POLISH ACADEMY OF SCIENCES
SYSTEMS RESEARCH INSTITUTE

STRATEGIC REGIONAL POLICY

A. STRASZAK AND J.W. OWSIŃSKI
EDITORS

PART II

WARSAW 1985

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STRATEGIC REGIONAL POLICY

Paradigms, Methods, Issues and Case Studies

A. Straszak and J.W. Owsiński
editors

Documentation of the workshop on "Strategic Regional Policy", December 10 - 14, 1984, Warsaw, organized by the Systems Research Institute, Polish Academy of Sciences and the International Institute for Applied Systems Analysis

PART II

WARSAW 1985

VI. METHODS:
MONITORING, MODELLING, CONTROL

EVALUATION OF THE EFFECTS OF PUBLIC POLICIES BY USING THE INTERREGIONAL TOURISM MODEL

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INTRODUCTION

Tourism is not only an interesting subject of study for social and geographic scientists. It had been recognised a long time ago as an important sector of regional economies. As a result there exists, among the regional planners and decision makers, a growing interest in the methods of evaluation of economic benefits accruing from tourism as well as - the eveluation of effects of concrete policies in pricing, taxing and regional investments.

The present paper is concerned mainly with the methodological aspects of tourism policies. In particular, an attempt has been made to analyse the following problems:

- how the demand, originating in subregion R_i, for recreation in subregion R_j, depends on demographic and socioeconomic structure of R_i and how it is influenced by attractiveness of R_j including prices, travel costs etc.?
- how the future demand for tourism is related to the future supply of accomodation and service facilities?
- what should be the regional policy in taxing and public investments so as to maximize the revenue, satisfy the tourists and private facilities owners, protect the regional environment etc.?
- how a computerised system can assists the planners and decision makers in improving the regional planning strategy?

CONSUMER DEMAND FOR TOURISM

The standard approach to consumer demand for recreation and tourism (which is a recreation spent outside the tourist residence place) is based on maximization of the utility function (see e.g. Becker (1965), De Serpa (1971), Vickerman (1975)), of the general form

$$U = F(x, x_o) \tag{1}$$

where

x - vector of consumption of recreation goods and services,

x_o - vector of consumption of the rest of goods and services;

subject to the budget constraint

$$\pi x^T + p_o x_o^T \leqslant Y, \tag{2}$$

where

π, p_o = vectors of prices attached to x, x_o respectively,

x^T, x_o^T = transposed vectors,

Y = consumer income per year.

A typical example of U, with scalar variables x, x_o, is the function

$$U = \bar{U} \, x^{\beta} x_o^{1-\beta} \quad , \tag{3}$$

where $\bar{U}$, β - given positive numbers, $0 < \beta < 1$.

Maximizing (3) subject to (2) one obtains the optimum quantities of x_o and x which are demanded by the consumer

$$\hat{x} = \frac{\beta}{\pi} Y \quad , \quad \hat{x}_o = \frac{1-\beta}{p_o} Y .$$

Then one can derive the value of $U(\hat{x}, \hat{x}_o) \triangleq \hat{U}$:

$$\hat{U} = \bar{U} \left(\frac{1-\beta}{p_o} \right)^{1-\beta} \left(\frac{\beta}{\pi} \right)^{\beta} Y . \tag{4}$$

Since the variable Y, p_o, π and U change in time t it is useful to introduce the relative increments of the type

$$\delta Y = (Y(t+\Delta t) - Y(t)) : Y(t)$$

Using the incremental variables one can represent (4) for small Δt in the form

$$\delta \hat{U} \cong \delta Y - (1-\beta) \delta p_o - \beta \delta \pi \tag{5}$$

It can be observed that in order to have $\delta\hat{U} \geqslant 0$ the relative increase of income per year δY should not be smaller than the combined increase of prices $(1-\beta)\delta p_o+\beta\delta\pi$.

As follows from statistical data analysis the share (β) of recreation expenditures $\pi\hat{x}$ in total of expenditures Y, depends on age, social group, and income class (to which a particular consumer belongs). For example, the Household Budget Survey, published by the Main Statistical Office in Poland (1984) reveals that the expenditure per person, in urban white collar families, meant for recreation (including also sports, culture, entertainments) is 0.109 of total income. However, for urban blue collar that figure is 0.076, while for the farmers it is only 0.035.

Generally, β, increases along with the increasing income Y.

It means that people whose income δY is growing faster (slower) than the annual rise of prices switch to the more expensive (resp. cheaper) forms of recreation (i.e. they use the utility model with bigger (smaller) β). It may be also assumed that β does not change when $\delta\hat{U} \approx 0$.

These observations indicate that in order to have a realistic model of recreation it is necessary to split the total population in different social and age groups and income classes, each characterised by a different β parameter. Dealing, in what follows, with such classes β is regarded as a constant within each class.

Another important feature of recreation demand model is that recreation x should not be regarded as another good existing on the market but as the good "produced", using the consumer's time T and his financial resources (see e.g. Backer (1965), Vickerman (1975)). An assumption of decreasing marginal utility with respect to recreation time T is also necessary. According to that assumption the consumer satisfaction, which follows from consumption of Δx, in elementary time interval ΔT, decreases with the increasing total recreation time T. In other words, function x(T) is assumed increasing and concave.

To be concrete, one can assume that function x(T) can be approximated (with accuracy sufficient for practical purposes) by the exponential function

$$x = k^{1-\alpha} T^{\alpha} \quad , \quad 0 < \alpha < 1 \; , \tag{6}$$

where k, α are given positive numbers.

It can be also assumed that recreation may be consumed within independent, separated in time, subintervals. During these subintervals one restores the physical and mental ability for an efficient work, which decays during the working interval. When the seperation intervals are long enough the resulting recreation x can be regarded as the sum of n recreations per year, taking place within T_i subintervals, i.e.:

$$x = \sum_{i=1}^{n} k^{1-\alpha} T_i^{\alpha} \tag{7}$$

It should be observed that in case of limited total recreation time T it pays to recreate in equal subintervals. Indeed, one can easily check that the optimum values of $T_i \triangleq \hat{T}_i$, $i=1\ldots n$, which maximize (7), subject to

$$\sum_{i=1}^{n} T_i \leq T,$$

become

$$\hat{T}_i = \frac{T}{n} \; , \quad i=1\ldots n.$$

The value of (7) for $T_i = T/n$, becomes

$$\hat{x} \triangleq x(\hat{T}_i) = (nk)^{1-\alpha} T^{\alpha} ,$$

and it is by the factor $n^{1-\alpha}$ greater than (6) (which corresponds to the recreation taken in one interval of T days).

One of the main reasons the tourists do not split T in subintervals indefinitely is the impact of travel cost

$$C_t = \omega n \tau .$$

where τ=time of travel (days), ω=cost of travel per day; which increases along with n.

The travel time $n\tau$ decreases also the effective time spent for recreation (unles the travelling itself is a recreation).

The optimum tourist strategy, when he is trying to maximize his utility (i.e. x) with respect to n and T, can be derived by finding

$$\max_{n,T}(nk)^{q}T^{\alpha} \tag{8}$$

subject to budget constraint

$$pT + \omega n\tau \leqslant \beta Y, \tag{9}$$

where p=cost of accomodation per day.

Solving the problem (8), (9) one finds easily that the optimum frequency of trips $\hat{n}$ and recreation time $\hat{T}$ becomes

$$\hat{n} = \frac{q\beta Y}{\gamma\omega\tau}, \quad \hat{T} = \frac{\alpha\beta Y}{\gamma p}, \quad \gamma = \alpha + q.$$

Using $\{\hat{n},\hat{T}\}$ trip strategy the tourists attain the following level of recreation

$$\hat{x} \triangleq x(\hat{n}\hat{T}) = \frac{(\beta Y)^{\gamma}}{\pi}, \tag{10}$$

where

$$\pi = \left(\frac{p\gamma}{\alpha}\right)^{\alpha}\left(\frac{\omega\tau\gamma}{kq}\right)^{q} \tag{11}$$

Observe that for $\gamma < 1$ the marginal recreation $d\hat{x}/dY$ decreases along with growing expenditures βY.

What one gets out of relations (10), (11) is the price of tourism type of recreation π. That price increases along with the accomodation price p and the travel cost $\omega\tau$.

Using (11) one can express the relative rise of utility (5) in the form

$$\delta\hat{U} = \left[1-\beta(1-\gamma)\right]\delta Y-(1-\beta)\delta p_{o}-\beta(\alpha\delta p+q\delta\omega) \tag{12}$$

which shows the impact of changing accomodation (δp) and transport ($\delta\omega$) prices on the growth of tourist utility.

One can now derive the monetary value of net demand for tourism (travel excluding) by L consumers, each having the income Y:

$$Y_{n} = (\beta Y - \hat{n}\omega\tau)L = (1 - \frac{q}{\gamma})^{\beta}\, YL \tag{13}$$

Using the population class (L) and income (Y) forecasts one can derive by (13) the expected, future (e.g. one year ahead) demands.

The next important step in our analysis is the derivation of interregional allocation of net demand (Y_n), which determines the future interregional tourism demands.

INTERREGIONAL DEMAND FOR TOURISM

Consider a system of m regions R_i, i=1...m, each having the (group) population L_i and the accomodation price (per 1 tourist and 1 night) p_i. Assume travel times τ_{ij} between each pair $\{R_i, R_j\}$ as given.

Each region has consumption preferences described by the utility function of the form (3):

$$U_i = \overline{U}_i x_i^{\beta_o} x_{oi}^{1-\beta_o}, \quad i=1...m, \tag{14}$$

where
x_i = aggregate tourism consumption at R_i,
x_{oi} = aggregate consumption of the rest of goods at R_i.

The tourists from R_i, i=1...m, come to the common market exhibiting the net demand for recreation (see (13)) $Y_{ni} = \beta(1-\frac{q}{\gamma})YL_i$.

In the present section our main task is to find the interregional allocation of the net demands. It will be assumed that the tourists visits to each region are independent and seperated in time so the term x_i in (14) can be regarded as composed of the relations (10), (11) as follows

$$x_{ij} = Y_{ij}^{\gamma}/\pi_{ij} = K_{ij}^{1-\beta} Y_{ij}^{\gamma},$$

where

$$\pi_{ij} = \left(\frac{\gamma p_j}{\alpha}\right)^{\alpha} \left(\frac{\gamma\omega\tau_{ij}}{k_j q}\right)^{q}, \quad K_{ij} = (\pi_{ij})^{1/\gamma-1}, \quad i,j=1...m. \tag{15}$$

The tourists strategy consists in finding such $Y_{ij} \triangleq \hat{Y}_{ij}$ j=1...m, which maximize

$$x_i = \sum_{j=1}^{m} K_{ij}^{1-\gamma} Y_{ij}^{\gamma}, \tag{16}$$

subject to

$$\sum_{j=1}^{m} Y_{ij} \leqslant Y_{ni}, \quad Y_{ij} \geqslant 0, \quad j=1\ldots m \tag{17}$$

In order to solve the present problem it is convenient to apply the aggregation theory, described in Kulikowski (1974). Using that theory one finds easily

$$\hat{Y}_{ij} = \frac{K_{ij}}{K_i} Y_{ni}, \quad j = 1\ldots m, \tag{18}$$

where

$$K_i = \sum_{j=1}^{m} K_{ij}, \quad i = 1\ldots m. \tag{19}$$

The value of $x_i(\hat{Y}_{ij}) \triangleq \hat{x}_i$ becomes

$$\hat{x}_i = K_i^{1-\gamma} Y_{ni}^{\gamma}.$$

On the other hand $\hat{x}_i = Y_{ni}^{\gamma}/\pi_i$

where

$$\pi_i = K_i^{\gamma-1}, \quad i = 1\ldots m.$$

is the resulting price.

It is possible to observe that the total demand $\sum_j Y_{ij}$ under optimum allocation strategy (18) is equal to Y_{ni}, $i=1\ldots m$.*

The formula (18) says that the share of total demand $(\hat{Y}_{ij} : Y_{ni})$ originating in region R_i with respect to the destination R_j is equal $K_{ij} : K_i$. It is going down when p_j or $\omega\tau_{ij}$ are increasing while the rest of regional prices do not change.

The coefficient K_{ij} may be called the resulting attractiveness of region R_j for tourists coming from region R_i, while k_j represents the original attractiveness of R_j.

When one knows the monetary values of demand Y_{ij} and prices p_j it is possible to derive the demand (in nights beds units) denoted by $D_{ij} \triangleq \hat{Y}_{ij}/p_j$.

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* One can show, however, that when $\gamma \to 1$; $K_{ij} = \max\{K_{ij}\}$ and the tourists are spending all of their resources in subregion j_m only.

Obviously the total demand at R_j becomes

$$Y_j = \sum_{i=1}^{m} \hat{Y}_{ij} = p_j D_j \quad , \quad D_j = \sum_{i=1}^{m} D_{ij} \quad , \quad j=1...m.$$

REGIONAL BENEFITS AND POLICIES

To complete the analysis of interregional tourist market it is necessary to derive the future supply of services, denoted by S_j, in each region $j=1...m$.

Generally the services are supplied by owners of facilities (such as hotels, restaurants, ski-lifts etc., and will be denoted S_{oj}) and by regional authorities (supply of water, waste treatment, cleaning streets and parks etc., which will be denoted by S_{aj}). The values of S_{oj}, S_{aj} are closely related to the existing capacities Q_{oj}, Q_{aj} of service facilities. If the tourism season duration is d_j days one can also express the supply of services in terms of capacities, i.e.

$$S_{oj} = Q_{oj} d_j \quad , \quad S_{aj} = Q_{aj} d_j \quad , \quad j=1...m.$$

The capacities express the supply in terms of such units as beds or daily water requirement per one tourist etc. These units are useful when one studies the capital and operating costs of service facilities.

A typical cost functional for a facility owner C_{oj} is a function of the supply i.e. capacity Q_{oj} and the really served number of bednights, determined by the demand D_{oj}:

$$C_{oj}(D_{oj}, Q_{oj}) = c_1(Q_{oj}) + c_2 D_{oj} + c_3(D_{oj}, Q_{oj}), \tag{20}$$

where c_1, c_2, c_3, are given positive coefficients.

The first term in (20) represents the capital cost component and depends mainly on the capacity Q_{oj}. The second represents the maintenance costs, such as water and electricity costs etc. The last term takes into account the "utilization of capacity" effect, i.e. an increase of marginal costs when the capacity is not fully used.

A similar cost function (C_{aj}) can be written for the facilities owned by regional authorities. Generally speaking the cost functions exhibit the scale effects with respect to increasing capacities and they are frequently given in the graphical form with capacity as a parameter.

When the cost functions are known one can derive the future benefits B_{oj}, B_{aj} of the facility owners and regional authorities. In order to do that it should be taken into account that the tourists are taxed so the resulting accomodation price per day (p_j) consists of the sum of price $\bar{p}_j$, which was used last year, the tax component $\kappa_j \bar{p}_j$, and the planned increase of price $\bar{p}_j$, δp_j, i.e. $p_j = \bar{p}_j (1 + \delta p_j + \kappa_j)$.

The expected benefit of regional facility owner, i.e. the annual profit, becomes

$$B_{oj}(\delta p_j, Q_{oj}) = D_j(p_j)(p_j - \kappa_j \bar{p}_j) - C_{oj}(D_j(p_j), Q_{oj}), \; j=1...m. \quad (21)$$

B_{oj} depends on the price strategy δp_j and capacity supplied by the owner of facility. In the similar way the expected benefit for regional authority is equal the yearly revenue

$$B_{aj}(\kappa_j, Q_{aj}) = D_j(p_j)\kappa_j \bar{p}_j - C_{aj}(D_j(p_j), Q_{aj}), \quad j=1...m, \quad (22)$$

depending on the tax level κ_j and capacity Q_{aj} set by the authority.

To make the picture complete one has also to include the expected benefits of tourists (B_{ti}) residing in the region R_i. These benefits can be assumed equal the annual increase of utility (see (12)):

$$B_{ti} = (1-\beta(1-\gamma))\delta Y - (1-\beta)\delta p_o - \beta\delta\pi_i \,, \; i=1...m, \quad (23)$$

where δY is the tourist's yearly increase of income,

$\delta\pi_i$ = relative growth of recreation prices (induced by δp_j, κ_j, j=1...m), and $\delta\omega$, where,

$\delta\omega$= relative growth of travel prices,

δp_o is here exogeneous.

A possible approach to the interregional population movements (such as migration, commuting, and also tourism) can be based on cooperative game theory (see Kulikowski (1979)). Using such an approach the facility owners, tourists and the regional authority are regarded as partners in a cooperative game. The main problem is the following: under what conditions the game is stable (in the sense that game participants take advantage entering a particular coalition of partners over the remaining coalitions)? The stability means in particular that the game is acceptable to all the partners, i.e. the benefits of the partners are nonnegative:

$$B_{aj} \geqslant 0, \quad B_{oj} \geqslant 0, \quad B_{ti} \geqslant 0, \quad i,j=1\ldots m. \tag{24}$$

When the game is unstable, and the benefits of tourists (or facility owners) become negative, they may switch to another regional coalition, characterised e.g. by different price and income class $Y(\beta)$.

The game participants may apply at each stage of the game the following strategies:

a) the facility owners set the prices δp_j and capacities Q_{oj},
b) the authorities, in the similar way, set taxes κ_j and Q_{aj},
c) the tourists come out with demands, claimed by group population L_i, depending on their income growth δY.

Due to the lack of suitable information the particular game participants may loose (or win) at each stage. For example, the facility owners may loose if they increase the price δp_j too much so that demand $D_j(p_j)$ drops down drastically and the existing capacity is not properly utilised. The same happens to the regional authority and the tourists of a particular class if they does not fit the right (with respect to price & service category) regional coalition.

In the interest of all the parties concerned it is important that a competitive market and an efficient exchange of information, among the game participants, exists. For example, the regional authorities and facility owners can benefit from coordination of investment policies. The tourists can benefit if they have a reliable information about prices and capacities, while the regions can benefit by learning about the future tourism demands.

AN INTERACTIVE MODEL OF INTERREGIONAL TOURISM

An interactive model can be regarded as a planning tool enableing evaluation of future effects of different policies, without necessity of performing experiments on the real regional economy. Experience gathered that way may prove to be useful when the planners and decision makers deal with the real regional systems.

In Fig.1 a simple (single class income) model, in which all the regions outside R_j has been aggregated into the so called rest of the country system (R_r), is shown as an example. The model consists of regional tourists submodels T_j, T_r, which generate regional net demands (in monetary units):

$$Y_{nj} = (1 - \frac{q}{\gamma})\beta Y L_j \ , \quad Y_{nr} = (1 - \frac{q}{\gamma})\beta Y L_r \ ,$$

using demographic, economic and travel cost forecasts, necessary for calculation of q/γ, β, Y, L parameters.

The net demands enter the tourism market submodel (TM) where, by formulae (18), (19), the regional demands are derived:

$$D_j = D_{rj} + D_{jj} \ , \quad D_r = D_{jr} + D_{rr} \ , \tag{25}$$

with

$$D_{rj} = \frac{K_{rj} Y_{nr}}{(K_{rj} + K_{rr}) p_j} \ , \quad D_{jj} = \frac{K_{jj} Y_{nj}}{(K_{jr} + K_{jj}) p_j} \tag{26}$$

$$D_{jr} = \frac{K_{jr} Y_{nj}}{(K_{jr} + K_{jj}) p_r} \ , \quad D_{rr} = \frac{K_{rr} Y_{nr}}{(K_{rj} + K_{rr}) p_r} \tag{27}$$

(K_{rj}, K_{jr}, K_{jj}, K_{rr} can be computed by (15)).

In order to compute D_j, D_r the M submodel should be also supplied with the information regarding prices δp_j, δp_r, taxes κ_j, κ_r, and capacities Q_{oj}, Q_{or}, Q_{aj}, Q_{ar}, which are set by FO_j, FO_r (facility owners) and RA_j, RA_r (regional authorities) submodels, representing regions R_j, R_r respectively. The TM submodel transmits also information on demands to the remaining submodels.

For each set of demands and supply strategies the computerized TM submodel derives by (22), (24) the set of benefits

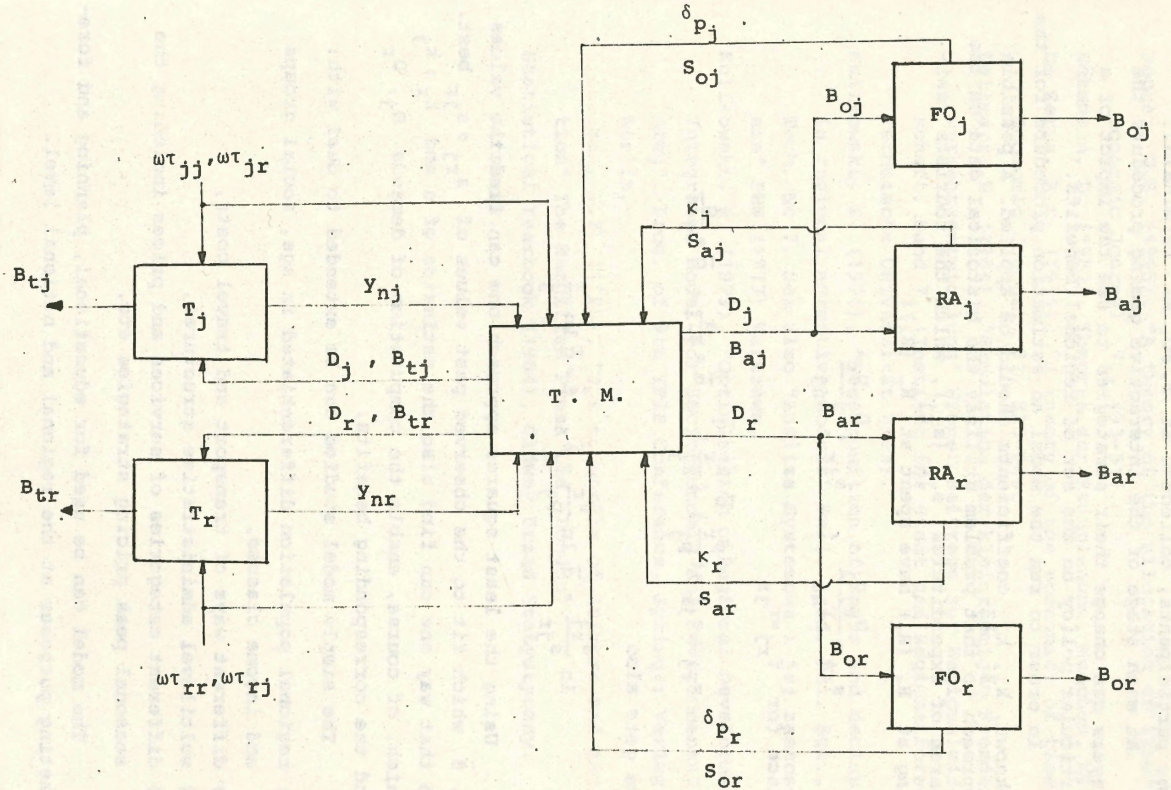

Fig. 1. Interactive Model of Interregional Tourism

B_{oj}, B_{or}, B_{aj}, B_{ar}, B_{tj}, B_{tr}, which are communicated to the game participants, collected at T, FO, RA terminals.

At each stage of the interactive gaming procedure the players can change their strategies to see the impact of a particular policy on the set of regional benefits.

In order to run the model an estimation procedure for the unknown, k_j, k_r coefficients should be applied. A possible approach to that problem utilizes the historical data on the shares of expenditures s_{jr} (s_{rj}), which the tourists residing at R_j (R_r) have spent at R_r (R_j):

$$s_{rj} = \frac{D_{rj} p_j}{Y_{nr}}, \quad s_{jr} = \frac{D_{jr} p_r}{Y_{nj}}$$

Since for $\tau_{rj} = \tau_{jr}$

$$s_{rj} : s_{jr} = \left(\frac{p_r}{p_j}\right)^{\overline{\alpha}} \left(\frac{k_r}{k_j}\right)^{\overline{q}}, \quad \overline{\alpha} = \frac{\alpha}{\gamma-1}, \quad \overline{q} = \frac{q}{\gamma-1}$$

one gets also

$$\ln \frac{s_{rj}}{s_{jr}} = \overline{\alpha} \ln \frac{p_r}{p_j} + \tilde{\beta}, \quad \tilde{\beta} = \overline{q} \ln \frac{k_r}{k_j}$$

Using the least squares approach one can find the values $\overline{\alpha}$, $\tilde{\beta}$ which fit to the observed past values of $s_{rj} : s_{jr}$ best. In that way one can find also the estimates of α and $k_r : k_j$ which, of course, enable the computation of demands D_j, D_r and the corresponding benefits.

The simple model studied can be extended to deal with:

a) regional population differentiated in age, social groups and income classes,

b) different ways of transport and travel costs,

c) multilevel administrative structures,

d) different categories of services and prices including the seasonal peak pricing strategies etc.

The model can be used for educational, planning and forecasting purposes at the regional and national level.

REFERENCES

Becker, G.S. (1965), "A theory of the allocation of time" Economic Journal, 75, 493-517.

Bökemann, D. (1982), Theorie der Raumplanung, Munchen, Wien.

De Serpa, A.C. (1971), "A theory of the economics of time" Economic Journal, 81, 828-846.

Feilmayr, W. (1984), "Simulation der kleinräumigen Fremdenverkehrsentwicklung" Wiener Beitrage zur Regionalwissenschaft. Band 7. (Institut fur Stadt und Regionalforschung Technische Universität Wien).

Kulikowski, R. (1974), "Decomposition of goals and decissions in regional normative models" Bull. Acad. Pol. Sci., Ser. Tech. No 7. See also "Analiza Systemowa i jej zastosowanie" PWN (1977) Warszawa.

Kulikowski, R. (1979), "Optimization of Regional Development - Integrated Model for Socioeconomic and Environmental Planning". Proc. of 9th IFIP Conference, Springer Verlag, Berlin.

Vickerman, R.W. (1975), "The economics of leisure and recreation" The MacMillan Press Ltd. London.

Statistical Yearbook (1984), Główny Urząd Statystyczny. Warszawa.

DISCUSSIONS

Paper by I. Masser

Discussion participants: R. Espejo, A. Straszak, I. Masser.

Discussion focussed on functions which should be performed by local government and on proper balancing of these functions. This regards e.g. the strategic monitoring function and the eveluation and appreciation functions. A lack of such a balance may lead to impairment of planning and implementation capacities in local governments. It turns out crucial to set up a mechanism for getting a feedback, through reporting, hearings - seemingly - redundant information, related to own plans and acttions. Modern computing equipment may greatly help in carrying out this task, but it must be used in a very delicate manner.

Paper by D. Boekemann and R. Kulikowski

Discussion participants: I. Masser, S. Dresch, S. Ikeda, R. Kulikowski, D. Boekemann.

The discussion concentrated first of all on the institutional side of the systems modell, with particular attention paid to the differences between Austria and Poland in that domain. The authors acknowledged existence of such differences, but pointted out that they can be reduced to the question of proportions, since e.g. there is in Poland an important, although not very large, share of market-oriented tourism operations. When the international tourism market is considered, differences get even smaller. In case of Poland the main problem is adequate cooperation between various operators in the tourism and recreation field*, be it specialized enterprises, trade unions, institutions owning facilities for their employees etc. This applies as well, to investment policies and regional promotion, made on the basis of investments and other approaches.

Utility functions of local authority decisions were said to be assessed primarily on the basis of monetary value of decisions made.

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* Most of these operators enlarge recently the market-oriented share of their activities (eds.).

Paper by M. Steiner and U. Posch

Discussion participants: A. Mouwen, S. Ikeda, M. Steiner.

First, in answering the question on possibilities of a foreasting use of the results obtained it was indicated that factor analysis by itself does not reveal the causal structure, which would be necessary for any sort of forecasting application. Thus, only a comparative study could be undertaken. On the other hand, the available time series of the data did not go beyond the period 1971--1981, and for some items only 1971-1979, and therefore the comparative study could not encompass the dynamics of processes in question, but only the static aspects.

Paper by J. Kacprzyk and A. Straszak

Discussion participants: R. Espejo, I. Masser, J. Kacprzyk.

Discussion centered around the need of implementing computer-based information systems using approaches which would not lose much of the information available and still present it in a simple and legible way. Besides the fuzzy-set-theoretic constructs other approaches were cited, such as Bayesian inference rules. Within this context the questions related to extensions of such applications were raised, pertaining namely to knowledge-based expert systems. These systems,nowadays in the development stage, may contain information in terms of "if... then..." statements, where both conditions and events are fuzzy defined. When developed and tested, such systems may have a great impact on observation and analysis of socio--economic processes.

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