The Application of Interpretive Structure Model in Evaluating Criteria for Online-Hotel-Booking-Website

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Abstract—**With the development of Information Technologies (IT) and the penetration of the internet, new expectations arise from the travel industry. The ease of access, an abundance of information, and low transaction costs of the web have motivated the tourism industry to provide online travel services. In intensely competitive and dynamic tourism and travel market, it is mandatory for online hotel booking websites (OHBS) to adopt innovative forms of IT to survive and flourish. This study uses the multiple criteria decision-making (MCDM) method to examine user adoption of online hotel booking. The results show that the factors are associated with each other using ISM-digraph. It is expected that by focusing on these fundamental drivers, OHBS will be able to develop and facilitate their users effectively. The present study will also help practitioners while creating their main marketing strategies for increasing user base and retaining existing users.**

I. Introduction

In this evolving world where information technology (IT) development has been making the entire globe connected, online hotel booking websites (OHBS) needs to advance so that the customers feel comfortable and have an ease with which they can use the services. With the swift evolution of electronic commerce (e-commerce) applications, consumers and providers can now meet and exchange information directly in an e-marketplace [7]. As an increasing number of consumers prefer to book their travel services via the Internet, the ability to manage and apply IT is a vital competency in obtaining and maintaining sustainable competitive advantages. This has led to definitive changes in the travel industry, including e-commerce via business-to-business (B2B) and via business-to-consumer (B2C).

With the rapid evolution of e-commerce applications, OHBS should undertake the intelligent management of B2C e-commerce services and optimal resource allocation to survive in this dynamic environment. The present research uses the multiple criteria decision-making (MCDM)- Interpretive Structural Modeling (ISM) method to examine critical factors and their interrelationships. ISM helps to investigate the importance of each element, thereby helping managers and executives to allocate the optimal resources, which helps in improving IT services to better meet customer needs. Therefore, to fill the gaps in the current research, this study uses ISM to identify the critical factors of B2C e-commerce adoption, thereby helping OHBS.

II. Literature Review

A. Information technology

The adoption of IT may take place in two phases. The initiation phase (first phase) involves knowledge and awareness of the innovation, the formation of attitudes toward the change, and related decision making. The next step (implementation stage) is when the IT applications are running. Rogers (2003) [4] explained how an innovation-decision process includes the five main steps, namely-knowledge, persuasion, decision, implementation, and confirmation.

Current e-commerce adoption is a form of innovative technology adoption, where tourists can easily book travel services online. Several websites specialized in hospitality and tourism are booming on the web and these include Booking.com, Hotel.com, Tripadvisor.com, Trivago.com, Expedia.com, Travelocity.com, Yelp.com, Orbitz.com and Citysearch.com [9]. Considering this viewpoint, OHBS should evaluate critical factors, understand influencing emerging e-marketing channels, by which tourists are persuaded to book travel services via the Internet.

B. Smart Tourism

The concept of smart tourism is novel both theoretically as well as practically, evolving from the advancement of smart cities [1]. It is an ICT tourism platform, which integrates ICT with tourism sources, such as artificial intelligence, cloud computing, and internet of things (IoT), to provide information and satisfactory services to tourists. Tourists in this smart era have mentioned some distinctive needs and behavior patterns from their counterparts in the pre-Internet/social media age. They are more IT-driven, who opts for online-service, and personal reservation tools. They value those OHBS that provides easier access to IT, better value for their money and time, flexibility, greater variety, personalization, and safety. Such changes in tourists' needs have been challenging the tourism industry for better results. Carefully monitoring customers' online behaviors and factors influencing their booking intentions can provide educated insights into customers' online behavior [9]. Hence, it is mandatory to understand the factors and their interrelationships that influence tourists' demands.

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C. Critical Criteria influencing online hotel booking websites

Academic researchers and business practitioners have explored the issue of OHBS quality and developed diverse methods for website evaluation. Some organizations have even used their website evaluation indices to evaluate websites. Few researchers have applied the modified Balanced Scorecard approach to the assessment of tourism and hospitality websites [3]. Various factors influence the OHBS, namely cost minimization, best pricing, easy cancellations, and refund policies. Among a vast range of criteria present in the existing literature, it is necessary to first focus on the primary and critical criteria.

III. Research Methodology

A. Methodological flow

The research is conducted using a mixed methodology approach using sequential design [2]. The study is carried out in 2 steps Qualitative, followed by Quantitative.

The qualitative phase is further conducted in two stages. The first stage focused on the authentication of existing criteria in the Indian context. The data is collected through open-ended semi-structured interviews, online hotel booking users in India. The second stage uses the Delphi technique to understand whether the criteria can be grouped. As OHBS is still in initial stages, especially in the Indian tourism industry; hence, Delphi is one of the reliable methods to understand the phenomenon in question. Delphi can make effective decisions in situations where there is contradictory or insufficient information. The Delphi is a group facilitation system that is used to acquire consensus on the experts' opinions through a series of structured questionnaires in multiple rounds which are completed anonymously by them. As, participants do not meet with each other face to face; therefore, they can present and react to ideas unbiased by the identities and pressures of others.

The quantitative phase is carried out by focusing on finding interrelationships among criteria. MCDM has been used in various research, studies using computational and mathematical tools for the subjective evaluation of criteria by decision-makers [5,6]. Analytic Hierarchy Process (AHP) has been used to identify ten (10) most influencing criteria among the identified criteria.

The current study is developmental. The research method in this survey is descriptive and analytical. This study begins with identifying the criteria influencing tourists for OHBS and then is followed by leveling the criteria using Interpretive Structure Model (ISM) model. Fig. 1. presents the flow of research methodology diagrammatically.

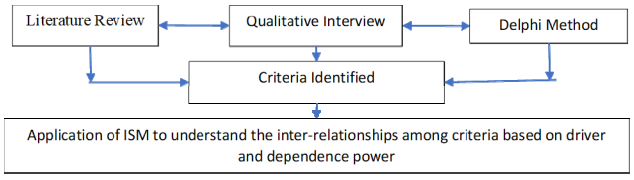

Fig. 1. Research Methodology

B. Interpretive Structural Modeling (ISM)

ISM method was proposed by Warfield (1973, 1974) [8] that can act as a communication tool in complex situations. The mathematical foundation of this methodology lays in the reference works carried out by various researchers. The application of the ISM method assists in understanding the interrelationships among the criteria. The steps of the ISM method are:

Step 1: To identify the criteria, specific to the problem, from the literature survey and interview with domain experts.

Step 2: To establish the relationship between each pair of identified criteria.

Step 3: A structural self-interaction matrix (SSIM) is developed, depicting the pairwise relationships among the identified criteria.

Step 4: The formation of a reachability matrix from SSIM is carried out. SSIM is first converted into the initial reachability matrix by substituting the four symbols, i.e., V, A, X or O, of SSIM by 1 or 0 in the initial reachability matrix and it is checked for transitivity. The transitivity is incorporated, if missing, by a re-evaluation of responses to obtain final reachability matrix.

Step 5: The reachability and antecedent sets are derived from the final reachability matrix to find different levels of identified criteria.

Step 6: Using the reachability matrix, the ISM digraph is drawn, and different levels obtained in step 4 and step 5, respectively. In this step, the transitive links are removed to show direct relationships.

Step 7: The final digraph is converted into an ISM model by replacing nodes of the criteria with statements.

Step 8: The ISM model is checked for conceptual inconsistencies if required, the changes are made.

Step 9: MICMAC (MICMAC (Matriced' Impacts Croise's Multiplication Applique'e a UN Classement or Cross-Impact Matrix Multiplication Applied to Classification) analysis: This analysis is performed to understand the nature of dependencies among the drivers and dependents of the study, i.e., Autonomous, Dependent, Linkage, and Independent drivers, maybe labeled to each criterion.

IV. Data Collection

A. The rationale for the selection of India as a suitable location for the study

India is a fast-growing developing country, and one of the world's most popular tourist attraction places. According to Forrester Research, poorly designed websites may suffer up to 50% loss in sales as users are incapable of locating the correct information they desire, and a loss up to 40% of potential repeated visits due to the initial negative experience. To improve the quality of the OHBS in India and to reduce their

likelihood of failure, it is essential that there is a systematic and comprehensive evaluation of factors that influence the users (tourists) while deciding on booking using these websites. Hence, 45 (15 existing users, 15 potential users, and 15 non-users of OBHS) were interviewed. The interviewees were interviewed twice. Each interview ranged from one to two hour. Most of the interviewees were face to face except two Skype-meetings which was done as interviewees were present at distant location and commuting would have taken delayed the research timeline. During the initial stage semi-structured, open-ended questions were asked. This style of discussion allowing users to explain clearly their understanding of likes and dislikes related to OHBS. Then content analysis was done using open and axial coding followed by identification of the criteria. During the second round of interview, more focused and criteria-related questions were asked to get in-depth knowledge about those criteria that affect the decision of interviewees while deciding whether to opt OHBS or not. Fifteen criteria were identified from the analysis of the interview's transcripts. AHP has been used to find out the 10 (most) critical criteria for further evaluation.

V. Results and Analysis

After using content analysis, fifteen criteria have been identified influencing OHBS. AHP has been used to find the ten most critical criteria whose definition is presented below:

1. Uncertainty Minimization- Hotels always encounter with a dynamic environment, including no-turn ups or over turn-ups. Sometimes, the hotel overbooks their rooms to save money loss due to end-moment cancellations, that can lead to last moment hassle. OHBS should keep such circumstances under control.
2. Reliability- to the extent to which an OHBS can solve customer problems competently.
3. Time Efficiency- OHBS are quick to understand and time-efficient with minimum time to booking.
4. Following-up Service- OHBS provide post-purchase service for inquiries related to booking questions, the refund and return of products and services, etc.
5. Cancellation & Refund Policy - Indicate that OHBS can provide a comprehensive and transparent description of the related policies to users of its website.
6. Customer Satisfaction- OHBS build trust, measure performance, value delivery quality, and work on customer feedback to provide satisfactory results to customers [11].
7. Price- refers to product pricing and discount policies that are directly related to consumer purchase cost and expenditure .
8. Service Quality- Identify if the actual level achieved and the essential areas then need to be improved to fulfill customers' demands [9], [11] .
9. Service Support- It includes online frequently asked questions (FAQ) (OHBS has a list of common questions and related responses, as well as access to a service that enables users to ask more questions), an inquiry service, follow-up service and value-added service (offering additional, free services, as airport pick-up).
10. Responsiveness- OHBS can quickly meet customer needs and ensure that its travel products and services meet customer expectation.

During the analysis of ISM, for each (i,j), the relationship between two variables is studied in the following framework.

V: variable i will help to achieve the variable j.

A: variable i will be achieved only by the variable j.

X: both i and j help will help achieve each other.

O: variables i and j are unrelated.

If the (i, j) entry is **V** in matrix SSIM, then in the reachability matrix the (i, j) entry will become **one** and (j, i) entry will become zero. If the (i, j) entry in SSIM is **A**, the in the reachability matrix the (i, j) entry will become **zero** and the (j, i) entry will become **one**. If the (i, j) entry is **X**, then in the reachability matrix the (i, j) entry will become **one,** and the (j, i) entry will become **one**. If the (i, j) entry is **O**, the in the reachability matrix the (i, j) and (j, i) entries will become **zero** (as presented in Table I). Reachability matrix is composed using structural self-interaction matrix (SSIM) as it is shown in Table II. If the correlation is as **V**, the (i, j) = 1 and (j, i) = 0; If the correlation is as **A**, then (i, j) = 0 and (j, i) = 1; If the correlation is as **X**, then (i, j)=(j, i) = 1; If the correlation is as **O**, then (i, j) = (j, i) = 0. Using these correlations, the reachability matrix given in Table II is composed. Having composed the reachability matrix, reachable and antecedent sets are defined, and then their intersection is obtained. That is, the reachable set is a set in which the criteria of rows are one and antecedent set is a set which the criteria of columns are one. Based on transitory in mathematic logic, if (i ,j) = 1 and (j, k) = 1, then (i, k) = 1. That is the criteria having an indirect impact on other criteria are considered, and the two variables which are correlated after applying this logic are shown as *1.

In Table III, considering transition relation, if i and j are related and j and k are also related, then i and k are related. Therefore, some criteria will become *1. Also, the obtained matrix will be partitioned into different levels, and the antecedent set will be collected for each criterion. Having composed the reachability matrix, reachable and antecedent sets are defined, and then their intersection is obtained. That is, the reachable set is a set in which the rows are the criteria transitory having obtained the intersection of these sets, the next column of the table will be filled. The criteria for which the reachability and intersection sets are the same are the top-level criteria. The reachability set consists of the criteria itself and other criteria, which it may help to achieve, whereas the antecedent set includes criteria itself and other criteria, which may help to achieve it. Then the intersection of these sets is derived for all the criteria. The criteria for which the

reachability and intersection sets are the same are the top-level criteria in the ISM hierarchy. The top-level criteria of the regime would not help to achieve any other criterion above their own level in the hierarchy. Once top-level criteria are identified, it is separated from the rest of the criteria. Then, the same process is repeated to find the next level of criteria. In Table IV, the criteria 8 (service quality) and criteria 10 (responsiveness) are located at level 1. Thus, they will be removed in Table V.

After removing criteria 8 and 10 from Table V next table is obtained in which reachable, and antecedent sets and their intersection are determined. By comparison, the interact column and reachable set in the second level, prioritization of criteria including criteria 7 (price) and criteria 9 (service support) are removed from Table VI. The process is repeated, and on third level-criteria 6 (customer satisfaction) and level 4 – criteria 5 (cancellation & refund policy) are placed (as presented in Table VII). The process is repeated for three times till Table VIII is obtained where all criteria are placed at their identified levels.

Using these levels, an ISM digraph is drawn in such a way that criteria 8 and 10 characterized as the top-level are put at the first level of the digraph and other criteria are likewise set in the additional level of the digraph. This digraph is shown in Fig. 2. Considering the above tables and figures and using prioritized levels of criteria and reachability matrix, the driving and dependence digraph in the reachability matrix is obtained. That is the first level is attributed to the most significant and last level to the smallest number. The clusters in Fig. 3 are defined as follows- First cluster includes the criteria that have strong driving power and weak dependence. The second cluster consists of the criteria that have weak power but strong dependence. Reliability (C2), time - efficiency (C3), customer satisfaction (C6), price (C7), and service quality (C8) fall into this cluster. The third cluster includes the criteria that have weak driving power and dependence. No criteria fall in this category. The fourth cluster consists of the criteria with strong driving power and strong dependence where following-up service (C5) and responsiveness (C10) are identified.

TABLE I. STRUCTURAL SELF-INTERACTION MATRIX (CRITERIA COMPARISON MATRIX)

Criteria	10	9	8	7	6	5	4	3	2	1
1	O	O	X	V	O	O	V	V	O	-
2	X	A	A	V	X	X	X	V	-	-
3	O	O	X	V	X	O	V	-	-	-
4	O	X	X	X	V	A	-	-	-	-
5	O	O	O	X	O	-	-	-	-	-
6	V	V	V	V	-	-	-	-	-	-
7	V	O	V	-	-	-	-	-	-	-
8	O	O	-	-	-	-	-	-	-	-
9	V	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-

TABLE II. REACHABILITY MATRIX.

Criteria	10	9	8	7	6	5	4	3	2	1	Driving Power
1	0	0	1	1	0	0	1	1	0	1	5
2	1	0	0	1	1	1	1	1	1	0	7
3	0	0	1	1	1	0	1	1	0	0	5
4	0	1	1	1	1	1	1	0	1	0	7
5	0	0	0	1	0	1	0	0	1	0	3
6	1	1	1	1	1	0	0	1	1	0	7
7	1	0	1	1	0	1	1	0	0	0	5
8	0	0	1	0	0	0	1	1	1	1	5
9	1	1	0	0	0	0	1	0	1	0	4
10	1	0	0	0	0	0	0	0	1	0	2
Dependence Power	5	3	6	7	4	4	7	5	7	2	

TABLE III. MODIFIED REACHABILITY MATRIX (FINAL REACHABILITY MATRIX).

Criteria	10	9	8	7	6	5	4	3	2	1
1	*1	*1	1	1	*1	*1	1	1	0	1
2	*1	*1	*1	1	1	1	1	1	1	0
3	0	*1	1	1	1	*1	1	1	0	0
4	*1	1	1	1	1	1	1	0	1	0
5	*1	*1	*1	1	*1	1	0	0	1	0
6	1	1	1	1	1	0	0	1	1	0
7	1	0	1	1	0	1	1	0	0	0
8	0	0	1	0	0	0	1	1	1	1
9	1	1	0	0	0	0	1	0	1	0
10	1	0	0	0	0	0	0	0	1	0

TABLE IV. THE FIRST ITERATION TO DETERMINE TOP-LEVEL IN THE HIERARCHICAL ISM

Criteria	Reachable Set	Antecedent Set	Intersection	Level
1	1, 3, 4, 5, 6, 7, 8, 9, 10	1, 8	1, 8	
2	2, 3, 4, 5, 6, 7, 8, 9, 10	2, 4, 5, 6, 8, 9, 10	2, 4, 5, 6, 8, 9, 10	
3	3, 4, 5, 6, 7, 8, 9	1, 2, 3, 6, 8	3, 6, 8	
4	2, 4, 5, 6, 7, 8, 9, 10	1, 2, 3, 4, 7, 8,9	2, 4, 7, 8, 9	
5	2, 5, 6, 7, 8, 9, 10	1, 2, 3, 4, 5, 7	2,5,7	
6	2, 3, 6, 7, 8, 9, 10	1, 2, 3, 4, 5, 6	2, 3, 6	
7	4, 5, 7, 8, 10	1, 2, 3, 4, 5, 6, 7	4,5,7	
8	1, 2, 3, 4, 8	1, 2, 3, 4, 5, 6, 7, 8	1, 2, 3, 4, 8	I
9	2, 4, 9, 10	1, 2, 3, 4, 5, 6, 9	2, 4, 9	
10	2,10	1, 2, 4, 5, 6, 7, 9, 10	2, 10	I

TABLE V. THE SECOND ITERATION TO DETERMINE THE SECOND LEVEL IN THE HIERARCHICAL ISM

Criteria	Reachable Set	Antecedent Set	Intersection	Level
1	1, 3, 4, 5, 6, 7, 9	1	1	
2	2, 3, 4, 5, 6, 7, 9	2, 4, 5, 6, 9	2, 4, 5, 6, 9	
3	3, 4, 5, 6, 7, 9	1, 2, 3, 6	3, 6	
4	2, 4, 5, 6, 7, 9	1, 2, 3, 4, 7, 9	2, 4, 7, 9	
5	2, 5, 6, 7, 9	1, 2, 3, 4, 5, 7	2,5,7	
6	2, 3, 6, 7, 9	1, 2, 3, 4, 5, 6	2, 3, 6	
7	4, 5, 7	1, 2, 3, 4, 5, 6, 7	4,5,7	II
9	2, 4, 9	1, 2, 3, 4, 5, 6, 9	2, 4, 9	II

TABLE VI. THE THIRD ITERATION TO DETERMINE THE THIRD LEVEL IN THE HIERARCHICAL ISM

Criteria	Reachable Set	Antecedent Set	Intersection	Level
1	1, 3, 4, 5, 6	1	1	
2	2, 3, 4, 5, 6	2, 4, 5, 6	2, 4, 5, 6	
3	3, 4, 5, 6	1, 2, 3, 6	3, 6	
4	2, 4, 5, 6	1, 2, 3, 4	2, 4	
5	2, 5, 6	1, 2, 3, 4, 5	2,5	
6	2, 3, 6	1, 2, 3, 4, 5, 6	2, 3, 6	III

TABLE VII. THE FOURTH ITERATION TO DETERMINE THE FOURTH LEVEL IN THE HIERARCHICAL ISM

Criteria	Reachable Set	Antecedent Set	Intersection	Level
1	1, 3, 4, 5	1	1	
2	2, 3, 4, 5	2, 4, 5	2, 4, 5	
3	3, 4, 5	1, 2, 3	3	
4	2, 4, 5	1, 2, 3, 4	2, 4	
5	2, 5	1, 2, 3, 4, 5	2,5	IV

TABLE VIII. LEVELS OF CRITERIA INFLUENCING ONLINE HOTEL BOOKING WEBSITE

Criteria	Reachable Set	Antecedent Set	Intersection	Level
1	1, 3, 4, 5, 6, 7, 8, 9, 10	1, 8	1, 8	VII
2	2, 3, 4, 5, 6, 7, 8, 9, 10	2, 4, 5, 6, 8, 9, 10	2, 4, 5, 6, 8, 9, 10	VII
3	3, 4, 5, 6, 7, 8, 9	1, 2, 3, 6, 8	3, 6, 8	VI
4	2, 4, 5, 6, 7, 8, 9, 10	1, 2, 3, 4, 7, 8,9	2, 4, 7, 8, 9	V
5	2, 5, 6, 7, 8, 9, 10	1, 2, 3, 4, 5, 7	2,5,7	IV
6	2, 3, 6, 7, 8, 9, 10	1, 2, 3, 4, 5, 6	2, 3, 6	III
7	4, 5, 7, 8, 10	1, 2, 3, 4, 5, 6, 7	4,5,7	II
8	1, 2, 3, 4, 8	1, 2, 3, 4, 5, 6, 7, 8	1, 2, 3, 4, 8	I
9	2, 4, 9, 10	1, 2, 3, 4, 5, 6, 9	2, 4, 9	II
10	2,10	1, 2, 4, 5, 6, 7, 9, 10	2, 10	I

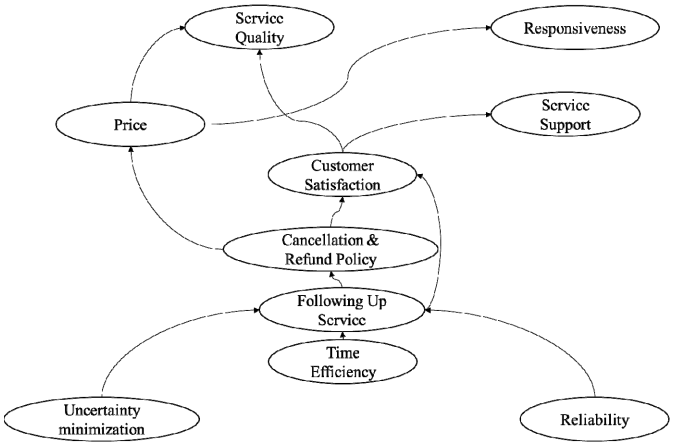

Fig. 2. ISM Diagraph

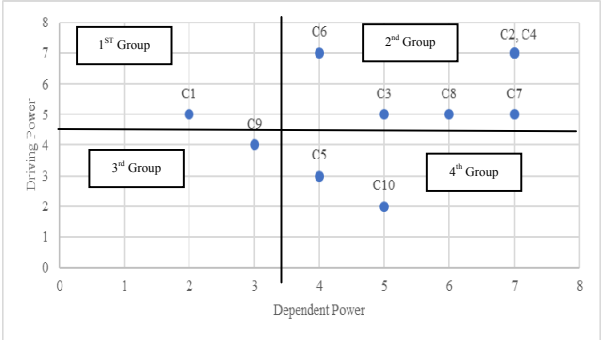

Fig. 3. Dependent-Driving Power: Clusters of Criteria

VI. DISCUSSIONS

In the knowledge age, the successful OHBS are the ones who rapidly run novel strategies based on learning from the market and tourists' feedbacks as well as requirements. They modify and improve their processes as per customers demands. In the current study, first, the criteria influencing OHBS are identified based on literature, qualitative interview, and Delphi method. The identified criteria are put in different levels using interpretive structural model and then are given in a driving power and dependence graph. The result of this process helps OHBS to choose a more efficient way to increase their competitive ability and customer base by working on the identified criteria.

ISM method results show that uncertainty minimization, reliability followed by time efficiency are the most important criteria influencing tourists for booking via OHBS. Then following-up service criteria on the next level. With taking a look at the graph of clusters, it can be seen that customer satisfaction, reliability, and following-up service are of high driving power, whereas responsiveness has the minimum driving power and maximum dependence. Cluster 1, i.e. independent cluster where uncertainty minimization and service support lies shows that these criteria are not dependent

on any other criteria and have maximum driving and minimum dependent power. The criteria in the linkage cluster (Group 2) have both high driving power and high dependence degree. Group 4, i.e., dependence cluster where cancellation & refund policy and responsiveness falls, shows that they are the most dependent criteria.

VII. Conclusions and Implications

The literary contribution of this work can be stated as the identification of criteria from the literature review, qualitative interviews and Delphi method, and the results of ISM method for the identification of critical criteria influencing OHBS. For practitioners, these criteria and ISM method would help in the selection of technical and economic driven criteria that can increase their gross conversion rate of bookings. This work would make a useful contribution towards the understanding of critical criteria that can serve to not only OHBS more user-friendly but also achieve competitive advantage using the insights from the research.

VIII. Limitations

In future studies, the ISM model can also be used in a fuzzy manner, and all calculations are done using a fuzzy method. This will help to work more effectively with unceratin data and imprecise knowledge. As fuzzy number gives a range of values for the concept and a membership quantity for each value, hence it helps to capture the expert or interviewee state of mind more closely.This study has been carried out using respondents from India, and it may lead to different results if performed for other developing nations. Hence for generalizability of findings, comparative study in more developing countries can be done so that their results can be generalized for future reference. Further interviewees from all over the world including both developed and developing nations can be conducted to understand the factors influencing the customer online hotel booking intentions all over the world.

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