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TOURISM AND STATISTICS
Bibliometric Study 1998–2002

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Abstract: The use of statistics in any scientific discipline can be considered a key element in evaluating its degree of maturity and demonstrates the generation of nonspeculative knowledge. The aim of this study is to carry out a bibliometric analysis of the use of statistical methods in tourism research. To accomplish this, a group of 12 tourism journals published within a 5-year period (1998–2002) were chosen and 1,790 articles were reviewed by means of a taxonomy with 24 statistical categories. The main results show the percentage of articles that apply statistical techniques as compared to those that do not, and a ranking of the techniques most often used and their distribution according to journal. **Keywords:** statistical methods, bibliometrics. © 2005 Elsevier Ltd. All rights reserved.

Résumé: Tourisme et statistiques: étude bibliométrique 1998–2002. L'utilisation des statistiques dans toute discipline scientifique peut être considérée comme un élément-clé pour l'évaluation du degré de sa maturité, et elle témoigne de l'apparition de connaissances non spéculatives. L'objectif de cette étude est de réaliser une analyse bibliométrique relative à l'utilisation des méthodes statistiques dans la recherche en matière de tourisme. On a choisi 12 revues touristiques sur une durée de cinq ans (1998–2002), et on a examiné 1,790 articles dans une étude taxonomique consistant en 24 catégories statistiques. Les principaux résultats montrent le pourcentage qui appliquent les techniques statistiques face à ceux qui ne les appliquent pas, un classement des techniques les plus utilisées par les revues et leur distribution. **Mots-clés:** méthodes statistiques, bibliométrie. © 2005 Elsevier Ltd. All rights reserved.

INTRODUCTION

The use of statistics in empirical research can be regarded as an indicator of the degree of scientific progress in a field, because empirically contrasted, stochastic conclusions can be reached through statistical techniques by following the scientific method. At the same time, it is expected that such progress in a certain field is more fruitful, because possible multivariate relationships among the variables under study can be discovered. Thus, crossing the bridge from descriptive to multivariate statistics must represent a better way of generating scientific knowledge for a discipline. The way statistics has been used in

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hospitality and tourism research and the degree to which it has been applied has largely depended on the quality of the theoretical knowledge that has been generated in these fields over the last few decades. Obviously, to ensure the consolidation and development of tourism sciences, empirical tests should not be ignored, as they are key factors in testing the validity of hypothetical models that simulate hospitality and tourism realities. The statistical methods are needed evident so that empirical knowledge can replace mere conjecture both in statistics' more classic economic role in tourism management (the one more highly represented in literature) and in studies on human behavior in hospitality and tourism paradigms. Therefore, the use of statistical tools is a means by which general results can be obtained and a way to formulate better explanatory conclusions.

It is important to note here that statistical complexity does not necessarily lead to scientific progress, because contributions of both correct methodological design and appropriately hypothesized models are necessary to generate scientific knowledge. Nonetheless, while more statistics does not equal greater intellectual progress, these tools are crucial for the application of the scientific method. Thus, one of the key factors in establishing the quality of current research is to ascertain how multivariate methods have been used as tools in assessing validity by inference or, in confirming whether hypothetical models fit a tourism-based reality. This cannot be considered a novelty because a number of previous studies with this same objective have already been described in literature (Baloglu and Assante 1999; Crawford-Welch and McCleary 1992; Grazer and Stiff 1987; Reid and Andereck 1989). Table 1 provides information on four previous bibliometric studies and indicates the year of publication, authors, journals selected, time period of the analysis, and total number of articles reviewed.

Grazer and Stiff's work (1987), which analyzed four journals and 922 articles published between 1980 and 1985, found that the most commonly used statistical techniques were analysis of variance, linear regression, and factor analysis. In this respect, research by Reid and Andereck (1989), based on three journals and 659 articles published between 1978 and 1987, showed that regression, linear correlation, analysis of variance, and econometric models were the most commonly applied techniques. At the same time, they found an increased use of multivariate techniques during the period analyzed, an indicator of maturity in tourism research. The bibliometric study conducted by Crawford-Welch and McCleary (1992), which covered five journals and 653 articles published between 1983 and 1989, established that most articles only used descriptive statistics and univariate analysis methods.

The most recent bibliometric analysis, carried out by Baloglu and Assante (1999), reviewed five journals and a total of 1,073 articles published between 1990 and 1996 and concluded that the most widely used statistical techniques combined univariate and multivariate procedures such as linear correlation, analysis of variance, multiple regression, and factor analysis methods. In addition, they found that very few multivariate statistical techniques had been used apart from multiple regression and factor analysis procedures. A combined general

Table 1. Previous Bibliometric Studies and their Search Parameters

Authors (Year)	Journals	Period	Number of Articles
Grazer and Sti (1987)	Journal of Marketing Journal of Marketing Research Journal of Consumer Research Journal of the Academy of Marketing Science	1980–85	922
Reid and Andereck (1989)	Annals of Tourism Research Journal of Travel Research Tourism Management	1978–87	659
Crawford-Welch and McCleary (1992)	Cornell Hotel and Restaurant Administration Quarterly Hospitality Education and Research Journal International Journal of Hospitality Management FIU Hospitality Review Journal of Travel Research	1983–89	653
Baloglu and Assante (1999)	Cornell Hotel and Restaurant Administration Quarterly Hospitality Research Journal International Journal of Hospitality Management International Journal of Contemporary Hospitality Management FIU Hospitality Review	1990–96	1,073

analysis of the results of these four studies, which almost evenly spanned the period between 1978 and 1996 (19 years), leads to three fundamental conclusions: that the degree of statistical and methodological sophistication achieved and used in tourism research highly correlates with its degree of progress and credibility from a scientific perspective; that the articles reviewed (3,307 in all) generally used descriptive statistics and univariate analysis, bivariate linear correlation, analysis of variance, multiple linear regression, and factor analysis methods, together with econometric models; that the infrequent use of multivariate statistics, ascertained from the limited range of multivariate tools applied, was a characteristic shared by all the articles.

On the basis of these perspective and by focusing the analysis on the use of multivariate methods, which are possible signs of progress and development in research, the present study seeks to evaluate the degree to which these techniques have been used in recent years and are still being used at present. As for the procedures used in this study, the main search parameters and methods established for classifying techniques are described below. The main goal of this paper is to examine the use of statistical methods which extend beyond mere

descriptive techniques in the field of hospitality and tourism sciences. Journals in these fields containing empirical and applied research and peer review procedures from the 5 years between 1998 and 2002 were selected. Following the above criterion, articles which used only descriptive statistics were excluded from the bibliometric count. For this study, information offered by the latter type of article was not considered useful in evaluating the relevance that techniques may have in the discipline on which this analysis is based.

The journals are listed according to the percentage of articles in which methods were applied as opposed to the percentage in which they were not, and the techniques used were also listed according to frequency of use. One should not infer here that a given journal is better or more important than another, because it is understood that many journals focus on theoretical or conceptual discussions, while research material in others may have a more pragmatic aim. The objective in using this data is to shed light on matters concerning methodology and its use and implications in published material.

It is hoped that the main objective of this study—an evaluation of the use of statistical methods in hospitality and tourism research—will be achieved through these analyses, as it may prove very useful in determining the statistical maturity achieved in recent years. From this perspective, an examination of the efforts made in a specific field ensures an appropriate understanding of its research practices and techniques, and indicates how it progresses in its use of research methods (Baloglu and Assante 1999).

BIBLIOMETRIC STUDY 1998–2002

A total of 12 journals and 1,790 articles published between 1998 and 2002 were reviewed and analyzed in this bibliometric study of the most commonly used techniques. Given the number of journals chosen and articles analyzed, this study leads the main group of similar bibliomet-

Table 2. Bibliometric Parameters of this Study

Year	Journals	Period	Article
2003	Annals of Tourism Research	1998–2002	1,790
	Annals of Tourism Research (Spanish version)		
	International Journal of Hospitality Management		
	International Journal of Service Industry Management		
	International Journal of Tourism Research		
	Journal of Hospitality and Tourism Research		
	Journal of Leisure Research		
	Journal of Travel Research		
	The Cornell Hotel and Restaurant		
	Administration Quarterly		
	Tourism Analysis		
	Tourism Economics		
	Tourism Management		

ric studies described in literature (Table 2). The criteria for journal selection were established ad hoc, starting with a search for articles that made use of statistical methods from hospitality, leisure, and tourism journals in the Institute of Tourism Studies' database and the Spanish Tourism Documentation Centre's catalogue, which contains journal summaries. This led to considering 281 publications, 12 of which were finally selected. In contrast to the limited range of journals chosen in previous bibliometric studies, which were generally related to a specific field of tourism or based on the systematic appearance of articles applying statistical techniques, the purpose here was to extend the range of publications under analysis. Thus possible biases towards specific target areas were avoided and the scope of study is representative of current hospitality, leisure, and tourism research.

At the same time, one of the criteria in choosing journals was whether they were listed as having an impact factor in 2001. The ''impact factor'' is provided by Thomson ISI (2002) and calculated by dividing the number of current year citations according to source items published in the journal during the previous 2 years. To count the statistical methods used, first a classification based on the inclusion of the greatest number of possible techniques used in literature was designed, a system similar to but more extensive than Gallarza, Gil and Calderon's (2002). Twenty four different categories were proposed, together with a final one entitled ''Other'' that included all the techniques not covered in the previous 24. Table 4 in the ''Results'' section shows all the ones that were considered. It is interesting to point out that new ones can be created when the information is broken down even further, depending on the needs or interests of the reader.

Thus, for example, this heading can be subdivided into categories for regression, anova, manova and ancova for those interested in ascertaining the use of techniques associated with the general linear model. On the other hand, categories for factor and principal component analysis, multidimensional scaling, and correspondence analysis can be created for those interested in ascertaining the use of techniques associated with dimensionality reduction techniques. As special cases, the category of econometric models has been employed: when authors explicitly used this category to refer to the statistical technique they applied, or when it is an economic model (macro or micro) not qualifiable as other statistical category; and chi-square refers basically to a test of independence. In general, it is far more productive to present information within a certain framework but with the fewest possible groupings, both for the purposes of simplification and to make it easier for readers to create a greater, more extensive number of groupings based on their own personal interests.

Study Results

The journals in this study are shown in descending order, according to the total percentage of articles using techniques, as opposed to articles that do not use them (Table 3). The results show a considerable

Table 3. Ranking of Journals according to % of Articles using Statistics

Journal	Initials	% of Articles with Statistics	2001ISI[a] Impact Index
1. Journal of Hospitality and Tourism Research	JHTR	80.91	–
2. Tourism Analysis	TA	58.67	–
3. International Journal of Service Industry Management	IJSIM	57.69	0.185
4. Annals of Tourism Research (Spanish version)	ATRs	52.78	–
5. Tourism Economics	TE	39.39	–
6. Tourism Management	TM	38.79	0.259
7. Journal of Leisure Research	JLR	37.97	0.257
8. International Journal of Hospitality Management	IJHM	37.07	–
9. Annals of Tourism Research	ATR	36.07	0.378
10. Journal of Travel Research	JTR	35.16	–
11. The Cornell Hotel and Restaurant Administration Quarterly	CHRAQ	25.55	–
12. International Journal of Tourism Research	IJTR	8.04	–

[a] www.isinet.com.

difference in the use of statistical techniques between the first journal *International Journal of Hospitality and Tourism Research* (JHTR), with 80.91%, and the *International Journal of Tourism Research* (IJTR) as the last, with 8.04%. In only four of the 12 journals does the percentage of articles using such techniques rise above 50% *Journal of Hospitality and Tourism Research* (JHTR), *Tourism Analysis* (TA), *International Journal of Service Industry Management* (IJSIM), and *Annals of Tourism Research in Spanish* (ATRs), although six of the remaining eight journals have percentages that oscillate between approximately 35% and 39%. It is important to note that IJSIM is the only journal with an impact factor that also reaches a percentage of over 50% for its use of statistical techniques. The last column of Table 3 also provides values for the impact factor that only four of these 12 journals managed to achieve in 2001. More specifically, in order of the impact they had, these journals are ATR (0.378), *Tourism Management* (TM) (0.259), *Journal of Leisure Research* (JLR) (0.257), and IJSIM (0.185). From the results obtained and the journals' respective positions in the ranks (9th, 6th, 7th, and 3rd place, respectively), it can be inferred that impact factor is not very closely related to the use of techniques (nonsignificant ranked correlation).

In reference to the articles' use of techniques, Table 4 shows the number of times the 24 techniques considered (including the category ''Other'') were applied over the period 1998–2002 across all journals. The results point to the fact that linear regression models, factor analysis and principal component analysis, and analysis of variance are, in this order, the three most commonly used techniques, accounting for 37.99%

Table 4. Count of Use (%) of Statistical Techniques (1998–2002)

Statistical Techniques	1998	1999	2000	2001	2002	Total	%
1. Linear regression models	21	25	44	25	43	**158**	15.12
2. Factor analysis and principal component analysis	18	14	34	33	36	**135**	12.92
3. Anova	14	17	26	26	21	**104**	9.95
4. *t*-Test	17	10	11	19	19	**76**	7.27
5. Structural equation modeling	6	11	18	17	21	**73**	6.99
6. Chi-square	18	10	14	10	13	**65**	6.22
7. Reliability analysis	8	5	12	14	20	**59**	5.65
8. Cluster analysis	12	6	11	7	16	**51**	4.88
9. Time series analysis	9	6	8	19	6	**48**	4.59
10. Manova	7	4	6	9	9	**35**	3.35
11. Logistic regression	4	4	3	12	10	**33**	3.16
12. Discriminant analysis	7	5	4	2	9	**27**	2.58
13. Logit models	6	5	1	3	8	**23**	2.20
14. Non-parametric	3	5	7	6	1	**22**	2.11
15. Econometric models	2	5	3	7	2	**19**	1.82
16. Ancova	1	4	2	3	3	**13**	1.24
17. Probit and Tobit models	3	0	2	5	2	**12**	1.15
18. Correspondence analysis	2	0	3	2	4	**11**	1.05
19. Conjoint analysis	2	1	2	2	1	**8**	0.77
20. Log-linear models	0	2	3	0	2	**7**	0.67
21. Multidimensional scaling	3	0	1	1	2	**7**	0.67
22. Artificial neural networks	0	2	3	1	1	**7**	0.67
23. Chaid regression	0	1	2	0	0	**3**	0.29
24. Survival analysis	1	0	1	0	1	**3**	0.29
Other	11	8	10	6	11	**46**	4.40

of the total. Among the other techniques, *t*-test (7.27%), structural equation models (6.99%), chi-square methods (6.22%), reliability analysis (5.65%), cluster analysis (4.88%), time series analysis (4.59%), manova (3.35%), logistic regression techniques (3.16%), discriminant analysis (2.58%), logit models (2.20%) and nonparametric tests (2.11%) together represent approximately 49% of the total methods applied.

Although time series analysis was expected to be one of the most frequently used techniques, it ranked only 9th on the list (4.59%) and covered very specific areas, such as predicting economic indicators. On the other hand, results for techniques with categorical variables reveal that they are still rarely applied, although by way of dispensation, other scientific fields also share this situation. The use of both logit models (2.20%) and log-linear models (0.67%) might be considered to be on the low side. Results showed that 0.67% of all articles used the newest methods, such as artificial neural networks. Their application seems to have increased since 1999. Lastly, the ''Others'' category, which included a potpourri of different, more specific models such as spectral analysis, evolving data analysis, Poisson regression models, and negative binomial regression models for count variables, etc., obtained a percentage of 4.40%. Such methods, even when useful, are so infrequently used that it was not worth considering them independently.

The study has not found any evidence of the use of robust statistical methods or exact methods.

Another facet of the analysis was a percentage-based calculation of the techniques used in each journal, considered independently. This type of exercise allows the reader to examine which groups of techniques are more assiduously used per journal. For mainly descriptive purposes, the four most commonly used techniques are indicated subsequently. The journal with the highest percentage of technique use, JHTR (80.91%), most frequently uses the linear regression model (14.58%), followed by analysis of variance (12.50%), *t*-test (11.11%), chi-square statistics (10.42%), and factor analysis (10.42%). The second-ranked one TA (58.67%), makes the greatest use of factor and cluster analysis, both scoring 12.90%, followed by linear regression models (11.29%), and discriminant analysis (8.06%). It is important to point out that this is one of the few journals that includes articles that use survival analysis (1.61%). The third-ranked, IJSIM (57.69%), which makes considerable use of linear regression models (21.78%), clearly stands out from the rest in its application of structural equation modeling (17.82%), followed by reliability analysis (13.86%) and analysis of variance (11.88%). The fourth-ranked, ATRs (52.78%), shows a more common use of both linear regression models (13.21%) and time series analysis (13.21%), followed by factor analysis (11.32%) and logit models (7.55%).

In fifth place, *Tourism Economics* (TE) (39.39%), with percentages far below the first four, the most commonly applied methods are time series analysis (34.04%), linear regression models (29.79%), covariance analysis (4.26%) and the probit and tobit models (4.26%). As this is a publication which focuses on economic analysis, time series analysis appears to head the list of the different techniques used. As for Tourism Management (TM) (38.79%), it shows a more frequent use of analysis of variance (14.52%), factor analysis (14.52%), *t*-tests (11.29%), and linear regression models (9.68%). It concentrates on including articles that use advanced statistical techniques such as artificial neural networks (3.23%). In the case of the next, *Journal of Leisure Research* (JLR) (37.97%), factor analysis leads the field (15.53%), followed by analysis of variance (14.56%), and linear regression models (12.62%). Distinguishing it from the rest is the multivariate analysis of variance technique (10.68%). As for *International Journal of Hospitality Management* (IJHM) (37.07%), linear regression models (21.67%) account for the highest percentage, followed by analysis of variance (10.00%), *t*-tests (8.33%), and factor analysis (8.33%).

The 9th position, *Annals of Tourism Research* ATR (36.07%), shows a predominant use of factor analysis (12.50%), followed by analysis of variance (11.72%), nonparametric statistics (7.03%), and econometric models (4.69%). In the case of *Journal of Travel Research*, JTR (35.16%), factor analysis clearly take first place (29.66%), followed by linear regression models (19.49%), cluster analysis (11.86%), and discriminant analysis (7.63%). In the penultimate position, *Cornell Hotel and Restaurant Administration Quarterly* CHRAQ publishes articles with a greater use of *t*-tests (22.11%), chi-square statistics (15.79%), linear

regression models (12.63%), and analysis of variance (11.58%). Finally, at quite a distance from the other journals analyzed, from the perspective of its use of statistical methods, is IJTR (8.04%). This applies linear regression models (18.18%), factor analysis (18.18%), and time series analysis (18.18%). Surprisingly, other methods also appear, such as artificial neural networks (9.09%), logistic regression (9.09%) and Chaid regression (9.09%).

From all information gathered, there may be value in reviewing the percentage of articles using a single technique or two, three, four, five, or more than five techniques in each article. The total percentage of articles that use a single technique amounts to 66.64%; the percentage for those using two is 22.91%; for three 7.97%; for four 2.23%, and those using five or more do not even reach 1% (0.31%). Journals with higher numbers of articles using techniques also achieve higher percentages for the numbers of articles with a greater number of the same. For the lowest ranking journals, a drastic decrease can be observed in the percentage of articles using more than one or two, except for TE. Despite ranking 5th, 84.62% of its articles use one technique whilst the remaining 15.38% contain just two techniques. The journals with a richer distribution of percentages are JHTR, 55.06% for articles with one technique, 32.58% with two 7.86% with three, 2.25% with four, and 2.25% with five or more; CHRAQ, 72.86% for articles with one technique, 21.43% with two techniques, 2.88% with three, 1.43% with four, and 1.43% with five or more; TA, 65.91% for articles using one technique, 29.55% with two, 2.27% with three, 2.27% with four, and no articles with five or more. Lastly, 54.10% of the articles in IJSIM use one technique, 26.23% use two, 16.39% use three, 3.28% use four and, like TA, it does not have any articles with five or more.

CONCLUSION

This bibliometric study provides an overview of methodological directions of research in tourism. It sheds additional light on the use of statistical methods in articles and indicates a good measure of statistical sophistication of the area. Although the use of statistics does not lead necessarily to intellectual progress, these tools offer a better way to develop scientific knowledge than other more speculative methods. This paper does not defend statistics as the unique or true way, because some questions cannot be meaningfully answered with purely statistical techniques. This study carefully revised and ranked 1,790 articles from 12 significant journals in this field and ranked them according to percentages of use of statistical techniques.

In general, the results demonstrate that the linear regression model, factor and principal component analysis, and analysis of variance are, in this order, the three most frequently used techniques. This corroborates results in previous studies (Baloglu and Assante 1999; Crawford-Welch and McCleary 1992; Grazer and Stiff 1987; Reid and Andereck 1989) and it may be inferred that the current scenario has not experienced any significant change in the use of statistical methodologies.

However, in contrast to this initial conclusion, it is worth pointing out that these three techniques alone accounted for approximately 38% of all the methods used, meaning that others accounted for 62% of the total. Among these, it was found that (in descending order) *t*-tests, structural equation modeling, chi-square methods, reliability analysis, cluster analysis, time series analysis, manova, logistic regression techniques, discriminant analysis, logit models, and nonparametric tests together represent approximately 49%. Reid and Andereck (1989) found that the econometric model was one of the most commonly used techniques; yet results show that only 1.82% of all articles used it, although the three journals that do so are in fact the same journals chosen for the 1989 study (ATR, JTR, TM).

As for other, minor techniques, the increased use of structural equation modeling represents a leap forward in the application of complex variable interdependence models, and measurement error for operationalized variables may be included by means of psychometric or sociometric questionnaires. The application of structural equation modeling, which implies the juxtaposition of confirmatory factor analyses and endogenous regression chains, is a good way of overcoming the need to apply advanced statistical models which may achieve a state of isomorphism with the complex reality.

As regards the quality of psychometric or sociometric indicators, the application of reliability analysis techniques is very relevant, mainly from the perspective of validating new tools for measuring variables, so as to contrast their quality empirically. For statistical methods that work with categorical variables, results reveal that they are very infrequently applied. This shows a clear trend in favor of quantitative variables or indicators, compared to those of a categorical nature. A lack of familiarity and the groundless ''annoyance'' that handling these models can generate are probably the main reasons behind their lack of prevalence, although they are tools of tested quality. Nevertheless, their continuous presence throughout the period covered by this analysis leads to hope that they may be more extensively used, thereby taking on an important role as categorical variables in research.

As for the newest methods, such as artificial neural networks, their application seems to have increased since 1999. It is important to point out that this study has not found articles published from 1998 to 2002 that use robust statistical or exact methods. In general, it also confirmed serious deficiencies in the task of testing the fulfillment of all statistical assumptions inherent in each technique and no evaluation of their possible violation, which, if true, might discredit the results completely. In this sense, it is worth suggesting that an assessment be made of the extent to which this type of statistical requirement is not fulfilled so that, depending on the results, appropriate decisions can be taken regarding the subsequent estimation of the models. As an illustration, only 2.11% of the articles reviewed use nonparametric statistics. But it is practically impossible to ascertain whether the remaining articles that apply parametric models have controlled for the fulfillment of statistical requirements capable of guaranteeing whether an equation proposed by a technique functions correctly.

Results suggest that there is a nonsignificant correlation between the ISI (Institute for Scientific Information) impact factor and the percentages of use of statistical techniques. This may be because impact factor calculations do not take into account these types of statistics, but instead, deal with the number of references to articles published, weighted by the number of articles published over a certain period of time. It is debatable whether the capacity of this ''citation'' index describes the quality of a publication, but a discussion of this interesting topic is not an objective of this paper.

Not unlike Grazer and Stiff (1989), as a general conclusion it is recommended that authors using more sophisticated or perhaps less familiar statistical methods give their articles a certain didactic slant, so as to make them more accessible to potential readers. This might encourage the wider use of such techniques, together with the application of the different potential uses that such tools offer for analysis. This suggestion is strongly supported by Lynn (2002), the editor of the *Cornell Hotel and Restaurant Administration Quarterly*, in his article entitled ''The (Service) Industry Needs Less Descriptive and More Causal Research''. Lynn's opinion was that hospitality and tourism academics should conduct more causal research, that is, research that identifies a causal relationship between two or more variables, instead of descriptive research. Often researchers study causal relationships simply by asking so-called experts what they think causes a particular outcome.

Techniques that facilitate the acquisition of knowledge corresponding more closely to the reality of the situation under analysis should be applied through the use of experimental or quasi-experimental models (an experimental focus) or survey models (a correlational focus). Both types of models share the use of nondescriptive techniques, for example, they generally apply multivariate analysis as a confirmatory approach. According to the findings of Crawford-Welch and McCleary (1992), the increasing use of general multivariate models applied to hospitality and tourism reflects vigorous efforts to capture the complex reality of the phenomenon under analysis and undoubtedly may help to consolidate these fields, thanks to the credibility provided by both empirical tests and the rigorous application of statistical methodology in general. This work contributes to a general overview of the degree of statistical progress that research has currently achieved and, far from seeking to criticize and, further acts as motivation for improving the application of the wide-ranging, highly diverse, statistical methodologies that exist. A

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