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DEVELOPMENT HARMONISATION OF MOUNTAIN RESORTS ROPEWAY AND TOURIST INFRASTRUCTURES IN THE REPUBLIC OF SLOVENIA

ABSTRACT

Operation efficiency of mountain resort systems depends largely on harmonious operation of the most important and therefore most influential elements of ropeway transportation and tourist subsystems. Within the framework of a tourist subsystem, the extent and quality of tourist offer for long-staying guests plays an essential role. Harmonised development of the above-mentioned elements ensures major utilisation and better economic management of the entire system so that it may offer quality services. First of all, the system enables permanent and environmentally friendly development of the systems that are as a rule in an absolutely sensitive alpine region.

The article deals with some results of in-depth research on the ropeway transportation system and the results of know-how transfer into the actual environment of the Slovene mountain resorts.

KEY WORDS

Ropeway transportation infrastructure, tourist infrastructure, mountain resorts, development

1. INTRODUCTION

1.1. Description of research problems

The mountain resort system is an extremely complex, dynamic, open and stochastic system. It includes the following key elements:

- *transportation system* containing, in addition to a ropeway transportation subsystem as the main provider of transportation services in mountain resorts, transportation (road and/or rail) and public utility subsystems (water supply, sewage system, communications, etc.);
- *tourist system* divided into
  - tourism for long-staying guests (accommodation facilities),
  - one-day tourism (catering facilities),
  - additional tourist offer;
- *sports system* containing, in addition to winter ski trails, the facilities and areas where other sport activities are possible throughout the year;
- *staff* responsible for organising sports and leisure activities in mountain resorts;
- *service users* and
- *information system.*

As in all economic activities, operation efficiency of a mountain resort system is measured by the system operation balance. The prime requirement for the performance is to make sure that the development of single system elements is harmonised as much as possible. Therefore it is necessary to take into account

- natural laws of market functioning,
- protection requirements of natural and cultural heritage and
- expectations of system users regarding the quality and extent of an offer.

A lot of attention should be devoted to environment in establishing mountain resort systems. The alpine region (where sports and tourist activities are as a rule heavily concentrated) is especially vulnerable. That is why all the encroachments on mountainous environment should be weighed and planned on a long-term basis. It is important to note that *encroachments on environment intended for mountainous tourism should not degrade the surroundings but vice versa: they ought to be done in harmony with nature so that natural beauties could be brought nearer to people.*

The research has indicated that ropeway transportation infrastructure development harmonised with tourist infrastructure is one of the key requirements for operation efficiency. Within the framework of tourist infrastructure, the very extent and quality of offers have proved to be of vital importance to long staying tourists. The benefits expected from harmonisation of the above elements are the following:

- better utilisation of ropeway transportation system throughout the year;

- more balanced load of the entire system of mountain resorts,
- lesser need for space and therefore fewer detrimental effects on the environment,
- optimum real capacity of a ropeway transportation subsystem [4],
- more comfort and safety for system users and last but not least
- higher realisation.

Some development trends of mountain resort systems are well known [1], [2]. They derive mostly from long-time experience in this field. Nevertheless, in the theory and practice of the ropeway transportation system there is no method which would consider the effect of tourist infrastructure on efficiency of a ropeway transportation subsystem and thus on efficiency of system operation of mountain resorts.

1.2. Purpose and objective of research

With the intention of examining the factors that produce an effect on capacity utilisation of the ropeway transportation system, some in-depth analyses in this scientific and technical field were made at Road and Traffic Centre, Department of Transportation Engineering, Faculty of Civil Engineering, University of Maribor. The analyses were made within the research framework of the Development of ropeway transportation system in the Republic of Slovenia [3]. The research was ordered both by the Ministry of Science and Technology and the Ministry of Transport and Communications, Republic of Slovenia.

The research objective was to set an empirical link between the two variables that are seemingly not interconnectable: *Ctu* referring to the overall capacity of a tourist subsystem [the number of beds at a certain place] and *Ct* referring to the overall capacity of a ropeway transportation subsystem [the number of passengers per hour]. *The necessary capacity of the tourist subsystem* (*mCtu*) as a capacity set by a model and needed for tourist infrastructure designed for long staying guests is the expected analysis result.

1.3. Research hypothesis

The ratio between the necessary capacity of a tourist subsystem (*mCtu*) and the actual overall capacity of a tourist subsystem (*Ctu*) indicates a development harmonisation level of the ropeway and tourist subsystems of a mountain resort system.

2. DEVELOPMENT HARMONISATION OF ROPEWAY AND TOURIST INFRASTRUCTURES

2.1. Method

The existing system of Austrian mountain resorts has been chosen as a good starting point. Austria prides itself on its long-standing tradition in the field of ropeway engineering. In O.I.T.A.F., Austria is the leading country that has a strong impact both on ropeway engineering and technology, and on organising the ropeway transportation also within the framework of the European Commission for Transport (ECT). The Austrian model of mountain resorts is characterised by

- a high level both of technical and technological efficiency of their ropeway transportation subsystem;
- co-ordinated operation of different elements of mountain resort systems;
- co-ordinated offer of services provided by other subsystems of mountain resorts, etc.

These features result from an effect of the open market for goods and services and from an effective role of the state in this economically extremely important field of tourism.

In co-operation with the Austrian Ropeway Engineering Association (Fachverband der Seilbahnen) of the Austrian Chamber of Commerce (Wirtschaftskammer Österreichs) in Vienna, we conducted a survey among some evenly selected mountain resorts in Austria by post. The sample included 15 Austrian mountain resorts of large, moderate and small size. Besides the general data, we asked also for the overall theoretical capacity of all ropeway facilities (*Ct*) and for overall capacity of tourist infrastructure in single resort (*Ctu*).

The data we gathered were statistically processed and by means of the regression method we were ascertaining the possibility of interconnections among the variables in question.

In the case of well balanced resorts the capacity of tourist infrastructure (*Ctu*) should be almost the same as the capacity of tourist infrastructures calculated by the model (*mCtu*). The ratio *Ktu* indicates the intersystem harmoniousness level in mountain resort.

2.2. Survey results

In the course of research in Austria, we came across *the problem of defining the sphere of influence of single resorts*. It is well known that ski centres unite in large sports-tourist regions within which single centres are closely associated with a diverse infrastructure (ropeway facilities, ski buses). We gathered data only

Table 1: Basic characteristics of ropeway and tourist infrastructures in the Austrian mountain resorts

Mountain resort	Height above sea level	Height above sea level	Length of trails	Total number of facilities	*Ctu*	*Ct*
	Lower position [m]	Upper position [m]	[in km]		[beds in resort]	[pass. per hour]
Baerenalm Hinterstoder	660	1,150	6	3	1,700	150
Feuerkogel - Ebensee	460	1,680	12	7	800	4,500
Semmering Hirschenkogel	1,000	1,350	13.5	3	700	5,320
Lienz Zettesfeld	670	2,290	40	12	3,800	11,000
Schruns	700	2,400	35	13	4,000	13,000
Gerlitzen Sattendorf	1,000	1,911	25	14	2,000	1,800
Wagrain	650	2,000	40	20	5,240	56,000
Flachau	950	1,800	45	20	8,500	23,893
Schladming Planai	800	1,894	52	26	8,000	33,000
Kitzbuechel Begbahn	800	2,000	180	60	6,300	77,000
Lech	1,450	2,444	260	84	17,000	113,351
Total sample				262	58,040	339,014

from a limited sphere of influence of each individual mountain resort.

Table 1 illustrates the survey results. For comparison's sake, see also [4].

Statistical analysis was made for the cases of linear, logarithmic, potential, exponential and polynomial regression of levels 2, 3, 4 and 5. Logarithmic, potential and exponential regressions were discarded due to stochastic irrelevance of results (correlation ratio is $R^2 < 0.6$). Relevant and conditionally relevant results are shown in Table 2.

The results of the third degree (and higher) polynomial regression analysis have major statistical relevance ($R^2 \to 1$). In the case of the fifth degree polynomial regression, the result was $R^2 = 0.9839$ and/or $R^2 \approx 1$ which is close to functional dependence. Nevertheless, the results achieved by means of the linear and quadratic polynomial division have a major application value.

Table 2: Regression analysis results

Regression type	General form	R^2
Linear		
– general form:	$y = a_1 \cdot x + a_0$	
– regression:	$y = 0{,}1106 \cdot x + 1869{,}2$	0.7328
Poly. 2nd degree		
– general form:	$y = a_2 \cdot x^2 + a_1 \cdot x + a_0$	
– regression:	$y = 4 \cdot 10^{-7} \cdot x^2 + 0{,}067 \cdot x + 2303{,}3$	0.7429
Poly. 3rd degree		
– general form:	$y = a_3 \cdot x^3 + a_2 \cdot x^2 + a_1 \cdot x + a_0$	
– regression:	$y = 7 \cdot 10^{-11} \cdot x^3 - 1 \cdot 10^{-5} \cdot x^2 + 0{,}4921 \cdot x + 67{,}923$	0.9375
Poly. 4th degree		
– general form:	$y = a_4 \cdot x^4 + a_3 \cdot x^3 + a_2 \cdot x^2 + a_1 \cdot x + a_0$	
– regression:	$y = 3 \cdot 10^{-16} \cdot x^4 + 2 \cdot 10^{-12} \cdot x^3 - 6 \cdot 10^{-6} \cdot x^2 + 0{,}4161 \cdot x + 300{,}07$	0.9392
Poly. 5th degree		
– general fom:	$y = a_5 \cdot x^5 + a_4 \cdot x^4 + a_3 \cdot x^3 + a_2 \cdot x^2 + a_1 \cdot x + a_0$	
– regression:	$y = -7 \cdot 10^{-20} \cdot x^5 + 2 \cdot 10^{-14} \cdot x^4 - 2 \cdot 10^{-9} \cdot x^3 + 5 \cdot 10^{-5} \cdot x^2 - 0{,}1919 \cdot x + 1530{,}8$	0.9839

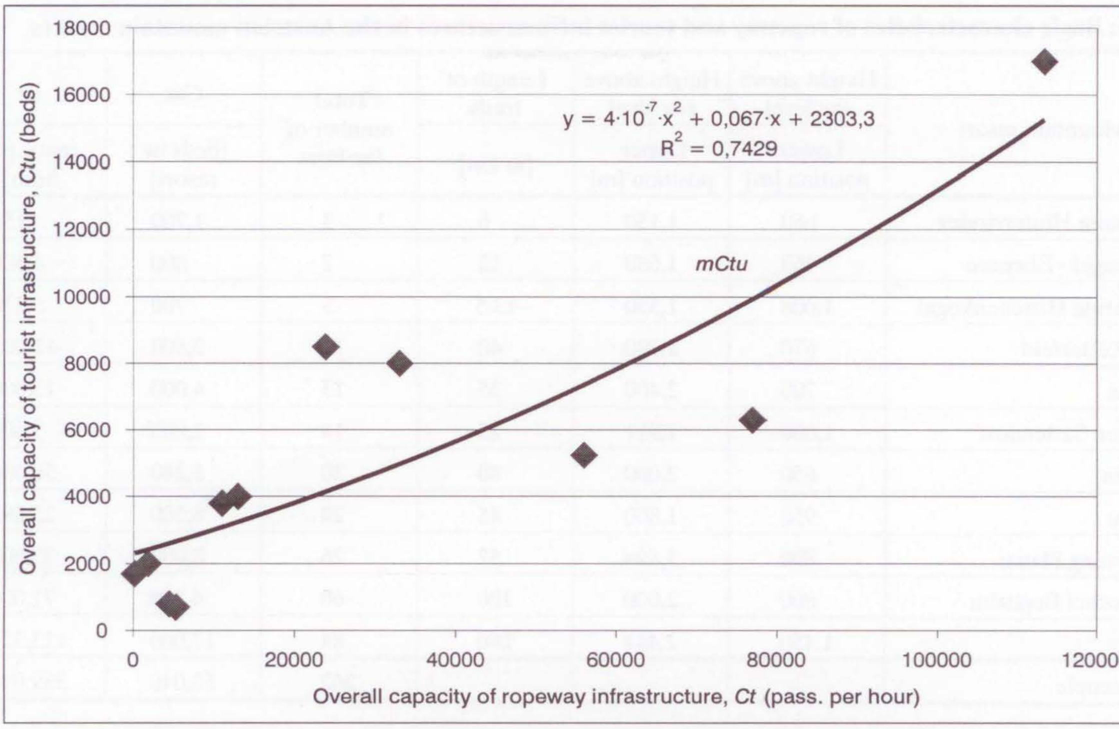

Figure 1 - Quadratic polynomial regression on ropeway infrastructure capacity (independent variable) and tourist infrastructure (dependent variable) in the Republic of Austria

The function being looked for

$$mCtu = mCtu\ (Ct) \qquad [1]$$

in an empirical form runs as follows:

$$mCtu = 0.1106\ Ct + 1869.2 \qquad [2]$$

and/or

$$mCtu = 0.0000004\ Ct^2 + 0.067\ Ct + 2303.3 \qquad [3]$$

in the case of the second degree polynomial regression.

The ratio between the actual overall capacity of the tourist infrastructure for long staying guests (Ctu) and the expected model capacity of a tourist subsystem ($mCtu$) sets the harmonisation level of the ropeway transportation and tourist subsystems of certain mountain resort systems.

Development harmonisation of ropeway transportation and tourist subsystems is provided when

$$Ktu = \frac{Ctu}{mCtu} \approx 1 \qquad [4]$$

where

Ktu – is the harmonisation ratio of ropeway and tourist subsystems [-].

On the basis of theoretical calculations it is possible to conclude the following:

The development of mountain resorts in terms of evenly developed ropeway and tourist subsystems is considered to be harmonised if there are additional 110 beds ensured for every 1,000 persons carried per hour by additional capacity of quality ropeway facilities. The basic offer of a tourist infrastructure includes 2,000 beds.

Consequently, *it is necessary to build a 50-room hotel for every new facility with a capacity of 1,000 persons per hour.*

3. TESTING THE RESULTS OF RESEARCH IN THE MAIN MOUNTAIN RESORTS OF THE REPUBLIC OF SLOVENIA

Figure 2 and Table 3 illustrate a comparison of model results with the actual state of the main mountain resorts in the Republic of Slovenia.

Figure 2 - Comparison of balanced development criterion of ropeway and tourist infrastructures with the actual state in the Republic of Slovenia

Chart 3 and Figure 2 indicate that, on average, the balance ratio between the ropeway and tourist subsystems of Slovene mountain resorts deviates from the level comparable in Europe by 14 %. The reason for this should be looked for in *under-equipped Slovene mountain resorts in terms of their being ill-equipped with tourist infrastructure.*

Out of 6 main Slovene mountain resorts, only two of them (Kanin and Kranjska Gora) either reach or exceed the model-based level of the ratio between the ropeway and tourist infrastructure capacities. Borderline cases are Kranjska Gora and Krvavec.

The Kranjska Gora ropeway transportation infrastructure is absolutely under-equipped. Streamlining of the existing facilities and building some additional

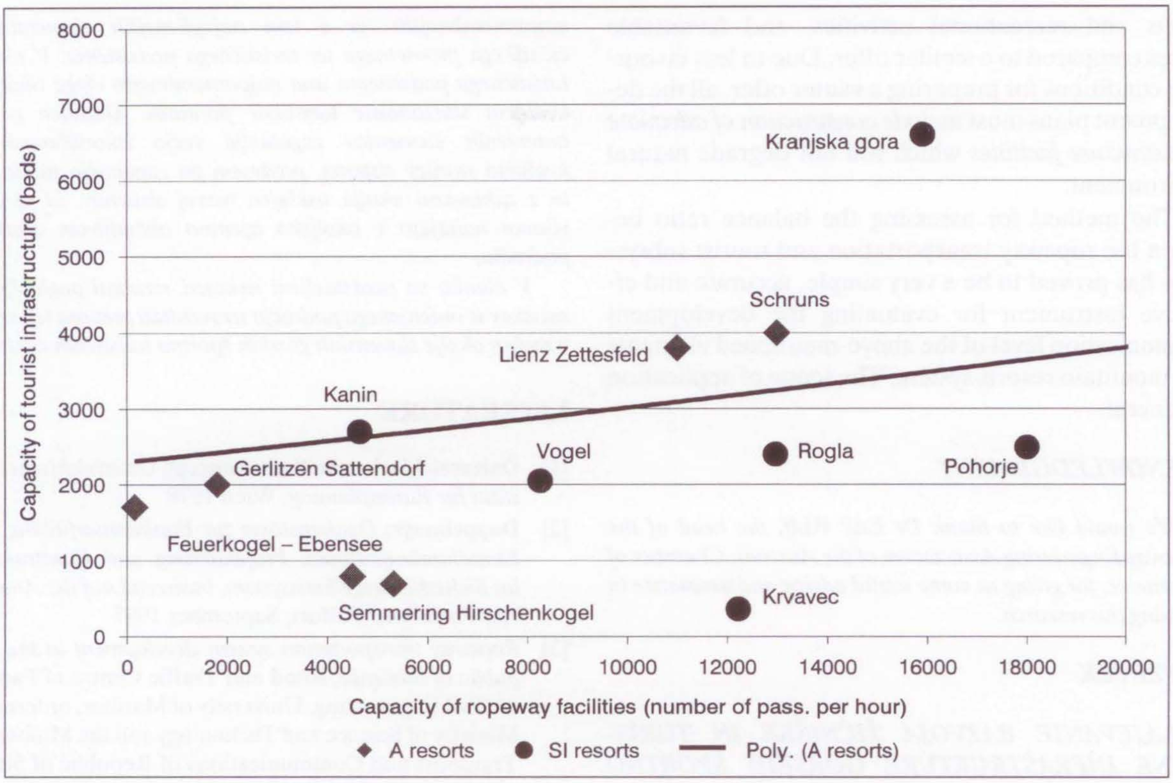

Figure 2 - Comparison of balanced development criterion of ropeway and tourist infrastructures with the actual state in the Republic of Slovenia

Table 3: Comparison of balanced development model of ropeway and tourist infrastructures with the actual state in the Republic of Slovenia

Mountain resort	*Ct* (pass. per hour)	*mCtu* (beds)		*Ctu* (beds)	*Ktu*	
		lin. reg.	quad. reg.		lin./*Ctu*	quad./*Ctu*
Vogel	8,256	2,782	2,884	2,050	0.74	0.71
Kanin	4,650	2,383	2,623	2,700	1.13	1.03
Kranjska Gora	15,902	3,628	3,470	6,600	1.82	1.90
Krvavec	12,222	3,221	3,182	366	0.11	0.12
Mar. Pohorje	18,006	3,861	3,639	2,494	0.65	0.69
Rogla	12,970	3,304	3,240	2,400	0.73	0.74
Total					0.86	0.86

systems in accordance with the given space requirements are urgently needed.

The RTC Krvavec with its tourist infrastructure does not even reach the basic 2,000-bed threshold. Most users of ski and sports facilities are day guests (95 %). The consequences of such a state are non-utilisation of ski facilities over the week and long queues and delays in front of ropeway facilities at weekends. Therefore the enlargement of the Krvavec tourist infrastructure is necessary.

The scientific hypothesis that has been set is confirmed by the above evidence and the research objective is attained.

4. CONCLUSION

The planning of tourist products designed for use in mountainous regions should be based on their availability, on their genuineness and on nature conservation and protection. Emphasised benefits of tourists' relaxing in nature should be considered in any tourist offer. Therefore the offer should include sports and recreational activities, discovering nature and enjoying it. The basic characteristics of tourist products in mountainous regions should be characteristics which make them different from those in other tourist regions: protected areas, non-massive tourism, various sports and recreational activities, and favourable prices compared to a similar offer. Due to less favourable conditions for preparing a winter offer, all the development plans must *include construction of adequate infrastructure facilities* which will not degrade natural environment.

The method for assessing the balance ratio between the ropeway transportation and tourist subsystems has proved to be a very simple, accurate and effective instrument for evaluating the development harmonisation level of the above-mentioned elements in a mountain resorts system. The scope of application is general.

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POVZETEK

UKLAJEVANJE RAZVOJA ŽIČNIŠKE IN TURISTIČNE INFRASTRUKTURE GORSKIH ŠPORTNO TURISTIČNIH CENTROV

Učinkovitost delovanja sistema gorskih športno turističnih centrov je v največji meri odvisna od usklajenosti delovanja najpomembnejših ter s tem najvplivnejših elementov – žičniškega prometnega ter turističnega podsistema. V okviru turističnega podsistema ima najpomembnejšo vlogo obseg in kvaliteta stacionarne turistične ponudbe. Usklajen razvoj omenjenih elementov zagotavlja večjo izkoriščenost ter kvaliteto storitev sistema, predvsem pa zagotavlja trajnosten in z zahtevami okolja usklajen razvoj sistemov, ki se praviloma nahajajo v okoljsko izjemno občutljivem alpskem področju.

V članku so predstavljeni nekateri rezultati poglobljenih raziskav iz omenjenega področja ter rezultati prenosa teh znanj v realno okolje slovenskih gorskih športno turističnih centrov.

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