmas. It is natural to resort to the theory of non-cooperative games to analyse the necessary conditions for the emergence of cooperative equilibriums, where the two for convenience internally homogeneous populations opt to share the same strategy. With a suitable definition of the objective of cooperative behaviour (i.e. cooperation in sustainable exploitation of local resources), the cooperative outcome may support a path of sustainable tourism, while the non-cooperative one in fact may be represented also as implying a sort of perverse "cooperation" in the accelerated exploitation of local resources, and therefore implying a path of unsustainable tourism. This is the outcome that emerges as the likely result of the social dilemma associated with the existence of a dominant strategy.

Before going into this, it is worth defining the concept of *tourist-relevant resource(s)*. This indicates any resource (whether natural or man-made, material or immaterial) upon which a potential for conflict in usages exists between residents and tourists. It is clear that the identification of the set of such resources, which may be a subset of those available in a given location, is precondition to any discussion of the type in this paper. Any other resources will not be considered. For simplicity we will limit ourselves to the case of a single relevant resource, named "space-resource". *Space-resource* is a good metaphorical name for it highlights the fact that (almost) any tourist relevant resource has the character of a common. Since it may be used by both guests and hosts, problems arise on how and how much, and who should use it. However, in a sense it is the resource of one of them, the hosts who have

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been tilling, cultivating, preserving etc (and have, in fact, shaped it) all the time up to the recent tourist peaceful invasion. The novelty with respect to the classical situation leading to the *tragedy of commons* lies in this.

Let us drastically simplify and take only one tourist and one resident, representatives of their respective populations assumed to be internally homogeneous. This amounts to assuming that conflict may only arise among the two, not within. The object of potential conflict is of course the use of the space. In few cases the tourist resources are exclusively used by tourists or are preserved for residents. But this is not the case of what we defined space-resources. With regard to the latter, we may have an exploitation path, defined exogenously as being sustainable or unsustainable, the two populations may or may not agree upon. As things could get out of hand and become uneasily to handle, verbally as well as mathematically, we will assume only two possibilities well fitting the metaphor of the space, each being by definition an individual's strategy: the tourist (the host, respectively) may act in a non cooperative way in terms of resource utilisation trying to maximising her own benefits from the use of the common resource, being its discount rate high, or else she may opt for proposing cooperation in a project of preservation-cum-valorisation of that resource, being its discount rate low. It is worth noting that the reverse would apply if the parties cooperate in a project of exploitation-cum-deterioration. The first strategy is denoted by the symbol NC, while the latter by the symbol C. In this way, if the exploitation path on which to find an agreement is of the sustainable type, we associate with the (NC, NC) outcome the dreaded resources exploitation (the player *eating out* space or trying to crowd out the opponent), although within a non-conflicting context; while to the (C,C) outcome the dreamed sustainable tourism. In fact, the latter merges the minimum level of conflict with a sustainable exploitation path of resources.

4.1 The game within a context of ex-ante knowledge

Whenever tourist's and host's strategies match (i.e. (C, C) or (NC, NC)) and are known ex-ante, the two representative players share the same social norms and preferences even in conflicting uses over the resource. Therefore, an equilibrium emerges and the intercommunity conflict is minimised. Of course, with (C, C), the hosts makes willingly room for the guest, who tries not to be *too* invasive, he is soft tourist as he sees *intrinsic* value (possibly, with overflowing benefits) in the preservation of the local community. Akin to symbiotic cohabitation of biology, this *cooperative equilibrium* is a Pareto-optimum. This is

the only case in which the sustainable tourism emerges: the conflict is minimal, the exploitation path is sustainable and the long run social welfare is maximised.

When (NC, NC) prevails, both communities exhibit the same tendency to over-utilisation, which can also be interpreted as speculative prevailing over sustainable use of the relevant resource. In this case, the conflict is minimised but the resources are by mutual consent unsustainably exploited. Therefore, sustainable tourism does not emerge and the long run social welfare is not maximised.

Off the main diagonal, cooperation is unilateral, roles being interchanged. These cannot be either sustainable path or equilibrium states: at least one of the players can improve its position going for a different strategy, and the state of the game will move towards one of the two equilibrium outcomes. Which of them will eventually prevail depend on the preference rankings and the bargaining power of the players, of course.

4.2 The one shot game within a context of ex-ante ignorance

The prisoner's dilemma is a paradigmatic example to represent social dilemmas linked to the sub-optima equilibria. In this simple but classic setting, suppose the tourist like the resident have the same preference ordering over the payoffs, i.e. $c \succ a \succ d \succ b$, but each player acts in the *ignorance* of simultaneous (and past) decisions of its opponent (technically denominated a *one-shot* game). Although this is quite difficult to imagine, because ex-ante information is always available, it helps us to build up the analysis. Joint outcomes are symbolised in the payoff matrix representing, at any given date, the non-cooperative game setting in strategic form. Symbols in the bi-matrix stand as usual for gains for each player in whatever appropriate measure.

		host	
		C	**NC**
guest	**C**	a,a	b,c
	NC	c,b	d,d

Figure 1.

As said, for the sustainable use of resources a simultaneous cooperation is required. Thus, for each of the players the best strategy is defecting in face of cooperation, i.e. play NC against C. As said before, the next result is via (C,C), followed by (NC,NC). Finally, the worst outcome is got by C against NC, because the conflict is at its maximum and, due to the public good and/or common pool nature of the involved resources, sustainable exploitation would

be prejudiced. Moreover, in order to reduce the costs of the interaction she is involved in, an agent may even decide to alter her behaviour and normative standards (Graefe and Vaske [21]). Thus, NC is a dominating strategy whatever the opponent's choice, and both will be playing it, ending up in the lower, non cooperative equilibrium, (NC, NC).

In this outcome, known as tragedy of the commons after Hardin [20], both guests and hosts find it optimal to over-utilise the relevant resource: hosts expanding tourist related operations at the expense of other, perhaps traditional ones; tourists demanding such a conversion of traditional space of the local community to space specially equipped for them. Being a Nash equilibrium this equilibrium is self enforcing, not having in other words any internal motivations in the agent's interests in moving out of it. Individual rationality dictates choices that will generate to both the tourist and the resident a lower level of welfare. In fact, if playing empathically the same (C,C) strategy by e.g. accepting to restrict or control their pressure over available space resource, both tourist and residents are better off.

In the absence of a system of selective incentives, which for example change the payoffs and/or the individual preferences over them, in the one shot game as described above, where any one of the two is led by rational choice to play non-cooperatively, we end up with the worst possible social result. *Designing one such system of incentives (or anything else to play the same structural function of altering the game in favour of outcomes associated with socially supported long run exploitation of resources) would have to become the first policy issue.*

In the previous game, the resident is the one who will remain with whatever will be left, while the tourist will have the chance to move on to a new destination (exit option) or to move on to a new destination informing other tourists about that place (exit and voice option). The resident may have, in other words, a greater tendency to overlook its immediate self-interest. Therefore, the issue becomes how to involve and/or make costly for the tourist, and the resident as well, the non-cooperative behaviour. One way out could be to implement a simultaneous proper management of tourism demand and supply and the development of incentives for commitment.

5   The encounter as a repeated game

Whenever an infinite or uncertain number of repeated encounters is possible among the same tourist and resident we all know, and the Folk Theorem confirms, that there is a great variety

of possible equilibrium outcomes (Gibbons [22], Taylor [23])[2]. Even in a prisoner's dilemma situation repetitiveness by itself creates the possibility of a cooperative equilibrium, the rationale for which, though intuitively obvious, can be spelled out as follows. When selecting interaction strategy, the tourist (the host) is bound to take into account the likelihood that her current action be remembered (directly or through accessible information) and its undesired outcomes bring punishment in the next round of the game. However, whereas the resident may punish the tourist increasing the level of conflict (i.e. exploiting the tourist and reducing the quality of her tourist experience), the tourist may punish the resident through the exit (i.e. choosing other destinations) or the voice (i.e. informing other tourists) option. As a result, the tourist influxes may come to an end or, through the crowding out effect, the bad tourists would be selected (adverse selection effect) (Bimonte and Punzo [3]). Repeated interaction teaches players to trust (or not to trust) their no longer fortuitous encounters. Memory makes room for history in current interaction.

Therefore, the only way to pursue sustainable tourism development is to managing it as it were a repeated encounter between agents. To this end, since only the tourist has the exit option, the resident is compelled to invest in reputation and to find a way to efficaciously disseminate information about free riders. At the beginning, this could produce conflicts between resident and tourist. Since conflict is costly and the tourist has the exit option, in the long run this would produce the selection of that tourist which complies with the resident preferences and norms. Once again, resident may invest in sustainable as well unsustainable path of exploitation. Accordingly, the selected tourist may be of one or another type. Locally shared norms, repeated interaction, actual exit and voice options would permit to reduce the conflict and to select cooperative equilibrium.

Thus, at times and places, either or both sides may find a further incentive to play *fair*, in this context cooperatively, *also* as a way to induce an analogous behaviour on the one side of the encounter. But it may also happen that it is the tourist' initial good behaviour to induce the resident to cooperate. However, the typology of the interaction is such that we think that it is up to the local community to move first.

While we have no explanatory theory in this causal sense, we can still consider the long run and possibly the unfolding of such strategic games. Thus, we may have a situation where the

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[2] See for instance Binmore [24], pp. 373–76. The possibility of repeating the encounter is the first of the three necessary conditions for the emergence of cooperative solutions in non cooperative games, as argued by Axelrod [18]. The second requires that players recognise each other. The third condition requires each player to retain memory of the past opponent's move. Stabilising population within small groups, Axelrod's argument for enhancing the chances of an emerging cooperative solution, still makes sense.

tourist (or the resident) begins with and sticks to cooperation as long as this is being matched by the opponent, to resort to a selfish, non cooperative behaviour the moment and as long as the opponent defects. This situation, called Tit for Tat in the literature, is relatively simple, the Folk theorem naturally applying: at any one point of time, the tourist as well as the resident will look at the discounted stream of benefits from either strategy, and choose accordingly.

6 Some concluding remarks

In repeated games, also in Axelrod's version, among other things players have to be recognisable to each other, and this is the key to cooperation. The key is missing in general when the players are the tourist and the resident. Cooperative solutions are hard to emerge, then, for "structural reasons", and policies aimed to this target, or policies for sustainability in tourism, have to promote structural change of a kind: altering time horizons, encouraging their convergence, so as to force players to take into account the future effects of their current interaction. Developing policies for increasing direct (the same tourist) and/or indirect (a friend of the present visitor) fidelization; reinforcing the cohesion of communities (sharing norms); building a set of efficient and efficacious tools to suction free riders (i.e. implementing a system to make the voice and exit option actually feasible), is one way to push into this direction.

The agenda of policies for sustainable tourism has, however, to look also at the intra-community effects of tourism development, hence at what can be called as the equilibrium within the host (guest) community, to distinguish it from the equilibrium between communities on which we focused so far. The persistence of cooperative equilibrium within an isolated community explains both the emergence of social shared norms, as well as the environment-production equilibrium characterising generally traditional communities (see e.g. Henrich, J. and R. Boyd. [25]). With respect to the latter (and all communities have gone through a similar phase at one point in their history), tourism is one of the structural shocks that can abruptly bring them out of a history ancient state of equilibrium with nature, and set them in search of a new one, where tourist is part of the landscape. Tourism therefore brings about a structural change by changing the rules of the game, and admitting new players to the green cloth.

The interaction with an often-anonymous tourist therefore breaks down norms with the social homogeneity that had been reached in the past. We know (Alesina and La Ferrara [26],

Esteban and Ray [27]) that internally less homogeneous communities have a lower capacity of reaching cohesion about a common project and therefore will tend to produce less of public goods, and/or find it more difficult to manage common resources. Some of these are, we said, the indispensable bread and butter of virtually all tourist products.

Game theory teaches us that the last but not least item in the agenda of a sustainable policy for tourism is to enhance and preserve, whenever it exists, and to promote or restore wherever it (no longer) exists, social cohesion as an essential input to long lived tourism industry.

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