Attractiveness Model of Environmental Quality and Recreation: a case study of the River rine Regions of Nigeria

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Abstract: The attention for tourism and recreation in advanced and underdeveloped Regions is the result of many socio-economic and environmental elements. This paper investigates with models why these regions consider tourism and recreation as a major source of an accelerated growth process. These socio-economic and environmental elements gave: (i) rise in leisure time (ii) rise in welfare especially the increase of discretionary income, (iii) increase accessibility of many regions and infrastructure etc. It is found that the rise of mass tourism and recreation has led to several negative externalities such as congestion, environmental decay, destruction of traditional social structures, increase in socio-economic Inequality and likes. The methodology and analysis were based on the local or regional attractiveness in the form of the set of physical and environmental qualities of a region. Discussion of result was based on assessment of sound methods and comparism of models. In conclusion, choice of attractiveness was made between environmental quality and quantity of tourism and recreational behaviour such as: family size, family composition, education, income etc., residential characteristics and characteristic of recreational areas such as: ecological quality accessibility etc. Their attractiveness activities have fairly high income elasticity with respect to the demand for tourism services. In Nigeria case that is full of uncertainty which should be a true life situation the models used for the analyses of these elements could not justify these uncertainties, therefore the work recommends the Gardener's model of the Markovian Decision Theory to take care of these lapses.

Keywords: tourism, recreation, environmental, social-economic, interaction models.

1 INTRODUCTION

Spatial mobility is to a considerable extent determined by environmental factors.The increased attention for tourism and recreation in advanced countries is the result of many socio-economic and environmental elements.

These elements constitute the general back ground of the post-war 'tourism and recreational movement; the average annual rise in tourist and recreational expenditure in industrialized countries during the post-war period has been approximately 10 per cent Burkart and Medik, (1974). This explains also why underdeveloped regions consider tourism and recreation as a major sources of an accelerated growth process, particularly because these activities have a fairly high income elasticity with respect to the demand for tourist services Baretje and Defert, (1972); Harper et al., (1966).

A further analysis of tourism and recreation has to be based on the notion of local or regional attractiveness, by which is meant the set of physical and environmental qualities of a place or region that determine tourist and recreational behaviour. This notion was operationalized via a profile analysis (section 2). This concept of an explicit attractiveness is confronted with an allied concept, such as, implicit attractiveness as revealed by actual tourist and recreation patterns. The latter concept may be based on entropy or gravity assumption (section 2.1). Next, attention is paid to some traditional approaches to tourist and recreational behaviour reflected by monetary assessments of local or regional attractiveness. A brief survey of these assessment methods is presented and also a comparison is carried out with respect to the foregoing methods (Section 2.1). The analyses presented in sections 2 – 2.2 is showed by some empirical models developed in the Netherlands (section 3).

1. 1 Statement of Problem

The rise of mass tourism and recreation had led to several negative externalities such as (i) congestion, (ii) environmental decay, (iii) destruction of traditional social structures, (iv) increase in socio-economic inequality and the like Dasmann et al., (1973); Stankey, (1972) (v) it has therefore become an extremely important problem to control tourist and recreation patterns. A prerequisite for more adequate management of tourist and recreational areas is a better insight into the motives of tourist and recreational behaviour, so that a more integrated view of supply and demand of tourist and recreational facilities may be attained.

2 CONCEPTION OF ATTRACTIVENESS ANALYSIS BY MEANS OF REGIONAL PROFILE MODELS

A regional profile is a quantitative vector-valued presentation of the quality characteristics of a region van Delft and Nijkamp, (1977); Nijkamp, (1977a), paelink and Nijkamp, (1976). The set of characteristics is determined by the phenomenon studied. For example, a locational profile comprises inter alia regional accessibility, forward and backward linkages, agglomeration factors, planning controls, etc. Similary, a regional tourist (or recreational) profile may comprise travel distance, volume of tourist accommodations, quantity of natural areas, socio-cultural assets and the like. A regional tourist profile P_r may be represented in vector notation as

$$P_r' = (P_{1r}, \ldots, p_{ir}, \ldots\ldots, p_{Ir}), \forall r, \quad (1)$$

Where p_{ir} is the i th element of the profile of region r (r = 1,….., R). obviously, these element should be defined in measurable operational terms. A whole set of regional profile date can be included in an I x R profile matrix p:

$$P = \begin{pmatrix} P_{11} & \ldots & p_{1R} \\ . & & . \\ . & . & . \\ . & & . \\ P_{11} & \ldots & p_{1R} \end{pmatrix} \quad (2)$$

There are two different methods to extract a regional tourist attractiveness indicator from matrix p (provided the elements are measured in metric units). The first method is based on a standardization of p, so that all elements are translated into dimensionless comparable units. The simplest standardization is to divide all elements of the ith row of p by the row maximum p_i^{max}, provided profile element is a ‘benefit' criterion (‘the higher, the better'). Other wise, the elements should be transformed as $I - p_{ir} / p_i^{max}$. in other words, the standardized matrix, denoted by p*, becomes

$$\begin{aligned} p^* &= (p^{max})^{-1} p, \text{ for benefit criteria} \\ &= I - (p^{max})^{-1} p, \text{ for cost criteria} \quad (3) \end{aligned}$$

Where p^{max} is a diagonal matrix with elements p_i^{max} on the main diagonal. Then an R x 1 attractiveness vector a for all regions can be calculated as

$$a = (p^*)'_1, \quad (4)$$

where 1 is a vector with unit elements. If the individual attractiveness elements are weighted according to their relative importance by means of a weight vector w ($_I$'w = 1), the weighted attractiveness vector a* is equal to

$$a = (p^*)'w. \quad (5)$$

.The second method of calculating attractiveness indicators is based on more advanced multivariate techniques, especially interdependence analysis. Interdependence analysis is a new method by means of which a multi-dimensional data set can be reduced to a subset composed of a limited number original variables among others Beale, (1970), Boyce et al (1974), and Nijkamp, 1978, (1979). This analysis comprises an optimal subset selection on the basis of statistical correlation techniques by means of which a limited subset of variables can be selected from the original total set of variables. In this way the Multidimensional data set is reduced to an optimum subset that reflects the original data at a maximum degree. The advantage of an interdependence analysis is the fact that the optimum subset is composed of original variables and not of transformed variables (as is usual in principal component analysis). The basic idea of an interdependence analysis is a recursive correlation analysis between successive subsets of the original data set. By means of multiple correlation coefficients a subset of original variables closely associated with the total data set can be identified an application of this technique to environment evaluation problems is contained in Nijkamp, (1977b).

2.1 Attractiveness analysis by means of implicit regional indicators

The analysis in section 2 described how attractiveness indicator determined a priori might serve to explain and predict tourist and recreational behaviour. A frequently used alternative method is the calculation or assessment of the attractiveness of tourist or recreational areas on the basis of actual behaviour. Such a revealed preference assumption can be used to predict spatial tourist or recreational mobility via regional attractiveness indicators determined on the basis of the implicit attractiveness of an area resulting from visits from the past.

Implicit attractiveness methods are mainly based on gravity-type models and on entropy models. The attractiveness value of an area can be seen as the relative size of tourist and recreational flows to that area with the effects of distance extracted, so that by means of spatial allocation models the implicit attractiveness of a tourist or recreation area can be argued. Examples of this approach can be found in Burton (1970), Cessario(1973), and Ellis and van Doren (1966) among others. A simple specification of such a gravity model is

$$t_{kr} = \alpha_r \, d_{kr}^{-\beta}, \tag{6}$$

with t_{kr} = number of recreation seekers from region k(k = 1, . . ., K) to r

(r = 1, . . ., R).

d_{kr} = distance between region k and r.

α_r = implicit (unknown) attractiveness indicator of region r.

β = distance friction coefficient.

Model (6) can be estimated by means of least squares methods after a logarithmic transformation, so that on the basis of observation on t_{kr} and d_{kr} the implicit attractiveness α_r of each area can be gauged. The foregoing model can be written in matrix notation as

$$T = \Delta\alpha \tag{7}$$

Where T is a K x R matrix elements t_{kr}, Δ a (K x R) matrix with elements $d_{kr}^{-\beta}$, and α a diagonal matrix whose elements are those of α_r.
an alternative specification of (6) satisfying additivity conditions is

$$\frac{t_{kr}}{t_k} = \frac{\alpha_r \, d_{kr}^{-\beta}}{\sum_{r=1}^{R} \alpha_r \, d_{kr}^{-\beta}}, \tag{8}$$

where t_k. is given by

$$t_k = \sum_{r=1}^{R} t_{kr} \tag{9}$$

Model (8) is written in matrix notation as:

$$t^{-1}T = (\Delta\alpha)^{-1} \Delta\alpha, \tag{10}$$

Where t is a K x K diagonal matrix with t_k . as diagonal elements. Operational extensions of the gravity approach are contained Klaassen and Verster (1974), who divided the attractiveness indicator into a quality component and a size component. A Monte Caro simulations study associated with a gravity model for recreation trips can be found in van Lier (1970).

By means of the above mentioned gravity models an implicit assessment of regional attractiveness from actual tourist or recreational behaviour can be carried out. The unidimensional elements α_r can be considered as the result of many heterogeneous quality factors reflected by human behaviour.

Models (6)-(10) were only based on attractiveness elements of the region of destination and did not take into account repulsion effects exerted by the regions of origin. Therefore, a model may be created which includes both emissiveness effects and attractiveness effects. A logical structure for such an integrated model is provided by entropy theory. Entropy theory constitutes a foundation for many spatial interaction models cf. Wilson, (1970). In the respect, entropy is a descriptive device, based on the assumption of spatial equilibrium (i.e. the most probable state of a spatial system associated with maximum entropy).

Obviously, there are numerous ways of assigning recreation flows to an origin-destination table, assuming a given number of recreation seekers to and from each region. The advantage of entropy theory is that it provides a logical and consistent framework for an optimal spatial arrangement of a spatial system also Nijkamp and paelinck, (1974), paelinck and Nijkamp (1976). In our approach the entropy variant developed by Cesario (1973) is employed. This variant can essentially be considered as a straightforward extension of (6) or (7):

$$t_{kr} = ce_k \alpha_r d_{kr}^{-\beta}, \qquad (11)$$

where c is a constant to be estimated and e_k the (unknown) emissiveness value of region k. The latter value is associated with the population size in region k and its 'propensity to recreate'. This model can be written in matrix notation as

$$T = ce\Delta\alpha, \qquad (12)$$

The relevance of the latter model is that it provides a tool to estimate simultaneously the relative implicit emissiveness values e_k of all starting regions and the relative implicit attractiveness values α_r of all regions of destination. These revealed preference values are essentially determined by recreational behaviour in the past and can only be estimated via observed flows.

Next, the important question arises whether the above-mentioned profile methods based on a priori quantified regional quality characteristics and be confronted with the ex post implicit attractiveness values based on revealed behaviour. A logical approach is to correlate the implicit attractiveness values α_r with the explicit attractiveness indices a_r (4) or with the J elements of the rth column of the truncated explicit quality matrix p. in other words, the hypothesis of a significant (linear) relationship for the following model, was tested

$$\alpha_r = k\,\alpha_r + \epsilon_r \qquad (13)$$

or

$$\alpha_r = \sum_{j=1}^{R} k_j p_{jr} + \epsilon_r, \qquad (14)$$

Where k and k_j are unknown coefficients and ϵ_r an error term. Models (13) and (14) was tested by means of least-squares techniques, so that conclusions can be drawn concerning the correlation between prior and posterior attractiveness for an application section (3). In other words, the profile methods also provide a tool to test revealed preference assumptions.

2. 2 Attractiveness analysis by means of implicit monetary values

In the foregoing section the relative tourist and recreational attractiveness of a region has been approximated on the basis of actual tourist or recreational flows to the area concerned. In traditional economic literature on tourist and recreational behaviour a different approach has been chosen, viz, a valuation of a tourist or recreation areas by means of monetary units. The monetary approaches are mainly based on demand curves for recreational commodities, so that this approach is essentially a result of a welfare-theoretic approach to the valuation of tourist or recreation areas.

One of the well-known approaches in this field is the method developed by Trice and Wood (1958). This method is based on a traditional van Thunen model with one centrally located recreation area and a set of surrounding residential places (at different distances from the central recreation places). The assumption is made that visitors from nearby places benefit from the proximity of the recreation area at hand. This social benefit (the consumer surplus) is equal to the difference between the maximum travel costs from the remote areas and the travel costs actually paid.

Consequently, total recreational benefit of the recreation area concerned is equal to the aggregated consumer surplus. Assuming, for example, N residential places 1, ... , N and assuming that place N has the highest distance with respect to the recreation area in question, the recreational benefits b are given by

$$b = \sum_{n=1}^{N} (c_N - c_n) r_n, \qquad (15)$$

where c_n (n = 1, . . . , N) represents the individual travel costs from place n to the central recreation area and r_n represents the total number of recreation seekers from zone n.

There are several stringent assumptions underlying the foregoing approach recreational trips as such are a disutility, the willingness to pay is equal for all recreation seekers, and the consumer surplus is mainly determined by the most remote residential place (N). Consequently, positive utility effects of traveling (like sightseeing) are neglected, individual features codetermining the actual willingness to pay are left aside, and indirect social externalities of the proximity of a recreation area (for example, its effect on residential property values are omitted.

Extensions of the above –mentioned method were proposed among others by Clawson (1959), who used total expenditures instead of travel expenditures for the recreation area concerned. In addition, he derived a demand curve for the recreation area itself and gauged the monetary value of this area by means of expected revenues of a hypothetical owner being a non-discriminating monopolist.

Another extension was suggested by knetsch (1963) who also took into account substitution effects with respect to another relevant recreation areas as well as congestion effects in the itself. Thus, the total recreation demand curve proposed by knetsch is:

$$t_r = f\,(c_r,\, y_r,\, g_{r,}\, \sigma_r) \qquad (16)$$

where t_r ,c_r, y_r, $g_{r,}$ and σ_r denote respectively the number of visitors of area r, the average expenditures for visiting area r, the average income of visitors to area r, the degree of congestion in area r (e.g the occupation rate), and the degree of substitution to recreation areas adjacent to area r. Clearly, the latter variable represents a spatial competition effect closely allied to a complementary utility-based analysis was presented by seckler (1966), who emphasized the benefit-cost ratio as a measure for evaluating recreation areas.

3 DISCUSSION OF RESULTS ON EMPIRICAL RECREATION MODELS

The foregoing types of recreation models were applied in a recreation study for the River rime regions of Nigeria. This region was divided into 10 residential areas and 21 recreation areas. First, the models discussed in section 2 were estimated, so that the implicit attractiveness of the 21 recreation areas was assessed. Given a set of data on t_{kr} and d_{kr}, the distance friction and the regional attractiveness indicators were gauged. A brief survey of the results is contained in table 1.

Table .1 Implicit attractiveness of 21 recreational areas

Region	Attractiveness	t-value	Region	Attractiveness	t-value
1	2.81	4.32	12	1.00	0.48
2	2.40	4.68	13	0.8	-1.68
3	1.65	1.62	14	0.2	-0.89
4	0.75	- 1.05	15	1.58	3.03
5	0.16	-5.01	16	0.58	-1.55
6	0.05	-7.31	17	4.90	5.16
7	0.58	-1.63	18	1.09	0.78
8	0.56	-2.08	19	0.85	-0.84
9	4.02	5.43	20	1.34	0.62
10	0.44	-3.40	21	4.61	6.23
11	0.35	-3.08			

The results of this table show that most attractiveness indicators are significant at a 2σ-level, although there are some glaring exceptions. The reason for this situation may be that the model does not take into account heterogeneous socio-economic groups and discrepancies or uncertainties among recreational purposes. Clearly, a more adequate assessment of the attractiveness of recreation areas would require an extension of the analysis with diverse income groups socio-psychological elements, different types of recreation and a model split, the Gardener's model of the Markovian Decision Theory etc. for the moment, lack of data hampers such a more satisfactory analysis.

The next step is link to the implicit attractiveness presented in Table .1 to the environmental profile of the recreation areas by means of model (4.9). The environmental quality characteristics of the profile are here on two main categories, viz. the total capacity of swimming pools and natural beaches in the area concerned and the total size of natural areas (divided among woods, lakes and dunes) in the recreation region concerned. These two explicit elements of each of the 21 recreation regions were correlated with the implicit attractiveness elements from Table .1. the following results were obtained by means of a least-squares procedure :

$$\alpha_r = 0.13\ \alpha_r^1 + 0.49\alpha_r^2 \qquad (17)$$

Where α_r^1 and α_r^2 represent the above-mentioned capacity variable (x 10^3 persons) and the size of natural area (x 10^3 hectares), respectively. The figures in brackets represent t-values of the least-squares estimation procedure. The results show that the ex-post attractiveness analysis can be explained in a significant way on the basis of the elements of the a priori environmental profile. Clearly, the latter simple model might be extended with distance friction etc.

Finally, the monetary evaluation procedure will be clarified. The reference region is assumed (region 19 from Table .1). The assignment model was based here on a maximum capacity assumption per recreation category (woods, beach, water sports), so that recreation seekers can be assigned from residential areas to recreation areas on the basis of a minimum distance hypothesis. When the capacity of the recreation area concerned is reached (i.e. the congestion occurs), the next minimum distance region is chosen, etc. when the recreation area at hand (region 19) is deleted, the total number of passenger kilometers will certainly rise (from t^A and t^B). Application of this ideal to the above-mentioned spatial system leads to average annual rise of passenger kilometers (viz., $t^A - t^B = 12 \times 10^6$).

Assuming 0.20Dfl. per direct recreational kilometer cost Tideman, (1975) and 0.085Dfl. per perceived recreational travel time kilometer do Donnea, (1971) and average recreational expenditure u is approximately equal to 0.285Dfl. Therefore, the shadow value of region 19 is 0.285 x 12 x 10^6 Dfl., so that $v_{19} = 3.4 \times 10^6$.

4 CONCLUSION

The general conclusion from the analysis is that environmental profiles are useful operational tools to study and quantify tourist and recreational behaviour, as their use make it possible to take into account a wide variety of regional environmental quality characteristics. The implicit attractiveness is an important complementary tool to these profile methods.

Another conclusion to be drawn is that recreation of all facets of recreational behaviour. Necessary elements to be included in a more integrated recreation study are individual characteristics (like family size, family composition education, income, etc.), residential characteristics (quality of dwellings, size of dwellings, social climate, urbanization rate, etc.) and characteristic of recreation areas (size, ecological quality, accessibility, etc.). There appears to be a basic need for a more integrated recreation model covering the wide variety of determinants of human spatial behaviour.

In Nigeria case that is full of uncertainty which should be a true life situation the models used for the analyses of these elements could not justify these uncertainties, therefore the work recommends the Gardener's model of the Markovian Decision Theory to take care of these lapses.

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