SIGHTSEEING TRAVEL DEMAND AND ECONOMIC IMPACTS OF TOURISM

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Abstract: Up to now, only the qualitative analysis or measure by some macro econometric techniques has been applied to the local economy with relation to the sightseeing-related projects. Moreover, there are few studies that propose the evaluation techniques for user benefit and economic impact of tourism adjusted to sightseeing demand forecasting approach. The aims of this paper are as follows: 1) propose a forecasting system for sightseeing demand which varies with the sightseeing-related trunk road projects. This system consists of inter-regional sightseeing travel flow model and sightseeing excursion model; 2) to evaluate the effect of the sightseeing-related trunk road projects, an Input-Output approach is proposed; and finally, 3) to evaluate the economic impact by the Kei-Na-Wa trunk road project.

Key Words: Sightseeing travel demand, Excursion behavior, Economic impact, Tourism

1. INTRODUCTION

In Japan, as the establishment of public investments has progressed, the marginal utility of newly established ones decrease. There may be some projects for which effects are not

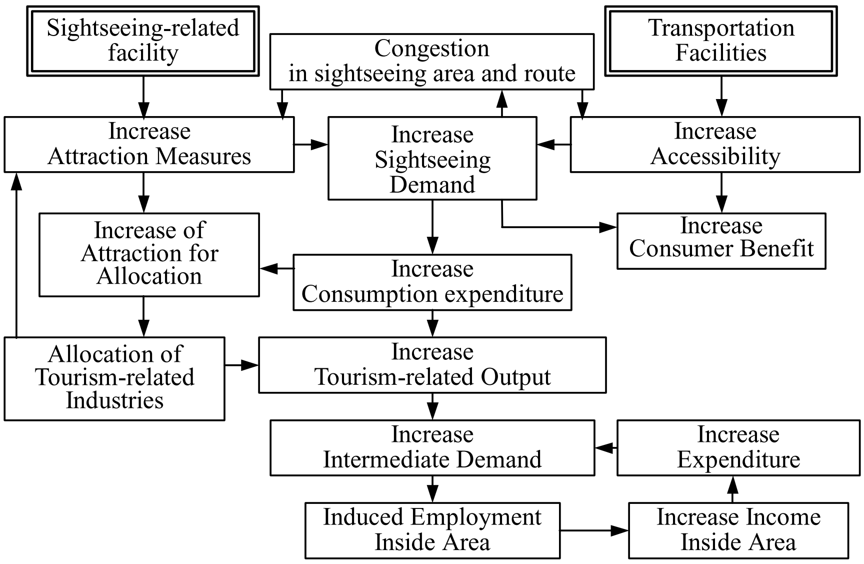

Figure 1 Extended process of effects by sightseeing-related facilities

accounted for by the citizens. From the viewpoint of cost effectiveness, as well as national and local governmental financial crisis, prior assessment of projects using an economic technique such as cost-benefit analysis is needed. Tourism has become one of the largest and most rapidly growing activities in the local economy, so that the investment in tourism such as sightseeing-related industries and transportation facilities has to be assessed sufficiently. Especially in an area where tourism is a main industry, it is necessary to examine accurately not only the cost-benefit ratio but also the local economic impacts of tourism.

In Figure 1, we show the extending process of effects in an area with the investment in sightseeing-related activities and transportation facilities. These investments increase sightseeing demands. The increasing demand consumes additional goods and services provided by sightseeing-related and transportation industries existing inside this area. They require the goods and services of other sectors. Consequently, the employment and income indirectly increase. Such increase in income will induce more consumption, which will increase output and income of other sectors. The effects of increase in demand by investments can be evaluated by technique such as Cost-Benefit analysis. However, this technique is based on a partial equilibrium approach and a number of explicit and implicit assumptions must be made during the formulation of models like a Travel Cost Method (TCM). As compared to the Cost-Benefit analysis, the technique of Input-Output analysis has a number of advantages when we evaluate an economic impact within the sightseeing area where sightseeing-related investments has been made. One advantage is that it is a general equilibrium approach, so we can focus our attention totally upon the industrial interdependencies that exist in economy. The most important advantage is that it can study the impact of investments in its direct, indirect and induced effects in the area.

Up to now, only the qualitative analysis or measures by some macro econometrics techniques has been done on the local economy by sightseeing-related investments. Moreover, there are few studies that propose the evaluation technique of user benefit and economic impact of tourism adjusted to sightseeing demand forecasting approach. The aim of this paper is:

1) to propose a forecasting system for sightseeing demand which varies by the establishment of sightseeing-related article road. This system consists of inter-regional sightseeing travel flow model and sightseeing excursion model.
2) to measure the local economic impact of tourism, an appropriate method using the input-output analysis is proposed.
3) finally, we try to evaluate effects of the investments on Kei-Na-Wa arterial road by this technique.

2. SIGHTSEEING DEMAND FORECASTING SYSTEM

2.1 Framework of Sightseeing Demand Forecasting System

At first, we define an individual sightseeing facility or point as a sightseeing spot. A sightseeing area or zone is a unit in which some sightseeing spots are aggregated. Moreover, some areas compose a region. Now, inter-regional demand between origin zones and some regions and excursion demand among sightseeing areas within a region are subjects of our study. Sightseeing behavior can be divided into an inter-regional part and an excursion part within a region shown by Figure 2. Because there are some different characteristics between them, both behaviors should be analyzed by appropriate methods respectively. Increase in

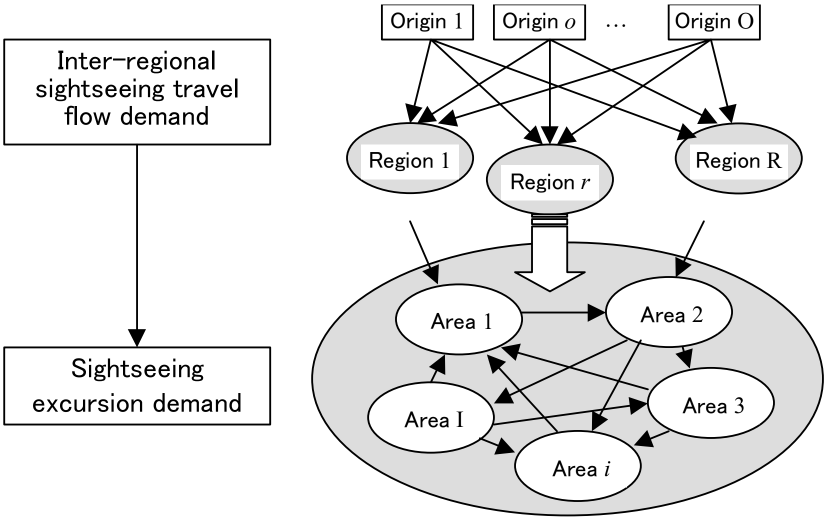

Figure 2 Framework of sightseeing demand forecasting system

the inter-regional sightseeing demand by improvement of sightseeing-related facilities is caused by both the increase of generated demand and the diversion of demand from other destinations, so we try to formulate the inter-regional sightseeing demand flow as an aggregated type trip generation/distribution combined model. On the other hand, the excursion behavior should be analyzed by individual because the excursion behavior of a traveler varies not only by a little change of traffic services between sightseeing areas but also by individual characteristics. We attempt to formulate individual sightseeing excursion behavior by the disaggregated choice model.

2.2 Inter-regional Sightseeing Travel Demand Flow Model

We propose a system that can forecast the variation of sightseeing demand by the improvement of an inter-regional trunk road. We focus on Kei-Na-Wa trunk road project. The road project connection from Kyoto to the south of Nara is in progress. Nara was the first capital in Japanese history about thirteen hundred years ago. In Nara northern area, there have been a lot of historic temples such as Tohdai-Ji and Hohryu-Ji, and imperial tombs and historic sites such as ruins of Heijokyo and Takamatsu-zuka tomb and so on. UNESCO has appointed this whole area as a world heritage. If this road will be completed and this will be increased accessibility to this area, a lot of guests from nearby prefectures can be expected.

Our forecasting system consists of (1) an inter-regional sightseeing travel demand flow model; and, (2) a sightseeing excursion demand model. In the inter-regional sightseeing travel demand flow model, we can predict simultaneously the trip generation demand from origin zone o and its share to sightseeing destination region r. This model is basically a trip generation/distribution combined model, but we improved it by constructing an aggregated nested choice model as follows;

$$Q_{or} = P_o \cdot p(o) \cdot p(r \mid o) \qquad (1)$$

where Q_{or} is the number of sightseeing flows between origin zone o to sightseeing region r.

P_o is a population of origin zone *o*. In the lower decision level in the nested structure, the marginal share of destination *r* is described by the next multinomial logit model.

$$p(r \mid o) = \exp(\gamma A_r + \delta C_{or}) \Big/ \sum_{r'} \exp(\gamma A_{r'} + \delta C_{or'}) \tag{2}$$

A_r, C_{or} are the attraction measures of sightseeing region *r* and travel cost between *o*-*r*, respectively. γ, δ are parameters which should be estimated. On the other hand, we formulate a sightseeing trip generation frequency per capita of nighttime population in the upper decision level as follows;

$$p(o) = 1/[1 + \exp(\alpha + \theta W_o + \mu V_o + \lambda \Lambda_o)], \tag{3}$$

where Λ_o is the composite cost which explains the accessibility of origin *o* with respect to all available sightseeing regions r$\in R_o$ and defined as follows;

$$\Lambda_o = \ln \sum_{r' \in R_o} \exp(\gamma A_{r'} + \delta C_{or'}). \tag{4}$$

W_o, V_{oi} are attributes native to generation zone *o* such as average income and car ownership ratio per capita, respectively. $\alpha, \theta, \mu, \lambda$ are unknown parameters.

2.3 Sightseeing Excursion Demand Model

(1) Model Framework

A traveler leaves home and visits some sightseeing areas sequentially and returns to his home in his one sightseeing travel activity. This excursion behavior is regarded as a multi-dimensional choice process. We assume his excursion behaviors to be sequential choices of both a sightseeing area and staying time at this area. We connect these choice sub-models with sequentially in time. Model framework is shown in Figure 3. Concretely, at first, by the first area choice sub-model, the first sightseeing area choice is expressed. Next, the staying time choice sub-model decides staying time in the first sightseeing area, forecasted by the first area choice sub-model. Then, the traveler will decide whether to visit a next sightseeing area or to return to his home. The Excursion choice sub-model describes his behavior. If he decides to visit another sightseeing area, the excursion sub-model chooses the next sightseeing area. Our model is able to describe this individual traveler's sequential choices until he returns home.

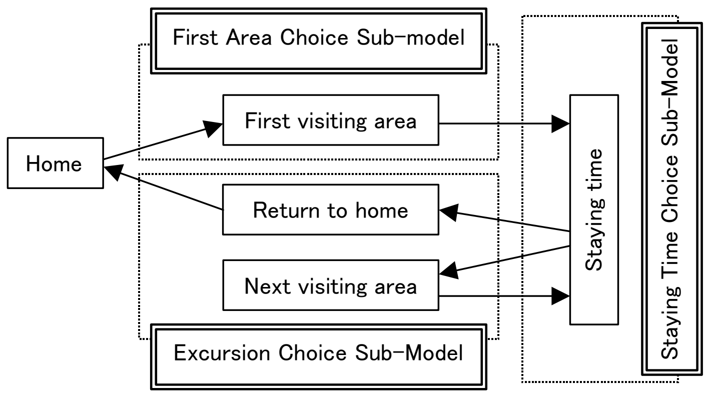

Figure 3 Framework of sightseeing excursion demand forecasting system

(2) Model Formulation

The First Area Choice Sub-Model: The first area choice sub-model expresses the choice probability P_{in} that an individual *n* chooses *i*'th sightseeing area among his available sightseeing areas choice set A_n as following the disaggregated multinomial logit formula;

$$P_{in} = \frac{\exp[\lambda V_{in}]}{\sum_{j \in A_n} \exp[\lambda V_{jn}]} \tag{5}$$

Where V_{in} is the deterministic term of his random utility, we can use his departure time from his home and travel time to each area and its attraction measures as its explanatory variables.

Staying Time Choice Sub-Model: We apply the concept of Hazard function to the staying time choice sub-model. This model can show a distribution of time interval until a different event happens after the existing event. In our model, a different event is the departure from his existing area. When we introduce a Staying Time Choice Sub-model, that is Hazard function, we can assume some kinds of functions as the probability function *F(t)* that a different event happens by period *t*. We use the Weibull distribution as its density function *f(t)*, because the distribution function of staying time should be an extreme value distribution. We assume the Weibull distribution function as the *f(t)*, the probability that staying time is equal to *t* is

$$S(t) = \exp\left[-t^{\frac{1}{\sigma}} \exp\left(\frac{-\beta \mathbf{X}_{in}}{\sigma} \right) \right] \tag{6}$$

where σ is a scale parameter. $\mathbf{X}_{in}$ is the attribute vector of sightseeing area *i* for traveler *n*, with which we can introduce his arrival time and the attraction measures of its area. The arrival time is given by sum of departure time from home and travel time to his existing area.

Excursion Choice Sub-model: At first, in this model, the choice whether the traveler returns to his home or visits another sightseeing area should be described, or if he has already decided to visit another, his next destination should be chosen. We apply the nested logit model to estimate such multi-dimensional choice probability. The joint, unconditional probability of a combined choice of excursion *e* and next destination area *j* is written as follows;

$$P_n(j,e) = P_n(j|e) \cdot P_n(e) = \frac{\exp[\lambda_1 V_{(j|e)n}]}{\sum_{j' \in A'_n} \exp[\lambda_1 V_{(j'|e)n}]} \cdot \frac{\exp[\lambda_2 (V_{en} + V^*_{en})]}{\exp[\lambda_2 (V_{en} + V^*_{en})] + \exp[\lambda_2 V_{hn}]} \tag{7}$$

where V^*_{en} is the composite cost that is expected to give in the case he visits another area as follows

$$V^*_{en} = \frac{1}{\lambda_1} \ln \sum_{j \in A'_n} \exp[\lambda_1 V_{(j|e)n}] \tag{8}$$

$V_{(j|e)n}$ is the conditional utility of selecting the next area *j*, given that excursion has already been chosen and include travel time needed to visit next destination area *j* and so on as the explanatory variables. V_{hn} is the marginal utility of homecoming. V_{en} is the marginal excursion utility which consists of the departure time from his existing area. We are able to use the departure time, which is sum of the staying time and arrival time at his existing area.

3. ECONOMIC IMPACT OF TOURISM

3.1 Method of Measuring Economic Impact of Sightseeing-related Projects

Economic impact of sightseeing-related projects is complex because it does not occur within the framework of a single industrial sector. There are a variety of methods that can be employed to study economic impact. The final choice of methodology should be determined by the quantity and quality of effects within an area where it is going to be analyzed. To begin with, a simple, but crude approach is to compare the available data on tourism activity with the key economic indicators such as GDP and domestic employment of some projects which are similar to this project. However, such an approach will give only a partial effect of the impact of sightseeing-related projects. Second, we can adopt a more sophisticated approach by using a technique like a cost-benefit analysis. However, this technique is based on a partial equilibrium theory, so we can not evaluate the impact of travelers nor can we measure the economic impact for other sectors within an area. Finally, the technique of input-output analysis can be employed to determine economic impact of sightseeing-related projects.

The technique of input-output analysis has a number of advantages when compared with alternative methodologies. First, it is based on a general equilibrium theory and provides a comprehensive view of the regional economy to decision-makers who evaluate the project. Second, we can focus our attention totally upon the industrial interdependencies that exist in economy. Third, the flexibility of the input-output structure enables us to construct a model to suit the purpose at hand. Finally, we can study the impact of sightseeing-related projects at its three levels: direct, indirect and induced effects by using input-output analysis. Then, we apply this input-output analysis technique to measuring the economic impact of a sightseeing-related trunk road project. When we adopt the input-output approach to measure the economic impact, there are some issues which should be considered.

1) The sightseeing-related consumption according to increase of sightseeing demands should be estimated;
2) Goods consumed by travelers should be distributed to the relevant industrial sectors of the available input-output table;
3) We have to calculate the regional economic impact of a part of the whole Nara prefecture

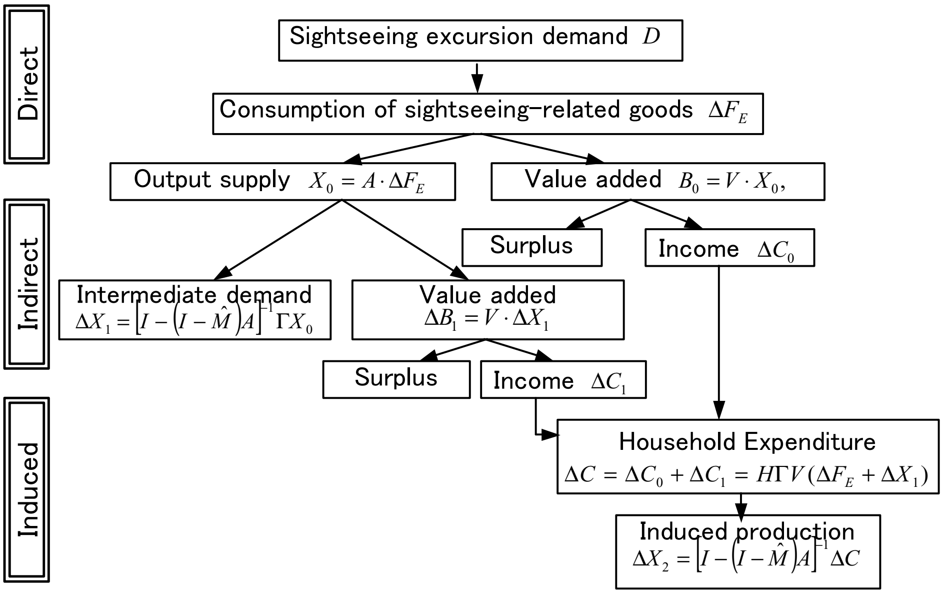

Figure 4 Measuring economic impact

for which the input-output table is prepared.

3.2 Measuring Local Economic Impact of Tourism by Input-Output Analysis Technique

We explain the process to evaluate economic impact by using Figure 4.

1) Increase of sightseeing demand from outside the region where we want to measure local economic impact, D, increase its consumption, ΔF_E, for sightseeing-related goods and services such as souvenirs, transportation services and hotel staying. This expenditure can be regarded as the export factor of final demand because money flows from outside the region to inside.
2) Demands for these goods and services require the supply of intermediate output, $X_0 = A\Delta F_E$ and value added, $B_0 = V \cdot \Delta X_0$, directly. A and V are the input-output table and the value added ratio, respectively, those are prepared normally.
3) To produce these outputs that should be supplied, more intermediate demand goods, $\Delta X_1 = \left[I - \left(I - \hat{M}\right)A\right]^{-1} \Gamma A \Delta F_E$, as well as value added, $B_1 = V \cdot \Delta X_1$, are required as input resources, indirectly. $\left[I - \left(I - \hat{M}\right)A\right]^{-1}$ and Γ are the open-economic type input-output table and the degree of self sufficiency vector.
4) Both direct and indirect values added are divided into surplus and household incomes, $\Delta C_0 = H\Gamma B_0$ and $\Delta C_1 = H\Gamma B_1$, where H is the average propensity to consume.
5) The sum of direct and indirect income, $\Delta C = \Delta C_0 + \Delta C_1 = H\Gamma V(\Delta X_1 + \Delta F_E)$, becomes the household expenditure consumed inside this region.
6) Induced output is produced by this adding household expenditure, $\Delta X_2 = \left[I - \left(I - \hat{M}\right)A\right]^{-1} \Delta C$.
7) The production multiplier m by the sightseeing-related projects is defined as $m = (\Delta F_E + \Delta X_1 + \Delta X_2)/\Delta F_E$.

4. CASE STUDY

4.1 Alternatives

Nara was the first capital in Japanese history about thirteen hundred years ago and is older than the well-known Kyoto. There are some historically famous temples, imperial tombs and historic sites. UNESCO has appointed this area as one of the world's heritage. Nevertheless, recently, the total visitors per year decreased. The Kei-Na-Wa trunk road project connecting Kyoto to the south of Nara is in progress. The economic impacts for three alternatives on this project are compared. First alternative is the present network and is the benchmark. Second is the future network without Kei-Na-Wa trunk road and third alternative is the future network with Kei-Na-Wa trunk road. We will call these three alternatives as Case-1,

Figure 5 Study area and Kei-Na-Wa road

Case-2 (without Kei-Na-Wa Road case) and Case-3 (with case), respectively. We will show the stud area and alignment of Kei-Na-Wa road in Figure 5.

4.2 Estimation of Sightseeing Demand Model

(1) Inter-regional Sightseeing Travel Demand Flow Model

An origin region is correspondent with a zone of residence, which consists of cities and towns. The destination region is Nara northern area. Models were estimated using the data of road traffic census and the national census carried on in 1995. The estimation results of both models are shown in Tables 1 and 2. The sign of parameters are as expected and t-values are stochastically significant at 95% except for car ownership ratio. The correlation coefficient values of both models are about 0.9, so these models are able to predict inter-regional sightseeing travel flows.

Table 1 Estimation results of trip generation ratio model

		Parameter	t-value
	α_1	3.320	13.5
Zone Dummy	α_2	3.713	16.4
	α_3	3.776	20.9
Car ownership ratio μ		-0.0246	0.21
Composite cost λ		-0.814	4.15
Correlation coefficient		0.899	

Table 2 Estimation results of the marginal shear of destination

	Parameter	t-value
Attraction measures γ	0.00011	79.7
Travel time δ	-0.02614	564.4
Correlation coefficient	0.889	

(2) Sightseeing Excursion Demand Model

We used the data collected in the Nara sightseeing survey to estimate sightseeing excursion demand sub-models. The Nara prefecture government conducted this survey three times in

Table 3 Nara sightseeing survey

	Spring	Summer	Autumn
Date	25 May (Sunday)	2 Aug. (Saturday)	24 Oct. (Holiday)
Weather	fine	fine	fine
Survey time	business hour of each facility (mainly 7:00～19:00)		
No. of points	22	58	27
No. of deliver	13,330	10,272	39,550
No. of respondents (rate)	1,977 (14.8%)	1,064 (10.3%)	3,121 (7.9%)
Samples	All visitors		
Method	Distribute questionnaire at entrance of facility Response by post		

1997. It aimed to know the existing conditions of sightseeing for the northern area of Nara and to evaluate the economic impact of tourism by the Kei-Na-Wa road project. The details of this survey are shown in Table 3. The survey was partitioned into three sections as follows: a) Attributes of this travel like mode, aim, total expenditure, departure time from home et al., b) Visiting sightseeing points and arrival time, departure time, excursion route on road map, c) and Characteristics of individual and household like sex, age, companion and so on.

First area choice sub-model: Table 4 presents the estimation results of the first area choice sub-model by season. We can obtain the logical results that the higher the *Attraction measures* and the shorter the *Travel time to first sightseeing area from home* is, the higher the utility of the sightseeing area. There is a difference in relative weights of the coefficient of the area dummy by season. In spring, the parameter of *Historic heritage* is bigger than *Nature*, but it is in different in summer and autumn. ρ^2 values of every season's model are not high and goodness-of-fits are less than 40% , because the choice set seems to include seven and a lot of sightseeing area alternatives. The reliability of these models is not statistically high.

Table 4 Parameter estimates of the first area choice sub-model

Explanatory variables		Parameter (*t*-Statistic)		
		Spring	Summer	Autumn
Area dummy	Historic heritage	0.2072 (1.59)	0.4434 (2.21)	-0.2464 (2.69)
	Nature	-0.1328 (0.95)	0.5453 (3.19)	0.0116 (0.13)
Travel time to the first sightseeing area from home	(10^{-2})	-0.4303 (3.30)	-0.0254 (0.23)	-0.7237 (6.46)
Attraction measures	(10^{-3})	0.7064 (7.06)	0.3937 (3.58)	0.4637 (9.97)
Sample size		831	231	1339
Goodness-of-fit (%)		35.8	29.0	28.6
ρ^2		0.0599	0.0417	0.0299

Staying time choice sub-model: The parameter estimates of staying time choice sub-model is shown in Table 5. We used LIFELEG Procedure of SAS to estimate them. We could get logically reasonable results that the earlier the *Arrival time* and the higher the Attraction measures are, the higher the long-staying probability is. Almost all estimates are statistically significant because χ^2 values are sufficiently large.

Excursion choice sub-model: Table 6(a) shows the results of Level-1 in second visiting area choice model which is one of the excursion choice sub-model. All estimates have expected sign and high *t*-value. There is a difference in relative weights of the area dummy by season. *Travel time to next sightseeing area from existing area* is statistically significant, so traveler selects the area that is near in time length as next visiting area. The coefficient estimates of Level-2 in second visiting area choice model are shown in Table 6(b).

Departure time from existing area has expected sign and statistically significant coefficient estimate in all seasons, then the earlier the departure time is, the higher the utility of excursion is. The coefficient estimate for the *Composite value* term is significantly different statistically from both 0.0 and 1.0 in every season's model. Goodness-of-fit of all season's models is rather high compared to one of Level-1.

Table 5 Parameter Estimates of staying time choice sub-model

Explanatory variables		Parameter (χ^2-Statistics)		
		Spring	Summer	Autumn
Area dummy	1	-0.635 (78.9)	-1.588 (23.1)	-0.144 (8.2)
	2	4.827 (481.3)	0.277 (3.9)	3.036 (994.1)
	3	6.393 (467.6)	4.923 (52.7)	4.908 (1033.3)
	4	4.572 (426.2)	2.735 (55.4)	6.506 (1039.3)
	5	4.403 (420.0)	-0.227 (2.6)	2.474 (818.8)
	6	2.725 (325.9)	3.847 (62.0)	4.712 (1016.4)
Arrival time (min)		-0.00164 (131.2)	-0.00102 (10.8)	-0.00186 (231.1)
Attraction measures		0.00531 (482.5)	0.00269 (63.4)	0.00316 (1118.3)
Visiting order	First	-0.277# (1.1)	0.318# (0.3)	-0.164# (1.0)
	Second	-0.463 (3.1)	0.170# (0.1)	-0.420 (6.7)
	Third	-0.710 (6.8)	-0.036# (0.01)	-0.446 (6.8)
Scale parameter		0.514	0.588	0.522
Sample size		1018	252	1676

= not significant at 10%

Table 6(a) Parameter estimate of Excursion choice sub-model (Leve-1)

Explanatory variables		Parameter (t-Statistic)		
		Spring	Summer	Autumn
Area dummy	Historic heritage	0.8519 (5.12)	-0.2242 (0.47)	0.2751 (1.62)
	Nature	0.2892 (1.59)	-0.5018 (1.21)	0.3775 (2.35)
Travel time to the next sightseeing area from existing area	(10^{-1})	-0.1881 (6.37)	-0.2251 (3.33)	-0.1686 (8.06)
Travel time to the next sightseeing area from existing area	(10^{-2})	-0.3012 (1.50)	-0.0985 (0.38)	-0.5212 (3.19)
Attraction measures	(10^{-4})	0.9885 (0.58)	1.147 (0.65)	4.129 (4.97)
Sample size		321	71	405
Goodness-of-fit (%)		38.9	36.6	39.7
ρ^2		0.077	0.037	0.078

Table 6(b) Parameter estimate of Excursion choice sub-model (Level-2)

Explanatory variables		Parameter (t-Statistic)		
		Spring	Summer	Autumn
Constant	(10^{1})	0.4992 (7.46)	0.3804 (3.83)	0.8067 (12.3)
Departure time from existing area	(10^{-2})	-0.5890 (8.04)	-0.4344 (3.83)	-1.0370 (13.7)
Composite value		0.1574 (0.72)	0.6924 (1.81)	0.4615 (2.07)
Sample size		633	148	984
Goodness-of-fit (%)		64.7	63.5	74.1
ρ^2		0.086	0.109	0.223

4.3 Prediction Procedure of Sightseeing Demand

In Figure 6, forecasting procedure of future excursion demands is shown. The individual n is identified in every departure region and his excursion behavior is predicted by this Monte Carlo micro simulation. The inter-regional flow, which is predicted by the inter-regional sightseeing travel demand flow model, is the population set of this sample.

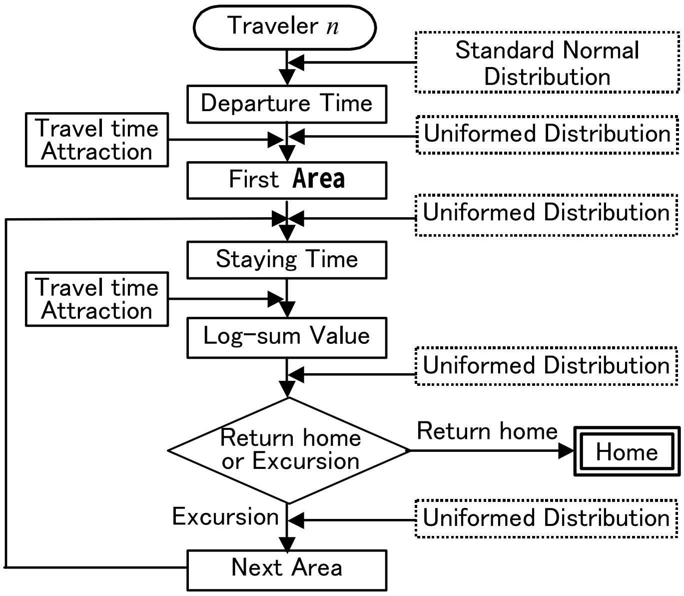

Figure 6 Micro simulation procedure to predict sightseeing travel demand

The inter-regional sightseeing demand flows model predict that the total sightseeing demand flows from all origin regions to Nara northern area will become 32,742 trips in case of Case-2 and 34,570 trips in case of Case-3, respectively, there is an increase 5.6%.

Table 7 The forecasted number of visiting sightseeing areas

	Number of visiting areas			total visiting areas	total demand flows	average
	one	two	three			
Case-1	14,779 (53.1%)	8,960 (32.2%)	4,090 (14.7%)	44,969	27,829	1.615
Case-2 (without case)	16,789 (51.3%)	10,624 (32.4%)	5,329 (16.3%)	54,024	32,742	1.650
Case-3 (with case)	17,408 (50.4%)	11,035 (31.9%)	6,127 (17.7) %	57,859	34,570	1.673
Difference between Case-3 and Case-1	▼ 2.7	▼ 0.3	△ 3.0	△ 12,890 (△ 28.7%)	△ 4,913 (△ 17.6%)	△ 0.058 (△ 3.6%)
Difference between Case-3 and Case-2	▼ 0.9	▼ 0.5	△ 1.4	△ 3,835 (△ 7.1%)	△ 1,828 (△ 5.6%)	△ 0.024 (△ 1.4%)

These flows are the control totals of excursion demand forecasting model and we carried out the Monte Carlo simulation per individual as shown in Figure 6. We showed the trips by the number of visiting areas in Table 7. Compared with Case-1, the ratios of trips, which will visit only one and two sightseeing areas decrease in case of Cases-2 and 3. In Case-3, the ratio of trips, which will visit over three areas, will increase by 3.0%, so that its average gets bigger by 3.6%. The total number of visiting areas will be 12,890 and will increase by 28.7%. The Kei-Na-Wa trunk road seems to be a very effective project for sightseeing demands in Nara northern area.

5. MEASURING LOCAL ECONOMIC IMPACT OF KEI-NA-WA PROJECT

We could obtain much accurate excursion demands by our sightseeing demand forecasting system. The traveler's expenditure seems to be different with his excursion pattern. The statistical difference in expenditure by excursion pattern is analyzed by ANOVA, which is the analysis of variance. Because the excursion patterns, for which is the number of levels is many, we replace an excursion pattern by both the number of visiting sightseeing areas and first visiting area. The results are shown in Table 8. There is a statistically significant difference in the amount of travelers' expenditure by the number of visiting areas. Then, we set the average values by the number of visiting areas as a unit amount of expenditure.

Table 8 ANOVA results on consumption of tourists

	Sum of squares	DF	Mean square	F-value	p-value
Main effects	465.38	6	233.55		
(1) No. of visiting areas	175.60	1	175.60	4.78	0.03
(2) First visiting area	289.78	5	57.95	1.57	0.16
2-way interactions	504.81	11	45.89	1.25	0.25
Error	6164.97	168	36.69		

Table 9 shows the results of economic impact of all cases. Compared with Case-1, output becomes 1.18 times in Case-2 and 1.24 times in Case-3. The production multiplier with the increase of sightseeing demand is 1.71. This value is bigger than the average of all sectors, which is 1.29. We found out that the Kei-Na-Wa trunk road project significantly affects the regional economy in Nara northern region.

Table 9 Economic impact of Kei-Na-Wa road project

Case	Travelers' expenditure	Total output
Case-1	0.863	1.472
Case-2 (without)	1.019	1.739
Case-3 (with)	1.071	1.826

*Billion dollars

6. CONCLUSIONS

In this paper, we proposed a method that could measure the local economic impact of tourism. This method consists of the following two sub-systems:

1) A forecasting system of sightseeing demand that varies with the sightseeing-related trunk road projects. This system consists of the inter-regional sightseeing travel flow model and the sightseeing excursion model.
2) An effect evaluation system that can measure the local economic impact due to the increase in sightseeing demand. This system is based on the input-output approach with which we can evaluate the local economic impact of tourism by using a standard open type input-output table.

These two sub-systems are applied to the economic impact evaluation of the Kei-Na-Wa trunk road project. As a result, it was found out that our economic impact evaluation method is applicable and useful. Usually, the economic benefit in the Cost-Benefit analysis can evaluate only the effect on the amelioration in accessibility by the provision of transportation facility. In the case of the sightseeing-related trunk road projects, however, we sometimes cannot expect the good evaluation because of the shortage of the demand. This kind of road projects affects the regional economy greatly through tourism activity, so we have to evaluate the regional economic impact as well as the economic benefit. In our case study, the economic benefit by the provision of the Kei-Na-Wa trunk road is bigger than its construction cost in only the case that the time value is fairly big and the social discount rate is rather small. The regional economic impact, that is the total output value, by using I/O method proposed, corresponds to about 25% of the total economic benefit, so we cannot neglect this amount. We will have to grasp the economic impact of tourism much accurately. In order to do so, we need to improve not only the sightseeing travel demand-forecasting model but also the economic impact measurement model.

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