Bayesian Network Analysis for the Questionnaire Investigation on Tourists’ Behavior

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Tourists from abroad are increasing rapidly in Japan. Kawazu town in Izu Peninsula is famous for its cherry trees. In the cherry blossom season, many tourists visit this town. The Kawazu Cherry Blossom Festival was carried out in February 2015. Our research investigation was performed during that period. In this paper, a questionnaire investigation is executed in order to clarify tourists’ behavior, and to seek the possibility of developing regional collaboration among local government, tourism related industry and visitors. In this research, we construct the model utilizing Bayesian Network and causal relationship is sequentially chained by the characteristics of travelers, an objective to visit Izu Peninsula in Japan and the main occasion to visit them. Sensitivity Analysis for “Main occasion to visit to Izu Peninsula” was conducted and 17 cases were analyzed. These are utilized for constructing a much more effective and useful tourism service. To confirm the findings by utilizing the new consecutive visiting records would be the future works to be investigated.

Keywords: tourism, Izu Peninsula, Kawazu Cherry Tree, Bayesian Network

1. Introduction

In recent years in Japan, the national and local governments have been trying to attract foreign tourists by using strategic approaches and developing tourist facilities, with the aim of promoting regional exchange and generating economic benefits. Particular aims of local government are to overcome the common problems of an aging population and declining birthrate through tourism-generated income and to stimulate the local society through regional exchange and migration.

However, in order to take measures that will increase tourism, it is necessary to understand the attraction of particular regions in Japan, as well as the resources they offer to tourists. Moreover, it is necessary to have a picture of the tourists that might want to such regions.

Although it is useful to have an understanding of an issue at a given time and under specific social conditions, it is difficult to analyze chronological changes or cross-regional trends statistically. It is standard practice to design a survey such that it permits examination of the statistics for a given region over time, but in order to investigate solutions to problems shared across regions it is necessary to carefully examine the critical basic data as well as appropriate methods of data collection.

To try to obtain such data, preceding studies on tourist destinations that have statistically analyzed trends in tourist behavior will now be reviewed.


In this paper, a questionnaire investigation was executed in Kawazu town [4] in February 2015, which was conducted to coincide with events on the Izu Peninsula featuring flowers; the Kawazu Sakura Festival (Feb–Mar), and ways that regions can collaborate to carry out surveys of tourist behavior was also performed.

This survey of tourist behavior was carried out in February 2015, during the Kawazu Cherry Blossom Festival. Given the geographical peculiarities of Kawazu town and its relative lack of accommodation facilities, some of the survey personnel were located also at Izuju-Inatori Station and Izuju-Shimoda Station. On the first day of the survey, the weather was good, while on the second it was raining.

The 25th Kawazu Cherry Blossom Festival was held from February 10 to March 10, 2015. It was attended by 801,330 people, which was an increase of 9% over the previous year.

On the first day of the survey, 30–50% of the flowers were in bloom, and the nighttime illuminations lit up on the evening of the 21st. According to the figures of the Kawazu town Tourist Association, there were 30,590 visitors on the 21st and 20,913 visitors on the 22nd [5].

During the Kawazu Cherry Blossom Festival, around

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150 stores were offering food & drink or souvenirs on the road with the row of cherry trees linked to Kawazu Station. A number of events were held during the festival, including the “Semi Gourmet” and “Izu no Odoriko Photography Event.”

In this paper, a questionnaire investigation is executed in order to clarify tourists’ behavior, and to seek the possibility of developing regional collaboration among local government, tourism related industry and visitors. These are analyzed by using Bayesian Network.

The analysis utilizing Bayesian Network enabled us to visualize the causal relationship among items. Furthermore, sensitivity analysis brought us estimating and predicting the prospective visitors.

Some interesting and instructive results are obtained. These are utilized for constructing a much more effective and useful tourism service.

The rest of the paper is organized as follows. Outline of questionnaire investigation is stated in Section 2. In Section 3, Bayesian Network analysis is executed which is followed by the sensitivity analysis in Section 4. Remarks is stated in Section 5.

2. Outline and the Basic Statistical Results of the Questionnaire Research

2.1 Outline of the Questionnaire Research

We make a questionnaire investigation on tourists’ behavior who has visited Izu Peninsula and is studied mainly at Kawazu town in Shizuoka Prefecture. Kawazu town is famous for its cherry trees. The outline of questionnaire research is as follows. Questionnaire sheet is attached in Appendix.

- Scope of investigation: Tourists who have visited Kawazu town in Shizuoka Prefecture, Japan
- Period: February 21, 22/ 2015
- Method: Local site, Dispatch sheet, Self writing
- Collection: Number of distribution 500, Valid answer 478 (collection rate 95.6%)

2.2 Basic Statistical Results

Now, we show the main summary results by single variable.

2.2.1 Characteristics of Answers (Q4)

(1) Sex (Q2)
- Male 37.24%, Female 59.83%, (Not filled in 2.93%)

(2) Age (Q3)
- 10th 2.51%, 20th 14.23%, 30th 12.76%, 40th 13.18%, 50th 18.41%, 60th 17.78%, More than 70 8.37%, (Not filled in 12.76%)

(3) Occupation (Q4)
- Independents 3.77%, Office worker 48.74%, Student 4.81%, Housewife 16.53%, No job 12.13% Miscellaneous 1.26%, (Not filled in 12.76%)

(4) Residence (Q1)
- Tokyo 28.16%, Kanagawa 22.15%, Shizuoka 10.35%, Saitama 10.14%, Chiba 6.63%, Aichi 2.48%, Tochigi 2.48%, Ibaraki 1.86%, Gunma 1.24%, Yamanashi 1.24%, Osaka 0.83%, Nagano 0.83%, Gifu 0.62%, Fukushima 0.62%, Miyagi 0.62%, Else

(5) Fellow travelers (Q5)
- Solo trip 3.35%, Couple 34.31%, Family 28.45%, Male’s small group 3.77%, Female’s small group 12.76%, Male and female’s small group 7.95%, Group(More than 7) 7.53%, Miscellaneous 0.42%, (Not filled in 1.46%)

These are exhibited in Figure 1.

2.2.2 Visiting frequency to Izu Peninsula and Kawazu Cherry Tree:

- Izu Peninsula: ① First time 18.62% ② Second times 11.09% ③ Third times 9.83% ④ Fourth times 5.86% ⑤ Fifth ~ Nine times 15.90% ⑥ More than ten times 37.65%, (Not filled in 1.05%)

- Kawazu Cherry Tree: ① First time 48.95% ② Second times 16.53% ③ Third times 10.46% ④ Fourth times 4.60% ⑤ Fifth ~ Nine times 6.07% ⑥ More than ten times 7.74% ⑦ Has not been there 3.97%, (Not filled in 3.97%)

3. Bayesian Network Analysis

In constructing Bayesian Network, it is required to check the causal relationship among groups of items.

Based on this, a model is built as is shown in Figure 2. We used BAYONET software (http://www.msi.co.jp/BAYONET/). When plural nodes exist in the same group, it occurs that causal relationship is hard to set a priori. In that case, BAYONET system set the sequence automatically utilizing AIC.
Setting evidence to “Solo trip” case

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newspaper ad</td>
<td>+</td>
</tr>
<tr>
<td>Internet</td>
<td>+</td>
</tr>
<tr>
<td>Historic landmark, Literature monument, Construction</td>
<td>++</td>
</tr>
<tr>
<td>Gallery, Museum</td>
<td>++</td>
</tr>
<tr>
<td>Experience-based tourism</td>
<td>+</td>
</tr>
<tr>
<td>Park</td>
<td>+</td>
</tr>
</tbody>
</table>

4. Sensitivity Analysis

Now, posterior probability is calculated by setting evidence as, for example, 1.0. Comparing Prior probability and Posterior probability, we can seek the change and confirm the preference for tourism. We set evidence to all parameters. Therefore the analysis volume becomes too large. In this paper, we pick up half of the total cases and make analysis. Nodes we analyze here are “Fellow travelers,” “Main occasion to visit Izu Peninsula” and “An objective to visit Izu Peninsula.” We prepare another paper for the latter half.

As stated above, we set evidence for each parameter. We call the value of “Posterior probability - Prior probability” as “Difference of probability” hereafter.

Here, we classify each item by the strength of the difference of probability.

- Strong (++, ---): Select major parameter of which absolute value of difference of probability is more than 0.1
- Medium (++, -): Select major parameter of which absolute value of difference of probability is more than 0.07
- Weak: Else

In selecting items, negative value does not necessarily have distinct meaning, therefore we mainly pick up positive value in the case meaning is not clear.

4.1 Sensitivity Analysis for “Fellow Travelers”

(1) Setting evidence to “Solo trip”

After setting evidence to “Solo trip,” the result is exhibited in Table 1.

We can observe that “Those who make Solo trip had come by the occasion of Newspaper ad or Internet with an objective of visiting Historic landmark, Literature monument, Construction, Gallery, Museum, Experience-based tourism or Park.”

(Strong part is indicated by bold character.)

(2) Setting evidence to “Couple”

After setting evidence to “Couple,” the result is exhibited in Table 2.

We can observe that “Those who are Couple had come with an objective of visiting Hot spring.”

(3) Setting evidence to “Family”

After setting evidence to “Family,” the result is exhibited in Table 3.

We can observe that “Those who are Family had not come with (Strong Medium) positive occasion nor positive objective.”

(4) Setting evidence to “Male’s small group”

After setting evidence to “Male’s small group,” the result is exhibited in Table 4.

We can observe that “Those who are Male’s small group had come with an objective of visiting Stroll around town, Eating tour, Budget, Convenience of traffic, Historic landmark, Literature monument, Construction, Sightseeing facilities, Gallery, Museum, Experience-based tourism or Park.”

(5) Setting evidence to “Female’s small group”

There were only weak positive items.

(6) Setting evidence to “Male and female’s small group”

There were only weak positive items.

(7) Setting evidence to “Group (More than 7)”

After setting evidence to “Group (More than 7),” the result is
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4.2 Sensitivity Analysis for “Main Occasion to Visit to Izu Peninsula”

(1) Setting Evidence to “Poster”

After setting evidence to “Poster,” the result is exhibited in Table 6.

We can observe that “Those who put main occasion to visit to Izu Peninsula as Poster had come by Solo trip.”

(2) Setting Evidence to “Brochure by tour company”

After setting evidence to “Brochure by tour company,” the result is exhibited in Table 7.

We can observe that “Those who put main occasion to visit to Izu Peninsula as Brochure by tour company had come by Group(More than 7).”

(3) Setting Evidence to “TV program”

There were only weak positive items.

(4) Setting Evidence to “Newspaper ad”

After setting evidence to “Newspaper ad,” the result is exhibited in Table 8.

We can observe that “Those who put main occasion to visit to Izu Peninsula as Newspaper ad had come by Solo trip with an objective of visiting Gallery, Museum.”

(5) Setting Evidence to “Tour package for Kawazu Cherry Tree”

After setting evidence to “Tour package for Kawazu Cherry Tree,” the result is exhibited in Table 9.

We can observe that “Those who put main occasion to visit to Izu Peninsula as Tour package for Kawazu Cherry Tree had come by Group(More than 7).”

(6) Setting Evidence to “Online lodging reservation site”

After setting evidence to “Online lodging reservation site,” the result is exhibited in Table 10.

We can observe that “Those who put main occasion to visit to Izu Peninsula as Online lodging reservation site had come by Solo trip with an objective of visiting Gallery, Museum.”

(7) Setting Evidence to “Internet”

After setting evidence to “Internet,” the result is exhibited in Table 11.

We can observe that “Those who put main occasion to visit to Izu Peninsula as Internet had come by Solo trip with an objective of visiting Gallery, Museum.”

(8) Setting Evidence to “Advice by family, acquaintance”

After setting evidence to “Advice by family, acquaintance,” the result is exhibited in Table 12.

We can observe that “Those who put main occasion to visit to Izu Peninsula as Advice by family, acquaintance had come by Female’s small group, Male and female’s small group or Group(More than 7) with an objective of visiting (suitable) Budget, Gallery, Museum, Experience-based tourism or Park.”
Analysis is as follows. Analysis was conducted after that. The main result of sensitivity examination of the causal relationship among items. Sensitivity result is exhibited in Table 13.

| Table 12 Setting evidence to “Advice by family, acquaintance” case |
|---------------------------------|------------------|
| Female’s small group            | +                |
| Male and female’s small group   | ++               |
| Group (More than 7)             | ++               |
| Budget                          | +                |
| Gallery, Museum                 | +                |
| Experience-based tourism        | +                |
| Park                            | +                |

Table 13 Setting evidence to “Felt good at the previous visit” case

<table>
<thead>
<tr>
<th>Group (More than 7)</th>
<th>— —</th>
</tr>
</thead>
</table>

We can observe that “Those who make Solo trip had come by the occasion of Newspaper ad or Internet with an objective of visiting Historic landmark, Literature monument, Construction, Gallery, Museum, Experience-based tourism or Park.”

We can observe that “Those who are Couple had come with an objective of visiting Hot spring.”

We can observe that “Those who are Group (More than 7) had come by the occasion of Magazine or Tour package for Kawazu Cherry Tree with an objective of visiting (suitable) Budget.”

We can observe that “Those who put main occasion to visit to Izu Peninsula as Brochure by tour company had come by Group (More than 7) with an objective of visiting Gallery, Museum.”

We can observe that “Those who put main occasion to visit to Izu Peninsula as Budget had come by Group (More than 7).”

We can observe that “Those who put main occasion to visit to Izu Peninsula as Advice by family, acquaintance had come by Female’s small group, Male and female’s small group or Group (More than 7) with an objective of visiting (suitable) Budget, Gallery, Museum, Experience-based tourism or Park.”

5. Remarks

The main results of basic statistical analysis are as follows.

(1) The visitors were of all ages, from 20s to 70s-or-over, with no particular tendency towards visitors of a certain age group.

(2) As regards the type of trip, most visitors had come as individuals, and a mere 8% had come as part of a group. Looking at specific age groups, although married and unmarried couples were common across all age groups, those aged 10–19 and those in their 40s tended to be visiting with their families.

(3) The majority of visitors had been five or more times to the Izu Peninsula, indicating a tendency towards multiple repeat visits.

(4) Most visitors to the Kawazu Cherry Blossom Festival were attending the event for the first or second time. It may be that advertising promotion or the like had caused visitors to come to the festival.

(5) Most visitors came to the Izu Peninsula by train, and the majority of visitors moved around the Izu Peninsula solely on foot, or by train or bus. Only 3.14% of the visitors traveled to the west coast of the peninsula. This may be because the available transport in the area tends to serve the east coast.

(6) For around half of the visitors, what prompted them to come to Izu was a travel agency pamphlet, or some kind of mass media such as the television or the Internet. However, the media on the Internet including the accommodation booking site served as trigger for only around 8% of these visitors. Although it is likely that visitors used the Internet to gather information about their destination after they had booked their trip, it seems that, as ever, traditional analog sources of information still have the power to attract customers.

(7) As regards the visitors’ objectives for the trip, as many as 279 visitors came for the flowers, while others came for hot springs, scenery, nature, and the cuisine/experiencing new tastes. In contrast, few visitors came to visit historical sites, monuments to literary figures, buildings, tourist facilities, art galleries, museums, or other cultural facilities, which may indicate that the natural environment in the area was sufficiently attractive for visitors.

(8) Most visitors (63%) stayed just one night on the Izu Peninsula, while 21% returned home on the same day. In addition, 60% of visitors were from the Tokyo, Kanagawa, and Shizuoka areas. Given that they stayed one night or returned home on the same day, it appears that they consider the Izu Peninsula a handy location for a short trip.

The Results for Bayesian Network Analysis are as follows.

In the Bayesian Network Analysis, model was built under the examination of the causal relationship among items. Sensitivity Analysis was conducted after that. The main result of sensitivity analysis is as follows.

6. Conclusion

In this paper, a questionnaire investigation is executed in order to clarify tourists’ behavior, and to seek the possibility of developing regional collaboration among local government, tourism related industry and visitors. This survey of tourist behavior was carried out in February 2015, during the Kawazu Cherry Blossom Festival. The 25th Kawazu Cherry Blossom Festival was held from February 10 to March 10, 2015. It was attended by 801,330 people, which was an increase of 9% over the previous year. On the first day of the survey, 30-50% of the flowers were in bloom, and the nighttime illuminations lit up on the evening of the 21st. According to the figures of the Kawazu town Tourist Association, there were 30,590 visitors on the 21st and 20,913 visitors on the 22nd.

During the Kawazu Cherry Blossom Festival, around 150 stores were offering food & drink or souvenirs on the road
with the row of cherry trees linked to Kawazu Station. A number of events were held during the festival, including the “Semi Gourmet” and “Izu no Odoriko Photography Event.”

At around the same time (January 20 to March 31), the 18th “Hina no Tsurushikazari Festival” (Hanging Doll Festival) was held at Higashizhu town Inatori.

In order to look for policies for effective use of questionnaire surveys in tourist destinations, the present study reviewed preceding studies in the field. Moreover, an attempt was made to find possibilities for inter-regional cooperation based on the data.

In the Bayesian Network Analysis, the model was built under the examination of the causal relationship among items. Sensitivity Analysis for “Main occasion to visit to Izu Peninsula” was conducted and 17 cases were analyzed. Strongly changed items were made clear which suggest the way to improve policy or approaching method. Although it has a limitation that it is restricted in the number of research, we could obtain the fruitful results.

In the future, it will be necessary to continue such surveys at various locations on the Izu Peninsula using a standardized set of questionnaire items and methods, and the efficacy of the study will have to be confirmed.

References

Appendix
Questionnaire about the Tourism in Izu Peninsula

Please select the appropriate item in each column. Please write down the details in ( ) .

Q1. Address: Prefecture ( )
   ⇒If the prefecture is Tokyo, Kanagawa, Shizuoka, then City ( )

Q2. Sex: ① Male ② Female

Q3. Age: ① 10th ② 20th ③ 30th ④ 40th ⑤ 50th ⑥ 60th ⑦ 70+

Q4. Occupation:
   ① Independents ② Office worker ③ Student ④ Housewife ⑤ No job ⑥ Miscellaneous ( )

Q5. Fellow travelers:
   ① Solo trip ② Couple ③ Family ④ Male’s small group ⑤ Female’s small group ⑥ Male and female’s small group
   ⑦ Group (More than 7) ⑧ Miscellaneous ( )

Q6. Visiting frequency to Izu Peninsula and Kawazu Cherry Tree: Izu Peninsula= ① First time ② Second times ③ Third times ④ Fourth times ⑤ Fifth ⑥ Ninth times ⑦ More than ten times
   Kawazu Cherry Tree= ① First time ② Second times ③ Third times ④ Fourth times ⑤ Fifth ⑥ Ninth times ⑦ More than ten times

Q7. Means of transportation to IZU Peninsula:
   ① JR, Izu-kyuko train ② Sightseeing bus ③ Private automobile
   ④ Rent-a car ⑤ Highway bus ⑥ Shuttle bus service by the hotel
   ⑦ Miscellaneous ( )

Q8. Means of movement in Izu Peninsula (Plural answers allowed)
   ① Walking ② Fixed-route bus ③ Sightseeing bus ④ Private automobile
   ⑤ Rent-a car ⑥ Taxi ⑦ Miscellaneous ( )
   ⇒To whom who has selected ⑤: Starting point ( ) End point ( )

Q9. Main occasion to visit to Izu Peninsula (Plural answers allowed)
   ① Poster ② Brochure by tour company ③ TV program
   ④ Newspaper ad ⑤ Magazine ⑥ Tour package for Kawazu Cherry Tree
   ⑦ Online lodging reservation site ⑧ Internet ⑨ Advice by family, acquaintance
   ⑩ Felt good at the previous visit
   ⑪ Miscellaneous ( )

Q10. What is an objective to visit Izu Peninsula? (Plural answers allowed)
   ① Hot spring ② Scenery, Nature ③ Dish, sense of taste ④ Flower of the season ⑤ Stroll around town, Eating tour ⑥ Budget
   ⑦ Convenience of traffic ⑧ Historic landmark, Literature monument, Construction ⑨ Sightseeing facilities
   ⑩ Gallery, Museum ⑪ Experience-based tourism ⑫ Park ⑬ Miscellaneous ( )

Q11. Staying time in Izu Peninsula:
   ① One-day trip ② 2 days stay ③ 3 days stay ④ More than 4 days
   ⇒If you have selected ② ~ ④, please answer the following question.

   (1) Staying type:
      ① Inn, Hotel ② Resort house ③ Second house ④ Relative’s house
      ⑤ Miscellaneous ( )

   (2) Use type of staying facilities:
      ① Per night with dinner and breakfast ② Per night with dinner
      ③ Per night with breakfast ④ With no meals ⑤ Miscellaneous ( )

Q12. Where are you going to go in Izu Peninsula? *Place at which staying time is more than 30 minutes
   * Customer type ( ) : A: One-day trip, Depart from Kawazu Cherry Tree B: One-day trip, Depart from elsewhere except for Kawazu Cherry Tree C: Stay more than one night, Depart from Kawazu Cherry Tree D: Stay more than one night, Depart from elsewhere except for Kawazu Cherry Tree
Q13. Do you want to come to Izu Peninsula again?

Q13-A:

1. Want to come again
2. Slightly want to come again
3. Slightly do not want to come again
4. Do not want to come again

⇒ To whom has selected 1 and 2: What was good in Izu Peninsula?

⇒ To whom has selected 3 and 4: What was not good in Izu Peninsula?

Q13-B: What season do you want to come to Izu Peninsula?

1. Spring Month
2. Summer Month
3. Autumn Month
4. Winter Month

Q14. Select items in each theme concerning the attractiveness of southern part of Izu Peninsula. (Plural answers allowed)

Theme 1 “sea”:
1. Sea bathing
2. Activities such as diving and fishing
3. Pleasure cruiser
4. Sunset
5. Driving along the coastline
6. Open-air bath where the visitor can see the sea
7. Fresh products of the sea

Theme 2 “Hot spring”:
1. Feelings of the hot spring district
2. Japanese-style hotel
3. Open-air bath
4. Dinner in the hotel
5. Hospitality

Theme 3 “Nature”:
1. Flower of the season
2. Hiking, Stroll
3. Geopark
4. Experience-oriented program
5. Mount Fuji
6. Warm climate

Theme 4 “Culture”:
1. Temples and shrines
2. Letter bearing the shogun’s scarlet seal (Voucher seals of visit)
3. Stroll around town
4. Folk craft goods
5. Local dishes

Miscellaneous:
1. 1,000
2. 1,001 ~ 2,000
3. 2,001 ~ 3,000
4. 3,001 ~ 5,000
5. 5,001

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