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THE SYSTEM APPROACH IN MODELLING RECREATION

The present day is characterized by a continuously increasing leisure time and therefore a bigger demand for various services which might help in the organization of our free time and ensure its rational utilization. In such a situation recreation outside one's own place of residence, in the broad meaning of the term, has acquired a particular importance. At the same time, a sharp disproportion has appeared between society's recreational needs and their actual satisfaction, on the one hand, and scientific knowledge of the recreation nature, its role in social life and the country's or region's economics, as well as the organization of geographical space, on the other.

To fill in the gap between social needs and our knowledge of them is a very difficult task in this case, since tourist and recreational phenomena are very complex and make up a subject of interest to many scientific disciplines. Tourism and recreation, as social phenomena, are investigated by such sciences as sociology, social psychology, man's ecology, medicine, etc; as a branch of the economy they are studied by economics; as a spatial phenomenon they are researched by geography; and as a factor using up and transforming the natural environment they are also a subject of interest to natural sciences. Therefore, interest in research into the discussed phenomena is many-sided, though only some disciplines have undertaken more intensive studies. This is particularly true of the spatial, economic, and natural conditions of tourism and recreation outside one's own place of residence.

The unequal rate of the development of the separate research trends is predominantly caused by lack of a comprehensive approach to the nature of analysed phenomena and the prevalence of branch-reductionist approach upon a holistic one.

Because of the interdisciplinary character of investigated phenomena, to build up the general theory of the science of recreation requires

first of all the basing the whole process of thinking upon philosophical premises of one of the integrating metatheories, like the general theory of systems. Its premises seem to be best for the discussed research, though certain limitations are also apparent since it is impossible to transform data into the mathematical language and construct dynamic functional models. Recreation as well as one of its forms — tourism — are a combination of quantitative and qualitative, measurable and immeasurable properties, and this is a serious handicap to the application of formalized methods.

Certain qualitative properties can be expressed in the quantitative language. However, there still remains a whole group of properties, which might never be expressed quantitatively. For example, such subjective feelings of man's resting as his appreciation of the beauty of the landscape, or the mental comfort. This makes it difficult to construct a homogeneous mathematical model, based entirely upon quantitative properties, and therefore to formalize the whole research procedure in mathematical terms.

In such a situation there is only one solution, namely to start with a heterogeneous model, qualitative-quantitative, consisting of the three groups of properties: quantitative, measurable qualitative and immeasurable qualitative, which can only be estimated. Of course, such a model will always be objective and subjective at the same time.

When we construct the theory of recreation, our basic problem is to identify the premises which stimulate recreation needs and the factors which lead to their satisfaction. In a general way, we may define those needs as a set of psycho-social motivations: recreational and health-oriented (R), cognitive (C) and ludicral (L), i.e. as

$$N = (R, C, L).$$

Irrespective of what form recreation adopts, these three groups of motivations will always be present, though their intensity and linkages between them may be varied. Sometimes, one group clearly dominates, e.g. a rest in a sanatorium; sometimes it is impossible to discover which motivation prevails.

Recreation needs cannot always be satisfied. This depends upon many external factors concerned with the needs felt by man. Thus, a *sui generis* controversy arises between those needs and their possible fulfilment, often causing quite considerable mental stress. Generally speaking, those needs, which are expressed by the intensity of recreation are a function of a number of variables: the level of society wealth (W), the degree of the country's or region's urban development (U), an ade-

quate material-technical base for recreation (B),, access to transport means (T), political-administrative conditions, favourable or unfavourable, underlying the satisfaction of needs (A), the character of job (J), and the style of living (L), which has developed under the influence of historical and cultural or professional tradition, the impact of fashion, etc. These can be presented as the following functional dependence:

$$P = f(W, U, B, T, A, J, L).$$

The elements of the above equation are intransitive: we cannot maneouvre them and replace the low value of one by a high value of another.

The adoption of the general theory of systems as a basis for modelling and shaping recreation phenomena, enables us to confront the problem from one of the many possibilities of a comprehensive approach according tn implied objectives (e.g. the achievement of a specific state, structure, or the preservation of the system), criteria (e.g. social or economic effectiveness, preservation of nature's values), and the spatial character (world's, country's, regional, etc. systems). The system model may have various forms, from an explanatory (cognitive) to a utilitarian one.

The first geographical work in which the system approach was used to present recreation problems is an already classic study by W. S. Preobrazhensky (1975). The auhor believes that both the "recreational systems" (non spatial) as well as the "territorial recreational systems" can be defined as complex, open, with the structure of type UC (Universe of Discourse and Couplings), dynamic, with a substantial internal organization.

The present study is concerned only with spatial systems (territorial recreation systems, subsequently referred as TRS) as the most interesting for a geographer.

The structure of every system, i.e. also of the TRS, can be described following an analysis of interactions between its elements. However, the effects of the functioning of the system as a whole can be characterized by the identification of the relations between the input (i.e. independent variables of the system) and the output (i.e. dependent variables which result from the functioning of the system). In this case the system itself fulfils the role of a "black box", the transformer of inputs into outputs.

The territorial recreational system operates surrounded by other socio-economic-natural systems (agricultural, settlement, forestry, water, etc.) with which it is tied together by numerous links.

Therefore, the study is based upon the assumption that the structure of the TRS consists of 9 subsystems of rank I (demand, environment, natural resources, historical and cultural resources, participants in recreation, material and technical base, personal services, forms of the organization of recreation, spatial and functional structure) and 100 subsystems of rank II (Fig. 1).

This is clearly a complicated system, associating quantitative and qualitative, measurable and immeasurable variables. To collect data referring to measurable variables does not present any greater difficulty, but to arrive at objective qualitative variables requires the application of techniques and methods adopted in qualimetric research, or resulting from the theory of usefulness.

The transformation of data into the matrix of mutual linkages of the type N×N is a basis upon which the degree of linkages between the particular subsystems of ranks I and II is quantitatively estimated both inside the system and between the system and its environment, as donors or takers of interactions. The degree of linkages between the individual subsystems of rank II inside the TRS is presented in Table 1.

Another attempt to present system relations is by means of the method of the "black box", which is particularly useful in an analysis of the impact of the functioning of the TRS on its environment, particularly when the role of recreation in the region's economy is estimated.

Table 1

Linkages between Subsystems of Rank I on a Conventional Scale, 5 (strongest), 1 (weakest)

Subsystems of rank I		1	2	3	4	5	6	7	8	9
1	Demand	—	2	3	2	2	5	3	4	4
2	Environment	3	—	5	1	4	4	3	3	5
3	Natural resources	4	4	—	1	4	4	2	4	5
4	Historical and cultural resources	4	1	1	—	5	2	3	4	4
5	Participants in recreation	3	2	4	4	—	5	5	5	5
6	Material and technical base	4	3	5	1	5	—	4	3	5
7	Personal service	3	1	1	1	5	4	—	3	2
8	Forms of the organization of recreation	4	2	4	2	5	3	4	—	3
9	Spatial and functional structure	4	4	5	3	5	4	3	3	—

However, to measure other effects of recreation, such as a better state of health, or cultural effect is a difficult task and the only way out is to estimate them on the basis of questionnaires collected *post factum*.

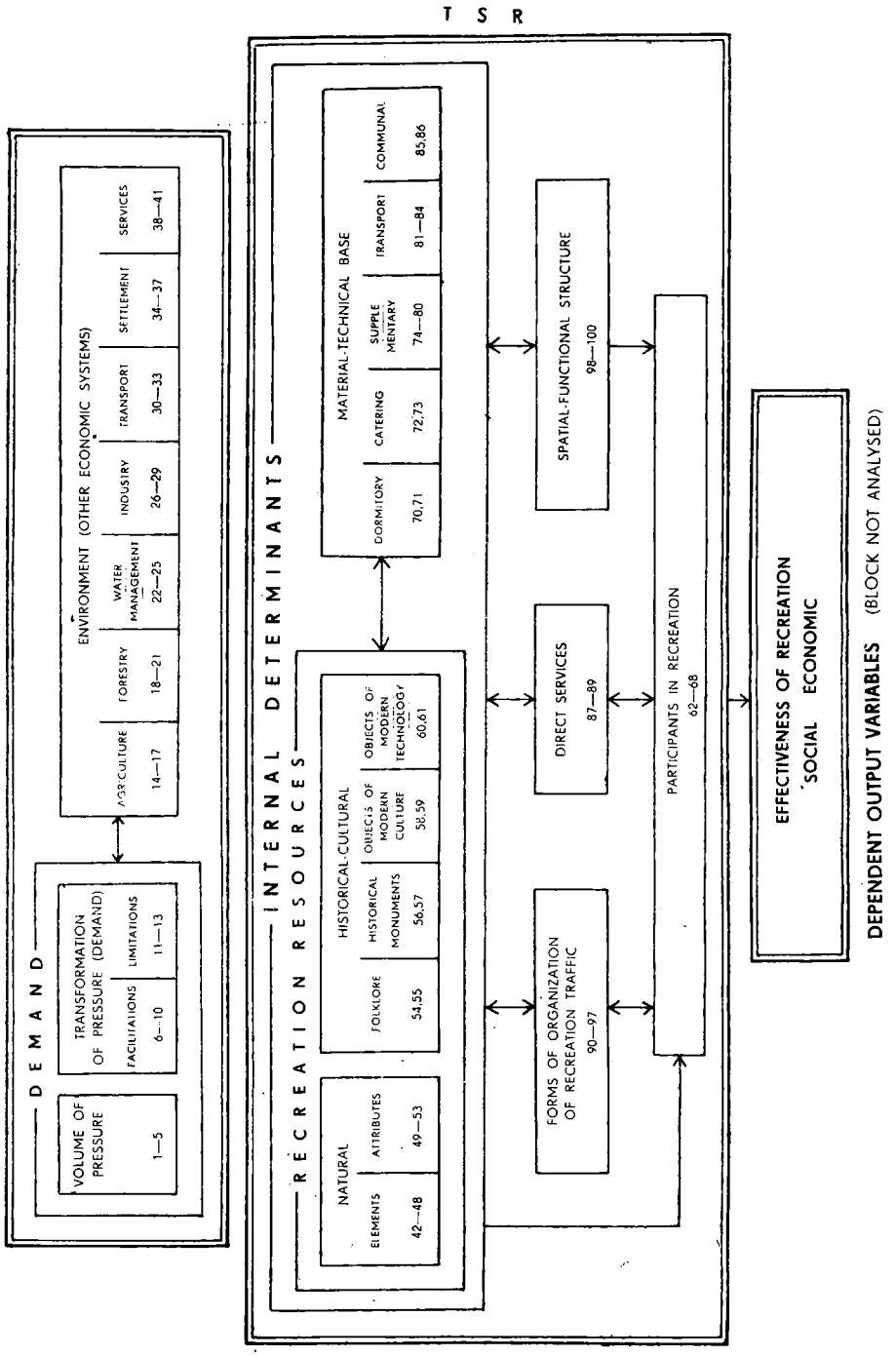
The territorial recreation system because of its functions and the mode of their realization can be treated also as the so-called system of mass-service. On the one hand, the TRS is characterized by its territorialism, and on the other by a great complexity resulting from the complex construction of "service channels". Moreover, the analysed system also differs in that it does not fulfil certain premises of the classic queueing theory, such as the randomness in the selection of clients, as a consequence of planning recreation and of the method of its organization. Thus, we are faced with a deterministic form of the system of mass-service. The general scheme of the TRS as a system of mass-service is presented in Fig. 3, and may be described as follows.

A stream $d(t)$ of potential participants in recreation arrives at a territorial recreation system at a time t (t may denote specific months or years) for a selected type of recreation. The TRS, having at its disposal a certain number of "service channels" (objects or groups of objects of the same class) can — or cannot — satisfy the clients' requirements. The intensity of service in separate channels may be influenced by adequate investment or by an administrative intervention.

The objective of steering the TRS as a mass-service system is to keep balance between demand for and supply of services, whereas simultaneously limitations imposed by the needs of a rational utilization of natural, historical-cultural, or material-technical resources, as well as the effectiveness of the process of recreation itself, should be taken into consideration.

The stream $d(t)$ of participants in recreation is difficult to regulate because its volume is a function of many factors that can be controlled (e.g. the dormitory base, the catering base, transport), as well as those which cannot be controlled (physico-geographical conditions, historical nad cultural resources, attractiveness of the landscape, etc.).

The construction of the mathematical model of the TRS requires the fulfilment of the following essential tasks: a) to determine possible maximum intensive services as a function of respective factors and limitations, b) to determine the volume of the stream $d(t)$ of potential participants, c) to formulate the optimation task which will link together the problem of steering the intensity of service and the intensity of the stream of demand while retaining limitations, resulting from the character of the natural environment, the organizational-legal system, the model of behaviour and social preferences, etc.


INDEPENDENT INPUT VARIABLES (TRS EXTERNAL DETERMINANTS)
D E M A N D
VOLUME OF PRESSURE
1—5
TRANSFORMATION OF PRESSURE (DEMAND)
FACILITATIONS
6—10
LIMITATIONS
11—13
ENVIRONMENT (OTHER ECONOMIC SYSTEMS)
AGRICULTURE
14—17
FORESTRY
18—21
WATER MANAGEMENT
22—25
INDUSTRY
26—29
TRANSPORT
30—33
SETTLEMENT
34—37
SERVICES
38—41
T S R
I N T E R N A L D E T E R M I N A N T S
R E C R E A T I O N R E S O U R C E S
NATURAL
ELEMENTS
42—48
ATTRIBUTES
49—53
HISTORICAL-CULTURAL
FOLKLORE
54.55
HISTORICAL MONUMENTS
56,57
OBJECTS OF MODERN CULTURE
58.59
OBJECTS OF MODERN TECHNOLOGY
60,61
MATERIAL-TECHNICAL BASE
DORMITORY
70,71
CATERING
72,73
SUPPLEMENTARY
74—80
TRANSPORT
81—84
COMMUNAL
85,86
FORMS OF ORGANIZATION OF RECREATION TRAFFIC
90—97
DIRECT SERVICES
87—89
SPATIAL-FUNCTIONAL STRUCTURE
98—100
PARTICIPANTS IN RECREATION
62—68
EFFECTIVENESS OF RECREATION
SOCIAL ECONOMIC
DEPENDENT OUTPUT VARIABLES (BLOCK NOT ANALYSED)

To construct the model of intensity of the service of a single channel (recreation homes, tourist hotels, shelter homes) is relatively easy, whereas to model the stream of demand for recreation services, rendered by a given TRS, is a much more difficult task. Though it is relatively easy to describe the demand when the forms of dependences are properly established (e.g. by using the function of Cobb-Douglas or polynomials), to obtain adequate data regarding the social needs is much more difficult. Nevertheless, the application of the mass-service model as a method of studying and organizing territorial recreation systems is possible at present, and results obtained may become a basis for any practical activity in this respect.

Fig. 1. Graphic model of the territorial recreation system
1. the volume of demand, 2. seasonality of demand, 3 transport accessibility 4. financial accessibility 5. impact of fashion, 6. administrative premises of the management of demand, 7. organizational conditions of the management, 8. financial outlays on the realization of demand, 9. material outlays on the realization of demand, 10. realization conditions of enterprises organized to promote recreation, 11. resulting from the pollution of environment, 12. resulting from excessive realization costs, 13. administrative and legal; Agriculture, 14. areas, 15. quality of agricultural environment, 16. population earning its livelihood from agriculture, 17. the functioning of agriculture; Forestry, 18. the area of economic forests, 19. the quality of forest sites, 20. population employed in forestry, 21. functioning of forestry; Water economy, 22. the area of economic waters, 23. the quality of waters, 24. population earning its livelihood from water economy, 25. the functioning of water economy; Industry, 26. the spatial structure of industry, 27. branch structure, 28. population employed in industry, 29. the functoining of industry; Transport, 30. spatial structure, 31. qualitative structure, 32. population employed, 33. the functioning of transport; Settlements, 34. spatial structure, 35. qualitative structure, 36. urban population, 37. the functioning of settlements; Services (besides transport and recreation), 38. spatial structure, 39. branch structure, 40. population employed, 41. the functioning of services; Natural resources, 42. climate, 43. relief, 44. open waters, 45. lithology and soils, 46. vegetation, 47. animal life, 48. landscape (the spatial structure of ecosystems), 49. resistance of the natural environment, 50. natural capacity, 51. elastictiy, 52. health conditions, 53. attractiveness; Folklore, 54. character and differences, 56. attractiveness; Historical monuments, 56. character and differences, 57. attractiveness, Objects of modern culture, 58. character and differences, 59. attractiveness, Modern technical objects, 60. character and differences, 61. attractiveness; Participants in recreation, 62. the number of participants in recreation, 63. the age of participants in recreation, 64. duration of stay, 65. state of health, 66. socio-professional structure, 67. intellectual and cultural level, 68. financial status, 69. recreation model; Material and technical base: number of beds, 70. permanent, 71. seasonal; Catering base, 72. permanent, 73. periodical, Complementary base, 74. trade, 75. craftsmen services, 76. tourist industry, 77. health services, 78. communal and sanitary services, 79. sport services, 80. entertainment services, 81. types of recreation communications, 82. capactiy of recreation transport networks. 83. frequency of transport, 84. technical and service base of transport, 85. water and sewage network, 86. informatoin network; Personal services supplied to participants in recreation, 87. volume of service, 88. seasonality, 89. qualifications; Structural and organizational forms of recreation, 90. organized recreation, 91. non-organized recreation, 92. long-term recreation, 93. short-term recreation, 94. stationary recreation, 95. wandering recreation, 96. recreation of youth, 97. recreation of adults, Spatial and functional structure of territorial recreation system, 98. spatial structure, 99. territorial specialization of the function, 100. coexistence of recreation forms.

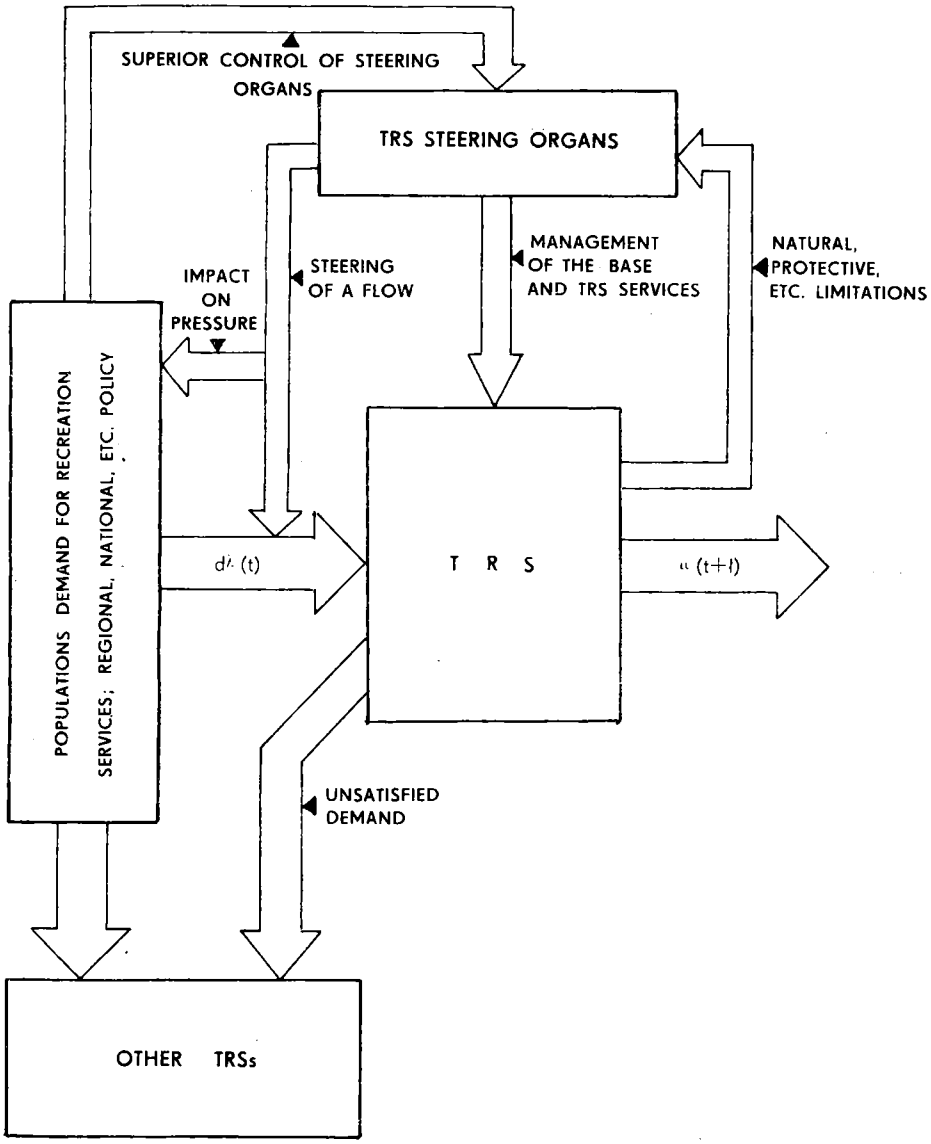


Fig. 2. General scheme of the functioning of the TRS as a system of mass services.

BIBLIOGRAPHY

Cosgrove, I., Jackson R. T., *The Geography of Recreation and Leisure,* London 1972.

Dumazedier, J., *Sociology and Leisure,* Amsterdam 1974.

Klassen, L. H., Paelinck, J. H. P., Wagenaar, S., *Spatial System,* Rotterdam 1979.

Krzymowska-Kostrowicka, A., "Territorial Recreation System. An Analysis of the Structure and Character of Connectivity", *Geographical Studies* No. 138, 1980.

Klir, G. J. (ed.), *Trends in General Systems Theory.* New York 1976.

Preobrazhensky, W. S. (ed.), *Teoreticheskiye osnovy rekreacionnoy gieografii* (Theoretical Basis of the Recreation Geography) Moscow 1975.

Vedenin, J. A., *Dinamika territoryalnykh rekreacionnykh sistem* (Dynamic of the Territorial Recreation Systems), Moscow 1982.