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A Structural Equation Model of Risk Perception of Rockfall for Revisit Intention

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***Abstract*—**The study aims to explore the relationship between risk perception of rockfall and revisit intention using a Structural Equation Modeling (SEM) analysis. A total of 573 valid questionnaires are collected from travelers to Taroko National Park, Taiwan. The findings show the majority of travelers have the medium perception of rockfall risk, and are willing to revisit the Taroko National Park. The revisit intention to Taroko National Park is influenced by hazardous preferences, willingness-to-pay, obstruction and attraction. The risk perception has an indirect effect on revisit intention through influencing willingness-to-pay. The study results can be a reference for mitigation the rockfall disaster.

***Keywords*—**Risk perception, rockfall, revisit intention, structural equation modeling.

I. Introduction

THE Taroko National Park, located in Hualien County, Tawian is a popular scenic spot for domestic and international travelers. There are more than 3300 thousand persons to Taroko National Park in 2012. The geology of Taroko National Park is metamorphic rocks and the terrain is very steep. After the earthquake and heavy rain, rockfall occurs frequently and the accident of travelers injured by rockfall often happens, which affects seriously the travelers' security and impact the local tourism industry. For example, the event of rockfall on July 6, 1987 made 3 persons killed and 7 persons injured. Another event of rockfall on April 3, 2005 made 1 person killed and 7 persons injured. Especially, the rockfall hit a tourist coach and made 26 persons dead, which is the worst travel accident in recently years. In addition, the landslide induced by the earthquake with a magnitude of 6.3 on June 2, 2013 broke the road of Tai-8, which influences the local tourism development again.

Based on the records of Taroko National Park, Taiwan, there are 42 accidents of rackfall occurred in Taroko National Park during 1986 to 2012 years. Among these rockfall events, there are 19 injury records, in which 3 dead records. The average risk of rockfall is about 0.79×10-7. The triggered factors to rokfall include earthquake (17%), typhoon (14%), heavy rain (19%), and natural wreathing (50%). In these factors, the probability of natural wreathing-induced rockfall is highest and is hard to prevent from rockfall. Nowadays, Taroko National Park management office adopts two strategies including tourists streaming and remediation engineering of rockfall to mitigate the rackfall disaster. It is estimated that the engineering cost of rockfall remediation will reach to 0.85 billion, which brings a heavy loading to government finance and obstructs the landscape of Taroko National Park.

The travelers are the main rockfall-affected elements. In the tourist process, travelers are deeply immersed in the joy atmosphere and are exposed in the rockfall risk [1]–[3]. For travelers, the perceived risk of rockfall can be awarded by sight, hearing sense, smelling sense and experience [4], [5]. That is, the perceived risk of traveler is influenced by the psychology, social colure, and so on [6]. Many studies show that the risk perception may influence the travel decisions. Therefore, the travelers' behavior can be predicted by the investigation of risk perception of travelers. The purpose of this paper is to investigate the risk perception of rockfall and the revisit intention by a case study of Taroko National Park, located in North Taiwan. The study results can be a reference for disaster response and strategy for mitigation the rockfall disaster.

II. Method

A. Study Design

The initial analytical model is designed for understanding the risk perception of rockfall and tourist behavior (see Fig. 1). The tourist behavior is expressed by the variable of revisit intention, which may be affected by variables of willingness to pay and tourist attitude consisted of perception, attraction, obstruction, and hazardous preference [7], [8]. The causal relationship between variables is presented as shown in Fig. 1.

A structural equation model analysis is performed in order to check whether the hypothesized model (see Fig. 1) is verified. Various fit indices are used to test a hypothesized model. Assessment of model fit is based on multiple criteria including absolute-fit-indices, incremental-fit-index and parsimony-fit-index. The absolute-fit- indices includes the root mean square error of approximation (RMSEA), Chi-Square (x^2), and goodness-of-fit index (GFI). The incremental-fit-index includes normal fit index (NFI). The parsimony-fit-index includes NC (= x^2/df). The *df* is the degree of freedom. A model is fit when the indices shows that (i) the less the value of x^2 is, and the more a model fit, (ii) index of GFI is greater than 0.9, (iii) the RMSEA index of 0.08 or less indicates a reasonable error and can be accepted, (iv) the index of NFI is greater than 0.9, and (v) the index of NC ranges between 1 to 3. These indices are used for evaluation of model fit.

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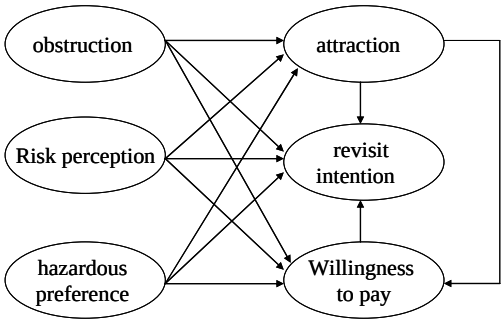

Fig. 1 Hypothesized model

B. Respondents

Questionnaire is used to collect data in order to investigate the risk perception of rockfall and revisit intention. A total of 600 questionnaires were selected from travelers, who went to Taroko National Park, Taiwan during April to May, 2013. The 573 valid samples were collected with an effective returns-ratio of 95.5%. The people in the sample are 64.4% female. Of the respondents, 22.2% are aged between 30-39 years old, 66.1% are college educated, and 38.9% are from Northern, Taiwan. There are 26.4% respondents, who travel frequency per year is greater than 6 (see Table I).

TABLE I
CHARACTERISTICS OF RESPONDENTS

Characteristics	Classification	Frequency	Percentage (%)
Sex	Male	369	64.4
	Female	204	36.6
Age	<20	35	6.1
	20-29	237	41.5
	30-39	128	22.2
	40-49	74	12.9
	50-59	54	9.4
	60-69	35	6.1
	>70	10	1.7
Highest education	Primary school	20	3.5
	Senior and senior high school	95	16.6
	College	379	66.1
	Master	76	13.3
	Doctor	3	0.5
Residence	Northern, Taiwan	223	38.9
	Central, Taiwan	81	14.1
	Southern, Taiwan	114	19.9
	Eastern, Taiwan	114	19.9
	Mainland	21	3.7
	Foreign(exclude Mainland)	20	3.5
Travel frequency per year	<1	64	11.2
	1	69	12.2
	2	115	20.1
	3	105	18.2
	4	45	7.9
	5	22	3.8
	6	2	0.3
	>6	151	26.4

Table II shows the trip status of travelers to Taroko National Park. Of respondents, about 66% are free travel and 62.1% arrange both of hotel and route in advance. The most traffic tool to Taroko National Park is driving by self. And 31.9% is the first time to Taroko National Park and 55.8% stay 1 day.

TABLE II
TRIP STATUS

Characteristics	Classification	Frequency	Percentage (%)
Travel pattern	Free travel with two person or less	136	23.7
	Free travel with three person or more	243	42.4
	Private group	144	25.1
	Organization group	11	1.9
	Package by agency	39	6.8
Trip arrangement in advance	Both of hotel and route	356	62.1
	Hotel or route	125	21.8
	Non arrangement	92	16.1
Traffic tool	Driving by self	321	56
	By bus	50	8.7
	By tourist coach	55	9.6
	By motorcycle	119	20.8
	By bicycle	28	4.9
How many time to Taroko National Park	First time	183	31.9
	Second time	111	19.4
	Third time	89	15.5
	Forth time	31	5.4
	Fifth time	15	2.6
	Sixth time	11	1.9
	> Sixth time	133	23.2
Stay days	1 day	320	55.8
	2 days	152	26.5
	3 days	53	9.2
	4 days	32	5.6
	5 days	5	0.9
	> 5 days	11	1.9

C. Questionnaire and Descriptive Statistics

There are six constructions adopted in this paper, including hazardous preference, tourism attraction, tourism obstruction, risk perception of rockfall, revisit intention and willingness to pay. Every construction is consisted by 3 - 7 items (see Table III). All items are answered on nine-point Likert response scale ranging from 9 (strongly agree) to 1 (strongly disagree). The mean values are calculated on the basis of the items measuring the agreement level. A high score on an item and construction indicates a high degree of agreement.

Table III shows the mean of all items and constructions. The main tourism attractions are canyon view and pleasant climate. For travelers, the main tourism obstruction is landslide and rockfall. Most respondents also show that they understand fully the rockfall possibility before departure. The majority of travelers has the medium risk perception of rockfall and is willing to revisit the Taroko National Park. The scales of hazardous preference and willingness to pay are above medium level of agreement.

TABLE III
ITEMS IN QUESTIONNAIRE

Construction/Item	mean
1.Attraction (ABS)	6.14
A1.Canyon view	7.97
A2.Pleasant climate	7.08
A3.Featured accommodation	5.06
A4.Wild Animals and plants	5.63
A5.Cultural Historical sites	5.60
A6.Trails and Hiking	6.26
A7.Activity participation	5.36
Cronbach's alpha =	0.87
2.Obstruction (IMP)	4.30
B1.Food health	3.75
B2.Traffic accidents	4.76
B3.Sick	3.49
B4.Security problems	3.35
B5.Earthquake	4.81
B6.Landslide and rockfall	5.61
Cronbach's alpha =	0.93
3.Risk perception of rockfall (REC)	6.35
C1.To understand fully the rockfall possibility before departure	7.16
C2.To worry about occurrence of rockfall	6.00
C3.To choose a safer opportunity to visit	5.90
Cronbach's alpha =	0.86
4.Revisit intention (DIS)	7.79
D1.I am very satisfied	7.75
D2.I will revisit Taroko National Park	7.79
D3.I will recommend Taroko National Park to my friends	7.83
Cronbach's alpha =	0.92
5.Hazardous preference (PRE)	6.88
E1.Compared to friends, you are the one who most like outdoor activity.	7.11
E2.Compared to friends, you are the one who most like to adventure	6.64
E3.Compared to friends, you are the one who most like the novel things	7.08
E4.Compared to friends, you are the one who easily solve all kinds of difficulties.	6.70
Cronbach's alpha =	0.88
6. Willingness-to-pay (PAY)	6.52
F1.I will visit Taroko National Park after rockfall risk reduces	6.00
F2.I am willing to coordinate management strategies of rockfall	7.13
F3.I am willing to pay extra ticket	6.40
F4.I am willing to pay extra insurance fee	6.56
Cronbach's alpha =	0.86

III. ANALYSIS AND RESULTS

A. Reliability

In this paper, a reliability scale test is carried out for all constructs in order to assess the internal consistency of variables. According to document [9], the value of Cronbach's alpha was classified based on a reliability index in which 0.90 – 1.00 is very high, 0.70 - 0.89 is high, 0.30 – 0.69 is moderate, and 0.00 – 0.29 is low. As shown in Table III, the resulting alpha values ranged from 0.86 to 0.93, which fall into the classification of high and very high. That is to say, the alpha values in this paper are above the acceptable threshold 0.70 suggested by document [9].

B. Data Analysis

A structural equation model analysis is implemented to check whether the hypothesized model (see Fig. 1) is fitted the data from 573 samples. The initial findings show that the data from the sample does not fit with the hypothesized model. Therefore, modifications are done to the model according to the guide [10] where some of information is checked. Modifications steps are as follows [11]:

a. Review of the factor loading of each item where it must exceed 0.50, and remove the items that do not meet this criterion.
b. Review of the standardized residual where the items with value of more than 2.58 will be dropped.
c. Review of the modification index to improve the model.

After modification, some items are dropped. Modified model is tested again and the results of fit indices indicate a better fit. The fit measure indicates that the proposed model fitted the observed data well from 573 samples. The goodness of fit indices show x^2 = 192.10, *df* = 165, p = 0.073, NFI = 0.99, GFI = 0.97, RMSEA = 0.017, NC = 1.16. The paths between latent variables are statistically significant. The modified model with standardized path coefficients is presented as shown in Appendix. Fig. 2 is the simplification of the modified model with standardized coefficients.

Table IV shows the results of component fit measures including standardized coefficient, error variance, t-vale, and composite reliability. The values of composite reliability in Table IV show every construct has a good inter-consistency. That is, items in every construct are inter-correlated.

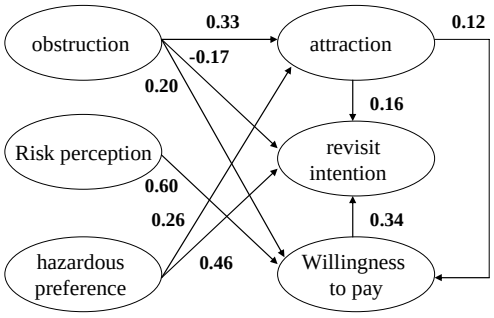

Fig. 2 Modified model

C. Discussion

Table V shows the effects of constructs on revisit intention. Tourism attraction (ABS), tourism obstruction (IMP), hazardous preference (PRE) and willingness-to-pay (PAY) are variables with direct effects on revisit intention (DIS). And risk perception (REC) is not related to revisit intention (DIS) in the path model. The lack of direct effect of risk perception (REC) on revisit intention impels that the effect on revisit intention is generally mediated through willingness to pay. That is, the risk perception has an indirect effect on revisit intention through influencing willingness to pay. The total effect of hazardous preference on revisit intention is greatest (= 0.51) which means the revisit intention is greater as the hazardous preferences is

higher. And the total effect of tourism obstruction on revisit intention is lowest. The equation between constructions can be expressed as follows:

$$DIS=0.56+0.16\times ABS-0.18\times IMP+0.46\times PRE+0.34\times PAY, \quad R^2=0.44 \qquad (1)$$

To integrate above analysis, some findings are listed as follows:

d. Although the worst fear is rockfall occurrence for travelers to Taroko National Park, Taiwan, its degree of fear is medium.
e. Under the threat of rockfall, travelers still have high revisit intention.

The influence degree on revisit intention is hazardous preference, willingness to pay, risk perception and tourism attraction, in turn.

TABLE IV
STATISTIC OF ITEMS IN MODIFIED MODEL

Item	standardized coefficient	Error variance	t-value	Composite reliability
ABS				0.90
A3	0.67	0.52	14.41	
A4	0.87	0.25	17.54	
A5	0.86	0.26	17.40	
A6	0.82	0.33	16.74	
A7	0.73	0.46	15.99	
IMP				0.86
B1	0.63	0.60	16.66	
B3	0.60	0.64	15.51	
B4	0.57	0.67	14.65	
B5	0.89	0.251	26.25	
B6	0.93	0.13	29.07	
C2	0.27	0.29	5.55	
REC				0.69
C1	0.49	0.76	11.35	
C2	0.71	0.29	13.58	
C3	0.68	0.54	15.68	
DIS				0.91
D1	0.90	0.20	5.44	
D2	0.90	0.18	19.41	
D3	0.85	0.28	19.06	
PRE				0.85
E1	0.81	0.34	23.02	
E2	0.79	0.38	21.83	
E3	0.87	0.25	25.28	
E4	0.77	0.40	21.24	
C2	-0.15	0.29	-3.56	
PAY				0.86
F1	0.58	0.66	14.22	
F2	0.88	0.22	13.12	
F3	0.79	0.38	12.24	
F4	0.78	0.39	12.24	

TABLE V
EFFECTS OF CONSTRUCTIONS

construction	direct effect	indirect effect	total effect
ABS	0.16	0.04	0.20
IMP	-0.17	0.14	-0.04
REC	0	0.21	0.21
PRE	0.46	0.05	0.51
PAY	0.34	0	0.34
coefficient	0.56		

IV. CONCLUSIONS

The rockfall disaster is an important issue for traveler security of Taroko National Park, located in North Taiwan. This paper investigates the relationship between risk perception of rockfall and visit intention from understating the traveler behavior. Through 573 valid respondents, the findings show majority of travelers are composed of persons like outdoor activities and the canyon view is the most popular attraction. The travelers have a medium degree of risk perception of rockfall and are willingness to revisit Taroko National Park. A structural equation model is adopted to develop the relationships between hazardous preference, tourism attraction, tourism obstruction, risk perception of rockfall, revisit intention and willingness to pay. The results indicate that risk perception displays an indirect effect on revisit intention through influencing willingness to pay. The main influence factor on revisit intention is hazardous preferences.

APPENDIX

See Fig. A1.

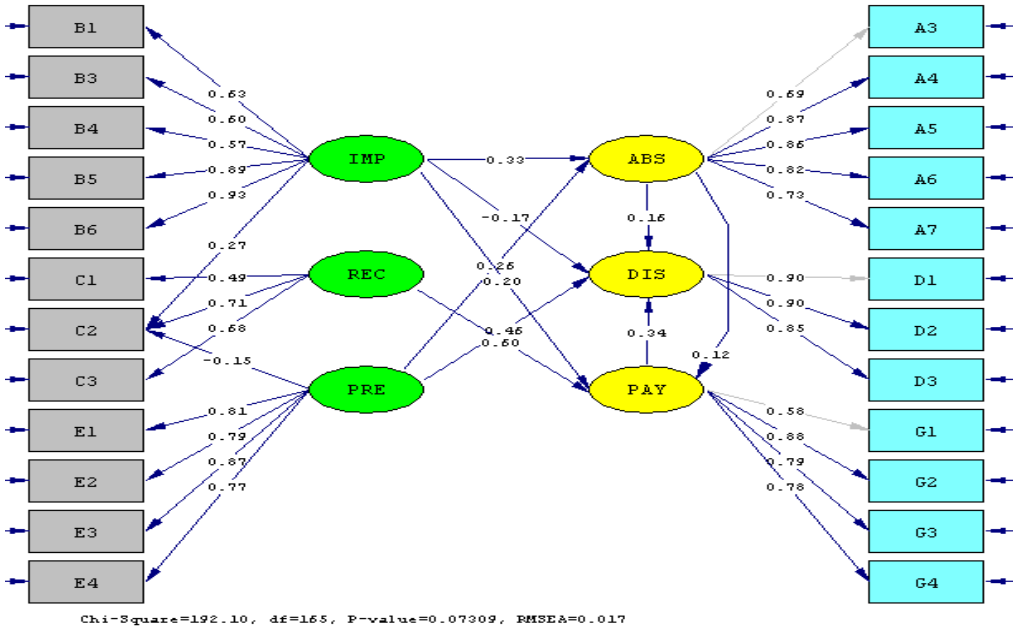

Fig. A1 Standardized coefficients of modified MODEL

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REFERENCES

[1] T. A. Bentley, and S. J. Page, Tourist injury. In Wilks J, D Pendergast and P Leggat (eds.), *Tourism in Turbulent Times-Towards Safe Experiences for Visitors*. Advances in Tourism Research Series, Elsevier Ltd, Oxford, 2006.

[2] S. J. Page, T. A. Bentley, and D. Meyer, *Evaluating the Nature, Scope and Extent of Tourist Accidents—The New Zealand Experience*. In Wilks J and SJ Page (eds.), Managing Tourist Health and Safety in the New Millennium. Pergamon, Oxford, 2003.

[3] S J. Page, and D. Meyer, Tourist accidents: An exploratory analysis. *Annals of Tourism Research*, vol. 23, no. 3, pp. 666-690, 1996.

[4] T. R. Tyler, Assessing the Risk of Crime Victimization: The Integration of Personal Victimization Experience and Socially-Transmitted Information. *Journal of Social Issue*, vol. 40, no. 1, pp. 27-38, 1984.

[5] N. D. Weinstein, Unrealistic Optimism about Susceptibility to Health Problems: Conclusions from a Community-Wide Sample. *Journal of Behavioral Medicine*, vol. 10, no. 5, pp. 481-500, 1987.

[6] S. Krimsky, and A. Plough, *Environmental Hazards: Communicating Risks as a Social process*. Massachusetts: Auburn House Publishing Company, 1988.

[7] J. D. Fisher, P. A. Bell, and A. Baum, *Environmental Psychology*, Holt, Rinehart and Winston, New York, 1984.

[8] S. K. Reed, *Cognition: Theory and Applications* (3th ed.), Boos/Cole Publishing, California, 1991.

[9] E. Babbie, The Practice of Social Research. California: Wardsworth Publishing Company, 1992.

[10] J. F. Hair, W. C. Black, B. J. Babin, R. E. Anderson, and R. L. Tatha, *Multivariate Data Analysis*. New Mersey: Person International Edition, 2006.

[11] H. Mohd Yusof, M. Ramlee, A. M. S. M. Syed, and M. Seri Bunian, *Measurement Model of Employability Skills Using Confirmatory Factor Analysis*. 56. pp. 348-356, 2012.