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Applying Semantic Web and Big Data techniques to construct a balance model referring to stakeholders of tourism intangible cultural heritage

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Abstract: Currently, intangible cultural heritage is a popular topic in the field of tourism research. The development of tourism intangible cultural heritage, by its very nature, is the process of society construction by stakeholders through their transaction, coordination, interest alienation and sharing the responsibility. Coordinating and balancing the interest conflict within every stakeholder to achieve the "Pareto Optimality" is a major difficulty in the tourism intangible cultural heritage development. In another side, Semantic web is a computer term that is known of its efficiency in knowledge representation of concepts. In this paper, we applied semantic web into modeling the balance model of stakeholders of tourism intangible heritage in the data collecting process including data acquisition from entire network combining with structural equation method and path analysis based on a big data platform and questionnaire design, which is the innovative attempt to integrate these two typical computer technologies into social scientific research. Further analysis of the final constructed model demonstrates the effectiveness of the proposed application.

Keywords: Semantic web, big data, stakeholders, tourism intangible cultural heritage

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1. Introduction

1.1 Introduction to big data and semantic web

Rigorous academic work needs the support of high quality data, however, different from natural scientific researchers who could obtain data from laboratories, social scientific researchers encounter the problems to collect high quality data since the investigating samples are always dispersed and not easy to collect. Fortunately, the new developed technology of computer science provides an alternative way to solve the problem, i.e., Big Data. Currently, there is not a uniform definition for big data, to our opinion; big data is a kind of spirit that collecting and exploring all the data produced from any fields to support making smarter decisions and predictions. Undoubtedly, big data technology will bring tremendous innovation in scientific research, which can be seen not only from the report from Computing Community Consortium in 2008: "Data computing: Creating revolutionary breakthroughs in commerce, sciences and society" [1], but also from the special issues of Nature and Science, titled by "Big Data" and "Dealing with data", in 2008 and 2011 respectively.

Regarding of tourism filed, big data has brought great opportunities to tourism industry with the arising of large amounts of data each year [2, 3]. First of all, big data provides a comprehensive insight based on big data spread, while tourism data has been looked at and analysed in an isolated way before big data appears. Secondly, through collecting integrated information from various resources, such as the Internet, tourism industries and organisations could learn a lot about customer preferences from individual travelers and thus make efficient and right decisions on tourism marketing and advertisements. However, despite such advantages can be delivered from the use of big data, this new technology is still not widely used in tourism industry because of certain technical challenges. Regarding this issue, Amadeus identified the challenges that need to be addressed on applying big data to tourism industry on The Big Data Report, which are "Fragment of data, Technology complexity, Data accuracy, Right of use, Business and technology alignment and need for data

specialists". Therefore, how to reasonably apply big data technology into tourism research, e.g., intangible cultural heritage study is a problem, which should be addressed. Due to the difference between scientific research and social scientific research, integrating resources collected from both of the two kinds of research approaches can be an alternative way to improve the effectiveness of data, such as integrating the data fetching from big data platform and data from questionnaires, which are the resources used in the following analysis in this paper.

Semantic web is a computer term that is known of its efficiency in knowledge representation of concepts. A typical semantic web consists of interconnected arcs and nodes that can be organised as a taxonomic hierarchy. Previous papers have shown significant applications of semantic web on analysing words in texts by developing various algorithms, which mainly includes analyses of meaning of networks and social networks [4-6]. With the development of semantic web, the theory is not only applied in information retrieval tasks in computer sciences and linguistics [7-9], but also wildly implemented on social scientific research, i.e., Friederike [10] explores cultural variations in managers' interpretations of worker participation process. Schultz et al [11] uses a semantic web approach to analyse the interplay of public relations and news in crisis situations. Semantic web is becoming popular in tourism research during these years, i.e. Pan and Fesenmaier [12] apply semantic web to explore the tourist behavior in micro level based on analysing travel blogs. Dimitris and Alkiviadis [13] proposes a metadata model encoding semantic tourism destination information in a RDF-based P2P network architecture. Ángel et al develops a hotel recommendation expert system based on semantic analysing customer experience.

Thus, the key challenges of this paper can be summarised as follows: 1) how to collect, abstract and integrate the information from the data fragment to provide a comprehensive insight for intangible cultural heritage study, 2) how to combine the semantic web to obtain the interaction information according to the relationship among the stakeholders and the tourism intangible heritage, and 3) how to

implement a big data platform and questionnaire design to construct stakeholder balance model. Comparing to former research, our work first integrates semantic web and big data theory and introduces them into tourism intangible cultural heritage study. To be specific, we leverage semantic web techniques and big data techniques to help collect data, and model a balance model of referring to stakeholders of tourism intangible cultural heritage. Then, we further analyse the relationships between stakeholders to demonstrate the effectiveness of the constructed model.

1.2 Introduction to intangible cultural heritage

Intangible cultural heritage, as important cultural resources, which has the natural advantage of coupling with the tourism, is becoming one of the most important attractions of travel destination because of its special regional characteristics, strong cultural connotation and colorful entertainment function. However, the intangible cultural heritage relates to many stakeholders including inheritors, community, government, corporation, tourists, specialist, media, civil society and so on during its access to the tourism market. These stakeholders have their own complicated benefit appeals that make up the multi-benefit balance and gaming network.

Efforts have been made by the previous publications on stakeholders from different aspects of tourism management scale [14-17]. In 1980s, Freeman [18] defines the “stakeholder” as “Any group or individual who can affect or be affected by the organisation goal”; he claims that the stakeholder theory should refer to the activity of corporation management the emergence of which is to balance the interest requirement of every interest-related person. Since different interest-related person owns different resources, they will cause different effect to the corporation. The definition and classification by Freeman enriches the content of stakeholder theory, which provides a sound theory basis for the later tourism research based on this theory. Sautter [14] continues the studies based on Freeman’s stakeholder pedigree, claimed that the stakeholders around the tourism planner are: community residents, staff, local operator, tourist, government, competitor, national management chain and social community. In 1999, World

Tourism Organisation passed the 《The Global Code of Ethics for Tourism》, officially introduce the concept of “stakeholder”, which made a framework of reference to regulate and inhibit the behaviour of stakeholders and greatly promote the sustainable development of the tourism industry in 21st century, and the “tourism stakeholder” term was derived correspondingly afterward [19], which is a new milestone of the stakeholder theory development in the tourism research field. Specially in tourism intangible cultural heritage research, all the stakeholders in the development of intangible cultural heritage tourism, the inheritor is the core of the stakeholder circle and other stakeholders have multiple relationships around the inheritor [20]. In the development of tourism intangible cultural heritage, the inheritors are individual or community who participate in intangible cultural heritage inheritance directly and make sure the intangible cultural heritage can inherit. Also, inheritors are the central point in the whole stakeholder circle, since other stakeholders have multiple relationships around the inheritors. Government is a special stakeholder, who offers important regulation environment such as law and politics [21], and has the capability to adjust the benefits between other stakeholders. Developers are the major investors in the development of tourism intangible cultural heritage; they pay attention to the excavation of the tourism value and the economic value of intangible cultural heritage tourism and have complicated commodity economic relationship with the inheritors. Tourists are the demand of the intangible cultural heritage products [22]; whether satisfy their demand or not determines the lifeblood of the intangible cultural heritage products. What is more important, intangible cultural heritage can get publicity and be promoted through the spread effect of tourists. The popular audience can guide more people to join the protection and inheritance of the intangible cultural heritage. Social community, as the “ground” of the intangible cultural heritage inheritance; their interest appeal is based on improving the life quality to obtain the sense of pride and approval to own culture [23]. Besides, in the process of intangible cultural heritage development, there exist stakeholders such as experts, media and civil society. They have strong

social responsibility in common; their participation can be the backbone of the social supervision and contains the excessive business development possibilities, and this also inevitably brings the appearance of the Vulgarisation phenomenon [24].

The development of tourism intangible cultural heritage is the process of resource allocation and benefit balance [25], as well as the process of society construction by stakeholders through their transaction, coordination, interest alienation and sharing the responsibility. Regarding to the precious tourism intangible cultural heritage resources, how to coordinate and balance the interest conflict among every stakeholder on the basis of protection and to achieve the "Pareto Optimality" is a major obstacle.

2. Methods

2.1 Initialising semantic web for stakeholders of tourism intangible cultural heritage

To prepare for the data collection and modelling, we firstly initialise the semantic web for stakeholders of tourism intangible cultural heritage. As shown in Figure 1, the five groups of stakeholders have direct relationships with tourism intangible cultural heritage (TICH), e.g. Tourism-visit-TICH, Corporation-invest-TICH, Inheritor-own-TICH, Expert-support-TICH, and Government-manage-TICH. The relationships determine the directions of the data collection step, that is, the data acquisition process will only collect the online reviews of these five kinds of relationships, and the questionnaire is designed to adjust to collect the information of these five kinds of relationships as well.

[Insert] Figure 1

2.2 Data Collection

As described in Step 2.1, the statistical respondents of questionnaire are classified into different stakeholders such as tourists, inheritors, corporation, government and experts by literature review and interview. The interest appeal of stakeholders of tourism intangible cultural heritage can be recognised, and the questionnaire was designed according to the five kinds of relationships. After Cronbach's Alpha test and Bartlett test, the questionnaire has high level of reliability and validity. From May to November in

2012, 310 questionnaires are distributed to five categories of stakeholders of tourism intangible

[Insert] Table 1

cultural heritage to the aim of tourism intangible cultural heritage products in Beijing, China. 300 questionnaires are returned and the recycling rate is 96.8%.

During the same period, the same collecting process is conducted through a big data platform to capture the comments, news and blogs from tourists and mass media, the snatching rule is set according to the relationships of stakeholders, e.g., only the reviews with the relationships of five objects can be recorded. In this process, we did not apply sentiment analysis because in this paper, we only count the relationships between the five stakeholders, the detailed relationships reflected from User Generated Content (UGC) and public sentiment will be explored in future work. Finally, the amount of online reviews achieves 25,327 after data filtering and cleaning. The integrated of two resources are used on the following analysis.

2.3 Structural equation model

This paper applies the structural equation method and verifies the interest model of stakeholders. The structural equation method belongs to a high level statistical category of multi-variate statistics, reallocates the factorial analysis and path analysis, tests the relationship of dominant variate, latent variable, interfere or errors included in the model at the same time, and obtain the direct, indirect or total effect of independent variables to induced variables.

Structural model is a method to verify, which use the theory to lead and construct the assumption model on this basis. As for the sample size, bigger sample size is better for the structural equation model analysis, which is same as the principle of general inferential statistics. But in the model fitting test, sample size has a large effect on the χ^2 , the absolute adaption index, when the researcher uses more test samples, the value of χ^2 is easily to reach the significance level ($p < 0.05$), which shows that the probability for the model to be rejected is increasing, the same as probability of the assumption model not

fitting to the data. From the calculation of factorial variance contribution, we summarised the six main factors for those five stakeholders of tourism intangible cultural heritage, which are the base of path analysis algorithm.

2.4 Path analysis algorithm

Path analysis is a multi-variate statistical technology proposed by the quantitative geneticist, Sewall Wright, which can resolve the effect of independent variables to induced variables to the direct effect and multiple indirect effects, by path diagram, path coefficient and path coefficient of concerns, which can analyse complicated relationship in the multi-variate construction, and provide reliable basis for statistic decision. Path analysis is a structural equation model, which is precise and intuitive. This article uses the path coefficient to study the interest requirement of stakeholders, and verify the hierarchical structural relationship model of stakeholders and the conceptual structure model of the interest requirement of each stakeholders of intangible cultural heritage in Beijing.

In Equation 1 and Equation 2, p_{0i} ($i=1,2\dots m$), p_{0e} are the path coefficient of reason and remainder term e to the result y ; d_{0i} ($i=1,2\dots m$) and d_{0e} are the related path coefficient of concerns; b_i ($i=1,2\dots m$) is the regression coefficient; and S is the standardised deviation. The survey uses the Likert scale and the formula is given below:

[Insert] Table 2, Table 3, Table 4

$$p_{0i} = b_i \frac{S_i}{S_0}, p_{0e} = \frac{S_e}{S_0} \quad (1)$$

$$d_{0i} = p_{0i}^2 = \left(b_i \frac{S_i}{S_0}\right)^2, d_{0e} = \left(\frac{S_e}{S_0}\right)^2 \quad (2)$$

In Equation 3, F_n is the sum of quantity amount of choosing n , M the sum of the sample for stakeholder and n ($n=1, 2, 3, 4, 5$) the score.

$$\sum_{n=1}^7 = (F_n / M) \times n \quad (3)$$

The programming language of computing

process is using R based on Agricolae software package. The package Agricolae offers extensive functionality on experimental design and it is designed originally for agricultural and plant breeding experiments, and then is extended to use on other fields. The package provides various analysis facilities for experimental data, e.g., treatment comparison procedures and several non-parametric tests comparison, biodiversity indexes and consensus cluster. Path analysis is one of the functions of this package. The following code shows a sample code of a path analysis procedure. In this study, we needed to determinate the relationship between the six types of stakeholders around six factors, which has described in the above content, e.g., public value, awareness, economic value, environmental value and cultural value.

```
> mydata <- read.table (file path) # read
external file pathanalysis.csv.
> x <- mydata[, -1] # extract independent
variable x1、 x2、 x3 and x4 from mydata
and assign to x.
> y <- mydata[, 1] # extract dependent
variable y from mydata and assign to y.
> cor.y <- correlation(y,x)$correlation #
compute coefficient of association between
vector y and x.
Correlation Analysis
Method : pearson
Alternative: two.sided
> cor.x <- correlation(x)$correlation
Correlation Analysis
Method : pearson
Alternative: two.sided
> path.analysis (cor.x,cor.y) #path analysis
```

3. Results

According to the processing results of path analysis algorithm, the score of each stakeholder on hierarchical structure model of tourism intangible cultural heritage in Beijing can be obtained. The conceptual structure model can be verified according to the collected data and the obtained score. Considering the recognition and the sense of identity, the path coefficient can be calculated according to five kinds of stakeholders respectively, which is shown in Table 2.

And then we can also obtain the path

coefficient of concerns of each stakeholder in hierarchical structure model of tourism intangible cultural heritage in Beijing. As shown in Tables 3 and 4, the 6 interest factors, recognition, sense of identity, cultural value, economic value, social value and environmental value, have positive influence on promoting the harmonious development of tourism intangible cultural heritage and the effect of all these requirements can achieve the harmonious tourism development of intangible cultural heritage.

General score, path coefficient of concerns of each stakeholder and path coefficient of concerns between different stakeholders are three main factors to calculate the final path coefficient between stakeholders, which can be used as standard criteria to construct semantic web models for tourism intangible cultural heritage. The final path coefficients of concerns are demonstrated in Table 4. The obtained path coefficient of concerns can be classified into 3 categories: 1-2 is the intimate relationship; 0-1 is the intermediate relationship; -2-0 is the weak relationship.

From the process of calculate path coefficient, it can be deduced that the recognition of different stakeholders to the intangible cultural heritage has direct effect on the harmonious development of tourism intangible cultural heritage. As a result, the final semantic web model is constructed finally, which is illustrated in Figure 2.

The above results show that the interest appeal of different stakeholders to cultural, economic, social and environmental value has direct effect on the harmonious development of tourism intangible cultural heritage, while the cultural interest appeal of tourist has the largest effect on the market development and the harmonious development of tourism intangible cultural heritage; the economic interest appeal of expert has the largest effect on the market development and the harmonious development of tourism intangible cultural heritage; and the social and environmental interest appeal of government has the largest effect on the market development and the harmonious development of tourism intangible cultural heritage. When focusing on the semantic web, the degree of interest appeal between each stakeholder has direct effect on

tourism intangible cultural heritage, it demonstrates that corporation has the tightest appealing relationship with other stakeholders and the appealing relationship between inheritor and expert are the weakest.

4. Implications and Discussions

4.1 Results and analysis of interest appeal of different stakeholders in the tourism intangible cultural heritage

Through the analysis of interest appeal, 5 classes of stakeholders of intangible cultural heritage have strongest recognition to the tourism intangible cultural heritage (the general score is 4.575). Between the interest appeal of all aspects, stakeholders pay more attention to economic value (the general score is 3.788), then social value (the general score is 2.585). In the usage and the development of tourism intangible cultural heritage, the market behavior and representation form indicate that stakeholders pay more attention to economic value of tourism intangible cultural heritage. Besides, stakeholders also pay much attention to the social values, which result may be due to that all stakeholders expect to promote the substantial development of tourism intangible cultural heritage. Despite different stakeholders have a similar profit attention and the degree of attention, but to view specifically, the interest appeals of each stakeholder are different.

4.1.1 Analysis for profit attention of inheritors

From the result of interest conceptual test model, an inheritor has a stronger appeal of recognition of the intangible cultural heritage, only next to the appeal of government. From the interest expression factor analytical layer, the inheritor has strong recognition to the intangible cultural heritage, they want to protect the intangible cultural heritage and consider intangible cultural heritage to be the cultural treasure of China and the pride of Chinese, which reflect the high level of recognition and pride of inheritors.

Even though the economic value achieves the most attention of inheritors, compared with other four types of stakeholders, inheritors pay the least attention to the economic value. Since life of many inheritors of intangible cultural heritage is

in or at the edge of a difficult situation, then under the pressure of life, inheritors pay more attention to whether the development of tourism intangible cultural heritage can help them to get rid of the difficult economical situation than the cultural value of intangible cultural heritage. These data reflect that their difficulty and focus. Therefore, admitting the cultural value of intangible cultural heritage and promising the economical situation and the life quality of the inheritor is the most important problem in the protection and usage of tourism intangible cultural heritage culture.

4.1.2 Analysis for profit attention of corporation

According to the model data, the recognition of corporation to the intangible cultural heritage is very strong (the general score is 4.629). This result related to the corporation respondents in the data collection. The profit model of these corporations is based on the knowing, using and developing the intangible cultural heritage in Beijing or Chinese traditional culture. During the development and the market sale of the tourism intangible cultural heritage, the corporation can strengthen the recognition to the intangible cultural heritage to push the sale of tourism intangible cultural heritage products.

Besides the economic value is the profit that corporation purchase which coincide with the common judgment. From the profit expression factor analysis, even the social value is not the focus of the corporation, the corporation respondent make donation to improve the social value of intangible cultural heritage; they believe that the protection of original ecology and reality of intangible cultural heritage is necessary. So during the purchase of the economic value, corporations have good social responsibility and show the recognition of keeping original ecology and reality of intangible cultural heritage. Therefore, giving necessary guide and helping to the corporation and representing the original ecology of intangible cultural heritage on the basis of ensuring the economical profit of corporation will receive the approval and support of the corporation.

4.1.3 Analysis for profit attention of government

The model data shows that the recognition of government to the intangible cultural heritage has

the highest score among the 5 stakeholders (the general score is 3.274), and this is related to the choice of respondent in this article since here we select the intangible cultural heritage administration department of Beijing government as respondent.

Among the four interest values, economical, social and environmental values are the focus of government. In particular, government pays most attention to the social and economic value comparing to other stakeholders. As the leader and regulator of the development of tourism intangible cultural heritage, government approves the social and economic value of intangible cultural heritage such as establishing atmosphere of harmonious social development, strengthening national sense of honor and disgrace, protecting cultural ecological environment, promoting the coordinated development of all aspects and so on. The attention to those value paid by government is important to digging the culture, publicising the national identity and protecting the heritage

4.1.4 Analysis for profit attention of heritage experts

From the identity to the intangible cultural heritage, expert is ranked next to the government on the identity of intangible cultural heritage, and takes the second place of five stakeholders, next to the government on the attention to the environmental value.

The experts focus on the social value and the identity, where they have comprehensive and scientific understanding to the intangible cultural heritage, receive professional training, focus on the practice and hope the social value of intangible cultural heritage can receive deep protection, development and usage, and concern about the harmonious, sustainable development of the society and the heritage of knowledge.

4.1.5 Analysis for profit attention of tourists

Tourists have the strongest interest appeal to the identity of intangible cultural heritage (the general score is 4.231), followed by the economic value (the general score is 3.718). From the profit expression factor analysis, almost all tourists consider that it is necessary for the country or local government to protect and develop the intangible cultural heritage, to respect the cultural

characteristic and to promote multi-culture, and want to help to protect the intangible cultural heritage.

4.2 Result and analysis of interest relationship of different stakeholders in the tourism intangible cultural heritage

According to the path analysis result, the interest relationship between different stakeholders can be classified into three categories, and they have close relationships, intermediate relationships and weak relationships. Now the close relationship and weak relationship are given in above tables (the relationship after the effect of other stakeholders are intermediate relationship).

4.2.1 Stakeholders having close relationship

The effect of stakeholders who have close relationships all started with corporation, the relationship between corporation and other four stakeholders are close. Motivated by the economical profit, corporations are positive stakeholders in the usage and development of intangible cultural heritage. During the development of intangible cultural heritage, corporations use their own advantages to advise inheritors, give constructive suggestions to the product development of intangible cultural heritage, scientific planning and market exploitation. During the sale process of tourism intangible cultural heritage products, corporation will focus on the need and preference of tourists and do targeted publicity and sale promotion; the interaction between corporation and tourists is most common and continuously; corporations provide first-hand data and information to the expert for the research use; government plays the role of guiding, which represents that they guide the protection, publicity and supervision of intangible cultural heritage, and control corporation by policy and regulations.

4.2.2 Stakeholders having weak relationships

From the analysis of stakeholders who have a weak relationship, i.e., the relationship between the expert and the inheritor, the same as that between the government and the tourist. The reason for this relationship is that there exists little

relevance between the interest appeal of them in the tourism intangible cultural heritage, and little interaction because of the effect of profit attention and the work content.

Even though the inheritor provides experience of practice to make the proposed model more practical during the study of the expert, due to the limitation of communication, the interaction seems less than other relationships, and there is no direct profit relevance between the inheritor and the expert.

Regarding to the relationships of tourists and government, there are two reasons for this weak interaction. Firstly, the policy made by government is not serving to tourists directly. Secondly, tourists rely little on the development of tourism intangible cultural heritage, and thus lack of inner motivation of tourism intangible cultural heritage.

5. Conclusions

This paper constructs a balance model referring to stakeholders of tourism intangible cultural heritage by applying semantic web and big data theory. This is the first try to integrating these two typical computer techniques into social scientific research. Obviously, initialising semantic web of stakeholders of tourism intangible cultural heritage has enormous limited the data collection scale when we conducted data acquisition process in mapping entire network. In questionnaire process, semantic web provides the intrinsic relationship for questionnaire design, which improves the reasonability of analysed results. In the future work, we will further explore the relationships of stakeholders of tourism intangible cultural heritage by proposing sentiment analysis in the process based on the big data platform, which would improve the effectiveness of the modeling of stakeholders of tourism intangible cultural heritage.

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References

1. Bryant, R., Katz, R.H. and Lazowska, E. D. (2008) 'Big-Data Computing: Creating Revolutionary Breakthroughs in Commerce', *Science and Society*, pp:1-15.
2. Xiang, Z. and Gretzel, U. (2010) 'Role of social media in online travel information search', *Tourism management*, Vol. 31, No. 2, pp: 179-188.
3. Leung, D., et al. (2013) 'Social media in tourism and hospitality: A literature review', *Journal of Travel & Tourism Marketing*, Vol. 30, No. 1-2, pp: 3-22.
4. Doerfel, M.L. (1998), 'What constitutes semantic network analysis? A comparison of research and methodologies' *Connections*, Vol. 21, No. 2, pp: 16-26.
5. Utigliano, L.(2007) 'Mergent communication networks as civic journalism', *Bloggng, citizenship, and the future of media*, pp: 225-237.
6. Doerfel, M. L. and Barnett, G. A. (1999) 'A semantic network analysis of the International Communication Association', *Human Communication Research*, Vol. 25, No. 4, pp: 589-603.
7. Laallam, F.Z., Kherf, M. L. and Benslimane, S. M. (2014) 'A survey on the complementarity between database and ontologies: principles and research areas', *International Journal of Computer Applications in Technology*, Vol. 49, No. 2, pp: 166-187.
8. Godfrey Winster, S. and Swamynathan, S. (2014) 'Ontology-based blog collection and profile-based personalised ranking', *International Journal of Computer Applications in Technology*, Vol. 49, No. 1, pp: 69-79.
9. Maheswari, S. and Karpagam, G. R. (2015) 'Enhancing Fuzzy Topsis for web service selection', *International Journal of Computer Applications in Technology*, Vol. 51, No.4, pp: 344-351.
10. Stohl, C.(1993) 'European managers' interpretations of participation', *Human Communication Research*, Vol. 20, No. 1, pp: 97-117.
11. Schultz, F., et al. (2012) 'Strategic framing in the BP crisis: A semantic network analysis of associative frames', *Public Relations Review*, Vol. 38, No. 1, pp: 97-107.
12. Pan, B., MacLaurin, T. and Crotts, J. C. (2007) 'Travel blogs and the implications for destination marketing', *Journal of Travel Research*, Vol. 46, No. 1, pp: 35-45.
13. Kanellopoulos, D.N. and Panagopoulos, A. A. (2008) 'Exploiting tourism destinations' knowledge in an RDF-based P2P network', *Journal of Network and Computer Applications*, Vol. 31, No. 2, pp: 179-200.
14. Sautter, E.T. and Leisen, B. (1999) 'Managing stakeholders a tourism planning model', *Annals of tourism research*, Vol. 26, No. 2, pp: 312-328.
15. Choi, H.C. and Sirakaya, E. (2006) 'Sustainability indicators for managing community tourism', *Tourism management*, Vol. 27, No. 6, pp: 1274-1289.
16. McKercher, B., Ho, P.S. and du Cros, H.(2005) 'Relationship between tourism and cultural heritage management: evidence from Hong Kong', *Tourism Management*, Vol. 26, No. 4, pp: 539-548.
17. Du Cros, H. (2001) 'A new model to assist in planning for sustainable cultural heritage tourism', *International Journal of Tourism Research*, Vol.3, No. 2, pp: 165-170.
18. Freeman, R. E.(1983) 'Strategic management: A stakeholder approach. *Advances in strategic management*', Vol. 1, No. 1, pp: 31-60.
19. Holden, A.(2003) 'In need of new environmental ethics for tourism?', *Annals of Tourism Research*, Vol. 30, No. 1, pp: 94-108.
20. Shi, M.Y. and Sun, M. (2010) 'Discussion about Three Key Components in the Utilization of Intangible Cultural Heritage Tourism—Based on An Empirical Study of Beijing', *Tourism Tribune*, Vol. 25 , No. 6, pp: 50-56.
21. Bingham, L. B., Nabatchi, T. and O'Leary, R. (2005) 'The new governance: Practices

- and processes for stakeholder and citizen participation in the work of government', *Public administration review*, Vol. 65, No. 5, pp: 547-558.
22. Vidal González, M. (2008) 'Intangible heritage tourism and identity', *Tourism Management*, Vol. 29, No. 4, pp: 807-810.
23. Kurin, R.(2003) 'Safeguarding intangible cultural heritage in the 2003 UNESCO Convention: a critical appraisal', *Museum international*, Vol. 56, No. 1 - 2, pp: 66-77.
24. Quan, Q. and Zeng, Y. (2012) 'Research on Digital Protection of the Intangible Cultural Heritage in Three Gorges Area', *Proc. International Symposium on Computational Intelligence and Design*, pp:515-518.
25. Rizzo, I. and Throsby, D.(2006) 'Cultural heritage: economic analysis and public policy', *Handbook of the Economics of Art and Culture*, Vol. 1, pp: 983-1016.

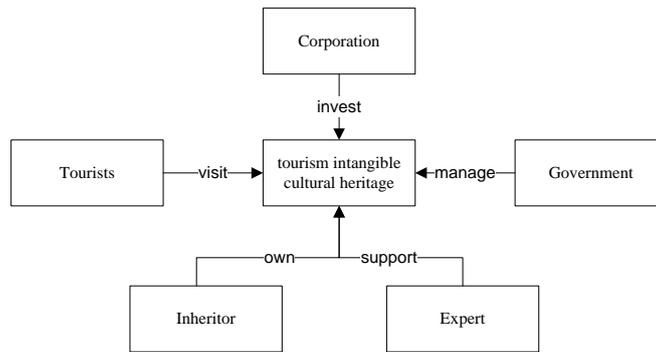


Figure 1 The stakeholders of tourism intangible cultural heritage

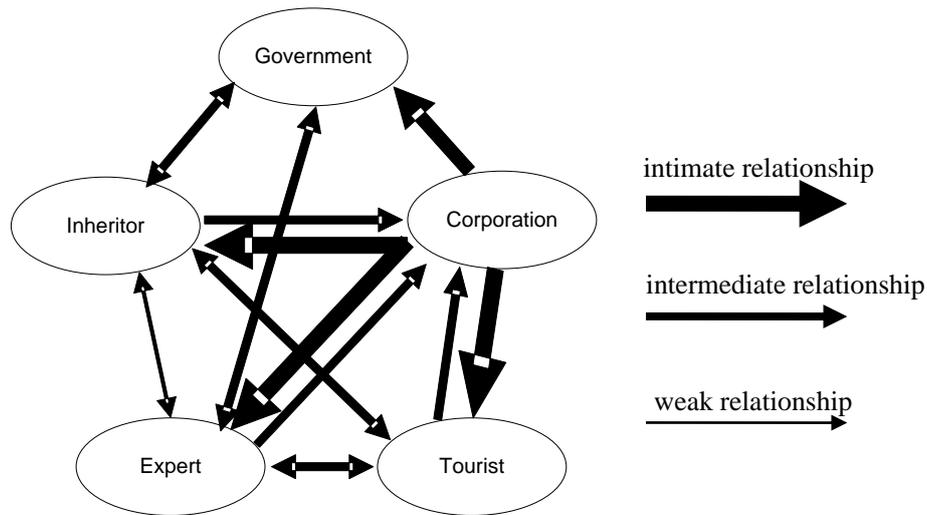


Figure 2 Semantic network of stakeholders of tourism intangible cultural heritage

Table 1 Factorial variance contribution of stakeholders

factor	Factorial variance contribution		
	characteristic value	variance contribution rate%	cumulative variance contribution rate %
Public value	5.842	14.250	14.250
Awareness	5.037	12.286	26.536
Economic value	4.593	11.203	37.738
Sense of identity	4.216	10.283	48.021
Environmental value	2.436	5.942	53.963
Cultural value	1.632	3.979	57.942

Table 2 Standard path coefficient of five kinds of stakeholders

stakeholders	Factors	Non-standard error		Standard coefficient	T	Sig.
		B	standard error	Beta		
inheritor	constant	.044	.021		2.083	.042
	awareness	.240	.003	.415	85.732	.000

	sense of identity	.275	.003	.500	98.874	.000
	cultural value	.055	.002	.119	23.053	.000
	economic value	.263	.002	.572	107.356	.000
	social value	.293	.003	.500	98.762	.000
	Environmental value	.164	.002	.336	66.677	.000
corporation	constant	.050	.024		2.041	.046
	awareness	.240	.002	.589	117.656	.000
	sense of identity	.277	.003	.488	92.421	.000
	cultural value	.052	.002	.111	21.169	.000
	economic value	.261	.002	.535	105.357	.000
	social value	.288	.002	.648	123.983	.000
	environmental value	.168	.003	.319	62.660	.000
government	constant	-.002	.016		-.142	.887
	awareness	.242	.002	.455	138.607	.000
	sense of identity	.285	.002	.382	119.842	.000
	cultural value	.056	.002	.095	24.311	.000
	economic value	.262	.002	.447	132.845	.000
	social value	.288	.002	.451	117.775	.000
	environmental value	.169	.002	.245	73.374	.000
expert	constant	.046	.024		1.966	.055
	awareness	.239	.002	.539	130.803	.000
	sense of identity	.274	.003	.342	81.505	.000
	cultural value	.058	.002	.127	28.897	.000
	economic value	.261	.002	.507	126.051	.000
	social value	.292	.002	.680	161.356	.000
	environmental value	.170	.002	.377	84.697	.000
tourist	constant	.052	.014		3.630	.001
	awareness	.236	.002	.527	123.937	.000
	sense of identity	.276	.002	.545	136.318	.000
	cultural value	.051	.002	.120	32.019	.000
	economic value	.262	.002	.471	127.661	.000
	social value	.298	.002	.495	135.733	.000
	environmental value	.162	.002	.341	87.716	.000
Five stakeholders	constant	.038	.008		4.936	.000
	awareness	.239	.001	.499	293.482	.000
	sense of identity	.278	.001	.428	252.829	.000
	cultural value	.054	.001	.103	59.665	.000
	economic value	.262	.001	.459	272.209	.000
	social value	.292	.001	.503	294.227	.000
	environmental value	.167	.001	.296	174.992	.000

Table 3 path coefficient of concerns of stakeholders

interest attention	inheritor		corporation		government		expert		tourist		Five stakeholders	
	the path coefficient of concerns	General score	the path coefficient of concerns	General score	the path coefficient of concerns	General score	the path coefficient of concerns	General score	the path coefficient of concerns	General score	the path coefficient of concerns	General score
Awareness	.415	2.840	.589	2.886	.455	3.274	.539	2.972	.527	2.038	.499	2.802
Sense of identity	.500	4.670	.488	4.629	.382	4.564	.342	4.787	.545	4.231	.428	4.575
Cultural value	.119	1.053	.111	1.116	.095	1.205	.127	1.142	.120	1.224	.103	1.147
Economic value	.572	3.679	.535	3.753	.447	3.775	.507	4.025	.471	3.718	.459	3.788
Social value	.500	2.640	.648	2.595	.451	2.772	.680	2.522	.495	2.390	.503	2.585
Environmental value	.336	2.287	.319	2.267	.245	2.487	.377	2.382	.341	2.034	.296	2.291

Table 4 Final path coefficient of concerns of stakeholders

stakeholders		The final path coefficient of concerns	stakeholders		The final path coefficient of concerns
left	right		left	right	
inheritor	corporation	1.414	government	inheritor	0.053
	government	0.016		corporation	1.163
	expert	-0.447		expert	0.187
	tourist	0.029		tourist	-0.427
corporation	inheritor	0.545	expert	inheritor	-0.068
	government	0.138		corporation	1.929
	expert	0.279		government	0.150
	tourist	0.004		tourist	0.127
tourist	inheritor	0.440			
	cooperation	1.713			
	government	-1.910			
	expert	0.706			