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CHAPTER 12

Guideline for Application of Fuzzy-set Qualitative Comparative Analysis (fsQCA) in Tourism and Hospitality Studies

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Abstract

The aim of this chapter is to review and illustrate a step-by-step guideline in conducting fuzzy-set Qualitative Comparative Analysis (fsQCA) in tourism and hospitality studies. As an emerging method, fsQCA is simultaneously quantitative and qualitative in nature which makes it an appropriate method for social science disciplines including tourism and hospitality area because of complex nature of relationships between multiple variables where theories and models are underdeveloped. Unlike conventional statistical techniques, fsQCA is an asymmetrical analysis technique that provides a holistic view and interrelationships among several conditions using Boolean algebra. The fsQCA analyses produce comprehensive assessment by revealing causal combinations of antecedents to predict an outcome; and identify sufficient configurations (i.e. causal combinations, recipes) and necessary condition/s. By utilizing this method, researchers would be able to produce complex, comprehensive, and robust results.

Keywords: Qualitative Comparative Analysis (QCA); fuzzy-set Qualitative Comparative Analysis (fsQCA); asymmetrical analysis; set-theoric approach; calibration; coverage; consistency; truth table

1. Introduction

The set-theoretic Qualitative Comparative Analysis (QCA) is a technique developed by Charles Ragin (1987) which is different to multiple-criteria decision making methods and conventional correlational techniques. According to Ragin (2008), the unique ability of the QCA technique is to analyze the complicated causations where the outcome condition emanates from several compositions of causal conditions, which is referred to "recipes". Ragin (2000) also indicates that QCA provides forms of set memberships where the patterned similarities and heterogeneities are discovered. The QCA approach has three main characteristics including: i) finding out causal inferences, ii) configuring truth tables, and iii) logical minimization, which makes it different from other set-theoretic methods (Schneider & Wagemann, 2012).

There are arguments amongst researchers regarding the merits of QCA and the necessity to move beyond interpretations originating from symmetric approaches such as multiple regression analysis (Woodside, 2013). In symmetric approach, one combination of conditions results into high value in a dependent variable (outcome condition), but in reality, more than one combination of conditions results into an outcome condition. In other words, "any combination of conditions has an asymmetrical relationship with an outcome condition and not a symmetrical relationship" (Woodside, 2013, p. 464). For example, in a symmetric relationship between two variables of job satisfaction and job performance, the existence/non-existence of the association between these variables are tested through the causality where there will (or will not) be a relationship between these variables. But in an asymmetric relationship between aforementioned factors (conditions), the existence/non-existence of the association between these conditioned are examined through a fuzzy set. In other words, the relationship between aforementioned conditions exist but to some extent.

There are two types of QCA: crisp-set QCA (csQCA) and fuzzy-set QCA (fsQCA). The main difference between these approaches resorts into the way the set membership is assigned. In the former technique, the conventional sets are assigned as either full non-membership (the value of 0) or full membership (the value of 1). Whereas, in the latter technique, the sets can get partial or gradual values (for instance a value of 0.5 or 0.75). Therefore, in the fsQCA approach, the extent of absence and presence of the set memberships are better recognized (Schneider & Wagemann, 2012).

Several studies in different social science disciplines, in recent years have applied fsQCA (Mikalef & Pateli, 2017; Olya & Altinay, 2016; Pappas et al., 2019; Phung et al., 2020; Xie & Wang, 2020; Yu et al., 2016). Researchers in tourism and hospitality started to use fsQCA technique for several variables of interest in high ranked hospitality and tourism journals. For instance, studies on travelers' willingness to pay (Agag et al., 2020), hotels' sustainability practices (Olya et al., 2020), tourism accommodation service (Pappas and Papatheodorou, 2017), green hotels (Olya et al., 2019), value co-creation (Navarro et al., 2016), peer-to-peer accommodation (Pappas, 2017), tourist engagement (Rasoolimanesh et al., 2021a), tourism firm performance (Kallmuenzer et al., 2019), and tourism governance network performance (Fadda and Rotondo, 2020) were published using fsQCA. The application of fsQCA has been increased recently and reviewing the current literature in tourism and hospitality researches reveals the significant lack of proper guideline, thus, this chapter book aims at filling this gap.

2. Literature review

2.1. Fuzzy-set Qualitative Comparative Analysis

Although there is a debate on the use of qualitative vs. quantitative approaches, fsQCA method brings together these methods (Rasoolimanesh et al., 2021b; Valaei et al., 2019). The fsQCA is sometimes referred to a mixed method approach (Ragin, 2009) and it is distinct from traditional quantitative and qualitative research strategies. However, it can consist quantitative data, qualitative data, or both in the analysis, thus, fuzzy sets are simultaneously quantitative and qualitative. This is due to the fact that fsQCA uses set-theory and formal logic to find recipes (relationships) between explanatory factors and an outcome condition. According to Ragin (2008), the fsQCA is a useful approach for social scientists, which is dissimilar with quantitative methods with correlational reasoning. By using fsQCA, the limitations of variable-oriented research are remedied and the researchers have the opportunity to formulate statements about broad patterns and cross-cases (Ragin, 2000). One of the merits of fsQCA is that it can be used for small sample sizes and previous studies, increasingly case studies were conducted using this method (Van Mieghem *et al.*, 2020). Prior to applying fsQCA, researchers can have a robust result through checking the conventional validity and reliability metrices such as discriminant validity, convergent validity, internal consistency, and indicator reliability.

One of the objectives of the fsQCA is to estimate causal combinations with a high membership score in the outcome condition (Rasoolimanesh et al., 2021b; Valaei et al., 2017). Using fuzzy-sets empowers the researchers to calibrate continuous variables for the sake of designing a set membership which can consider both qualitative and quantitative nature of the variable into consideration, according to Schneider and Wagemann (2012). These authors also indicate that the potency of fuzzy-sets in identifying the difference-in-kind amongst cases represent the qualitative aspect of the method while identifying the difference-in-degree represents the quantitative nature of the fsQCA.

Based on the guidelines of Ragin (2000; 2008), the value difference between non- and full memberships are shown in Table 1. As tabulated, the three-value fuzzy-set indicates that there are three membership scores of 0, 0.5, and 1 for non-membership, partial membership, and full membership respectively. The five-value fuzzy set is more informative than the basic version of three-value fuzzy-set. The seven-value fuzzy-set is more complex which has additional intermediate levels on both crossover points i.e., 0.17, 0.33, 0.67, and 0.83.

Table 1: Crisp vs. fuzzy sets (Ragin, 2000; Ragin, 2008), modified

Crisp set	Three-value fuzzy set	Five-value fuzzy set	Seven-value fuzzy set	“Continuous” fuzzy set
1 = fully in	1 = fully in	1 = fully in	1 = fully in	1 = fully in
		0.75 = more in than out	0.83 = mostly but not fully in 0.67 = more or less in	Degree of membership is more "in" than "out": 0.5 < Xi < 1
	0.5 = neither fully in nor fully out	0.5 = crossover: neither in nor out	0.5 = crossover: neither in nor out	0.5 = cross-over: neither in nor out (maximum ambiguity)
		0.25 = more out than in	0.33 = more or less out 0.17 = mostly but not fully out	Degree of membership is more "out" than "in": 0 < Xi < 0.5
0 = fully out	0 = fully out	0 = fully out	0.0 fully out	0 = fully out

Source:???

Finally, the most complex version of fuzzy-set is the “continuous” fuzzy-set in which the values can be set anywhere between 0 and 1. This fuzzy set has the highest degree of fuzziness/ obscurity and it is more sophisticated due to the fact that the cross over value of 0.5 is unknown whether a case is more “in” or “out” of the set (Rasoolimanesh et al.,2021b; Schneider & Wagemann, 2012). Nevertheless, the decision on the levels of fuzzy-sets is made by the researcher and the sets not necessarily need to have equal intervening values (Rihoux & Ragin, 2009). Table 2 shows the verbal description of fuzzy-set membership values.

Table 2: Verbal description of fuzzy-set membership scores (Ragin, 2000)

Fuzzy value	The element is…
1	Fully in
0.9	Almost fully in
0.8	Mostly in
0.6	More in than out
0.5	Crossover: neither in nor out
0.4	More out than in
0.2	Mostly out
0.1	Almost fully out
0	Fully out

Source: Did you copy it form this source or adapted?

2.2. Calibration of Fuzzy-sets

Fuzzy-sets are different from conventional variables and there is a need for calibration, which refers to the adjusting measurements to comply with the known standards (Ragin, 2008). According to Schneider and Wagemann (2012, p. 32), calibration is "the process of using empirical information on cases for assigning set membership to them". Calibration has also been applied in both qualitative and quantitative sciences and Ragin (2008) claims that, it is dominant over conventional measures in several perspectives. Rihoux and Ragin (2009) also suggest that interval or ratio-scale data can be also converted (calibrated) into fuzzy-sets.

In order to achieve analytically relevant results, Schneider and Wagemann (2012) suggest five steps to be taken into considerations: a) specifying the population of the cases, b) a thorough description of all the conditions and outcomes, c) identifying the non-membership and full membership points, d) determining the critical-point values, and e) identifying the gradual membership values between the critical points and cross over points. In addition, the researchers should note that extra-data criteria and knowledge from different sources are required in calibration process. Rihoux and Ragin (2009) highlights that the calibration process should not to be mechanical, but it needs to be backed up with theoretical knowledge.

2.3. Truth Tables

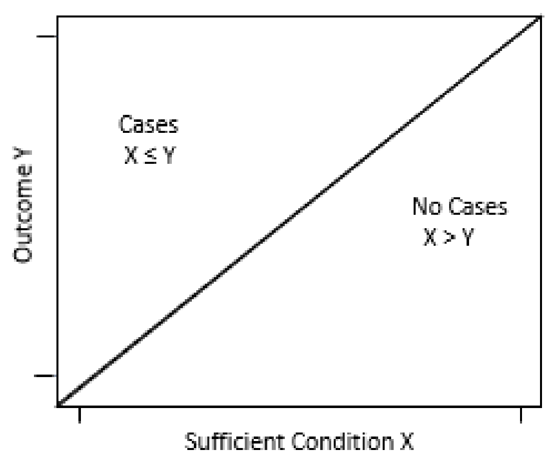
Understanding the QCA method resides on the comprehension of the truth tables as an analysis method. These tables consist of the empirical data collected by the researcher. Truth tables are analyzed using the logical minimization where sufficient and necessary conditions are identified (Ragin, 2009; Schneider & Wagemann, 2012). All causal configurations (feasible combinations of variables) set by the researcher are considered and the aim is to find the connections between the antecedent conditions (similar to independent variables in symmetric analysis) and outcome conditions (as known as dependent variables in symmetric analysis) (Ragin, 2008). Each column in a truth table indicates a different set (variable) and each row indicates a potential combination between different conditions. The rows in truth table also are called configurations, recipes, and causal combinations. There are 2^k rows in the truth table (i.e. logically possible combinations), which 2 refers to two states (absence or presence) of conditions, and k is the number of antecedent conditions used.

There is an exponential relationship between the number of rows in truth tables and the number of conditions. For instance, there are 8 configurations (i.e. recipes) for 3 conditions, 16 configurations for 4 conditions, 32 configurations for 5 conditions, and so on (Schneider & Wagemann, 2012). When analyzing the truth table, the consistency of the configurations is of great importance (this is identical to the correlation in symmetric analysis). The consistency scores are provided by fsQCA software and the researchers can analyze the causal combinations based on these scores and examine if there is a connection between antecedent conditions and the outcome conditions (Ragin, 2017).

2.4. Sufficient and Necessary Conditions

The logic behind the sufficiency indicates that when a condition is present, the outcome also exists. However, it is impossible that a condition exists without an outcome (Schneider & Wagemann, 2012). A case is sufficient in such a situation if it can produce an outcome by itself. Moreover, if a causal combination of antecedent conditions (i.e. configuration, recipe) is capable of producing the outcome, but it is not the only condition available, then it is sufficient and not necessary (Ragin, 2017). Sufficiency can be clarified in detail as follows: X Y i.e., “if X, then Y” (Schneider & Wagemann, 2012) where X is sufficient condition. In addition, the main set theoretic relation in the study of causal complexity is a subset relation, according to Rihoux and Ragin (2009). They indicate that “if cases sharing several causally relevant conditions uniformly exhibit the same outcome, then these cases constitute a subset of instances of the outcome” (Rihoux & Ragin, 2009, p. 90). According to Schneider and Wagemann (2012), the membership of X and Y needs to be as $X \leq Y$ in the subset relation of sufficiency. In fuzzy-sets, the sufficiency condition is illustrated through the XY plot that stretches from point (0,0) to the point (1,1) which includes the cases above the diagonal line ($X < Y$) and cases below the diagonal line ($X > Y$). In addition, if all cases are included above the diagonal line, it can be expressed that X is a subset of Y and the consistency is 1. Figure 1 schematically shows the subset relation of XY plot.

Figure 1: XY plot – Distribution of cases for sufficient condition X



Source: (Schneider & Wagemann, 2012)

Finally, a condition is called necessary in case both outcome and condition are present. For instance, in the following relationship: job satisfaction organizational commitment, job satisfaction is a necessary condition, if the existence of the condition (job satisfaction) is needed for the outcome (organizational commitment) to happen, albeit the presence does not inevitably indicate that the outcome will actually happen (Rihoux & Ragin, 2009). A necessary condition is also considered as the outcome’s superset (Rihoux & Ragin, 2009).

To identify the sufficient and necessary conditions, two criteria namely consistency (correlation in symmetric analysis) and coverage (coefficient of determination in symmetric analysis) should be calculated. The formulas to calculate the consistency and coverage of each configuration has been shown in Equation 1, and Equation 2 respectively (Ragin, 2006, 2009):

(Equation 1) Consistency $(CON_i) = \sum \quad ((CON_i\ ,\ Y_i)) / \sum \quad (CON_i)$

(Equation 2) Coverage $(CON_i) = \sum \quad ((CON_i\ ,\ Y_i)) / \sum \quad (Y_i)$

In these equations, CON_i represents the score of configuration for case number i, and Y_i is the membership score of outcome for case i. The consistency higher than 0.8 and coverage greater than 0.2 confirm the sufficiency of each configuration to generate outcome (Mikalef & Pateli, 2017; Ragin, 2009). In addition, to perform the necessity analysis and to identify the necessary condition, the both consistency and coverage should be greater than 0.9 (Ragin, 2009; Rasoolimanesh et al., 2021b).

2.5. Logical AND, logical OR, Logical NOT

The logical AND in the fsQCA refers to selecting the minimum score of the intersected sets of a case (Ragin, 2017) which is also referred to "weakest link" reasoning (Rihoux & Ragin, 2009). Following the logic of Boolean algebra, the logical AND is shown in the outcome pathways of the fsQCA as a multiplication sign "*" (Buche, 2017). For instance, if there are two sets of A and B, the logical AND refers to the shared parts of these sets shown as A*B. In this case, if A=0.17 and B= 0.33, then the shared part of these two sets is the minimum value of 0.17. In other words, A*B = min (0.17, 0.33) = 0.17. The main application of this Boolean sign is combinations of conditions that shape sufficient condition for an outcome.

Logical OR, as known as the set union, refers to another Boolean parameter in which two or more conditions have similar bases for an outcome (Ragin, 2017). Unlike to logical AND, the logical OR combines sets of A and B. Following the logic of Boolean algebra, the logical OR is shown in the outcome pathways of the fsQCA as the addition sign "+" (Buche, 2017). For example, if A=0.17 and B= 0.33, then the combination of these two sets (A+B) is the maximum value of 0.33. In other words, A+B = max (0.17, 0.33) = 0.33. The main application of this Boolean sign is finding the alternative pathways to an outcome condition.

Logical NOT, as known as the set negation, refers to the portion excluded from a set (Ragin, 2017). It is shown in the outcome pathways of the fsQCA as "~" (Buche, 2017). In other words, ~A= 1-A. For example, if A=0.17, then ~A= (1 - 0.17) = 0.83. The main application of this Boolean sign is looking at how the absence or the opposite of a set works as a condition or outcome.

3. Step-by-step Guideline for fsQCA

There could be differences in performing the fsQCA amongst different software packages developed for variety of methods and environments. For instance, "fuzzy" package, developed for Stata software, which performs both csQCA and fsQCA. QCA3 package is developed for R software, which performs csQCA, fsQCA, and multi-variate QCA. In addition, fs/QCA 3.0 is another software, which has been developed for windows and MacOS (Ragin, 2017). Following steps indicate the steps to run the fsQCA in fs/QCA 3.0 software.

Step 1: The first step is to enter the data into the fs/QCA 3.0 software. All data need to be in the "csv" format. This step is done through the File menu/Open. Researchers should note that the variable score should be calculated before entering data to the software based on all measurement items. For instance, if there are five measurement items for "job satisfaction" construct, the score (mean or average) of "job satisfaction" should be calculated based on five items, and the score of each construct (variable) should be used in software.

Step 2: The second step involves transforming the continuous data to fuzzy-sets and calibration of data. Based on the information provided in Table 1, the right calibration is chosen. This step is performed through the Variables menu in fs/QCA 3.0 software (Ragin, 2017), where a variable is computed. In Compute Variable, a target variable is named by choosing the "calibrate (x, n1, n2, n3)" function where "x" refers to the existing variable, "n1" refers to the threshold for full-membership, "n2" refers to the cross-over point, and "n3" refers to the threshold of non-membership in the target set. Using "Compute Variable" and "calibrate (x, n1, n2, n3)" function, the construct is transformed to the fuzzy sets accordingly.

Step 3: The next step is the main analyzes which are to generate the truth table, and produce the causal combinations (i.e. configurations, recipes) and identify the sufficient and necessary conditions. The truth table is computed through "Analyze" menu from which "Truth Table Algorithm" is chosen. To run this algorithm, in the "Select Variables" menu the outcome (dependent variable) condition is selected as a "Set or Set Negated" and the antecedent conditions (independent variables) are added accordingly. The results of fuzzy-set show the number of cases indicating the combination of conditions (i.e. configurations). Then by performing the standard analysis, which it includes all possible causal combination, the consistency and coverage of configurations are calculated. The configurations with consistency higher than 0.8 and coverage greater than 0.2 can be considered sufficient configurations to generate outcome.

However, the results of fsQCA provide three types of sufficient configurations namely complex, intermediate, and parsimonious, which complex output presents all possible configurations, parsimonious calculate only the essential configurations, and intermediate stands between these two (Rasoolimanesh et al., 2021b). The complex solution calculates the largest number of configurations and can be applied in more sensitive areas such as medical tourism (Olya & Nia, 2020). However, interpretation of all configurations of complex solution always is not possible, so for behavioural studies intermediate or parsimonious solutions are recommended (Olya, 2020; Rasoolimanesh et al., 2021b). It should be noted that the interpretation of results of fsQCA outputs need sufficient knowledge and understanding of theory, in particular for complex and intermediate solutions, which larger number of causal combinations are calculated (Rasoolimanesh et al., 2021b). In addition, in the "Analyze" menu, the "Subset/Superset Analysis" shows different terms ("*") which calculate the consistency and coverage of specific set configurations to generate the outcome condition. In the "Select Variables" menu the outcome condition is selected as a "Set or Set Negated" and the antecedent conditions (or their negations) are added accordingly. In addition, to check the necessity conditions, the "Necessity Conditions" is chosen from the "Analyze menu". In the dialog menu, the outcome condition (or its negation "~") is selected and different conditions (or their negations) can be computed ("+") and these conditions are to be added to the “Conditions menu” in the right side using the “” bottom. The results show different conditions tested in each row indicating their consistency and coverage. For identifying the necessary condition, both coverage and consistency should be greater than 0.9 for each condition (Ragin, 2009).

Step 4: The XY plot is shown using the “Graphs” menu. In the XY Plot menu, the researcher can choose the outcome condition (or its negation) in the “Y Axis” and a configuration is chosen as “X Axis”. The outcome of the plot depicts the fuzzy-set XY plot for the configurations and the outcome condition. Because of high number of configurational paths, merely those plots for outcome condition are presented. In fuzzy- set XY plot, the lower right box indicates the extent that the data marked in the plot adhere to “Y ≤ X” (Y is a subset of X). In addition, the higher left box indicates the extent that the data marked in the plot adhere to “X ≤ Y” (X is a subset of Y). If one of these two values (scores in lower right and upper left boxes) shows high consistency, the other can be inferred as a coverage value. In addition, this XY plot can be used to test predictive validity of configurations. To test the predictive validity, we need to split the data to two sub-samples. Perform fsQCA for sub-sample 1 and draw XY plot for sufficient configurations, and then perform fsQCA, draw XY plot, and calculate consistency and coverage using sub-sample 2 for specific configuration from sub-sample 1. If the results of sufficient configurations and consistency and coverage are identical for these two sub-samples, so this confirm the predictive capability of model (Olya & Al-ansi, 2018; Olya & Altinay, 2016).

4. Illustrative Example

In this section, using the data from Rasoolimanesh et al., (2019), we applied the four-step guideline presented in previous section to perform and report fsQCA results. Rasoolimanesh et al. (2019) for their study collected data from two cities in Iran; Kashan and Tabriz to examine the effects of community attachment (CAC), environmental attitude (EAT), cultural attitude (CAT), economic gain (EG), and involvement (INV) on residents’ perceptions (RP) towards heritage tourism development. However, in for current study, only we use the data collected from 404 residents of Kashan. In first step, the score of all constructs including CAC, EAT, CAT, EG, INV, and RP have been calculated and then were saved as a csv. file. The csv. file was imported to the software using the steps explained in Step 1. In Step 2, the data for six constructs were calibrated using the “calibrate (x, n1, n2, n3)” function in the software. Since the data for each construct is continuous and between 1 to 5, n1 was set to 5 for full membership, n2 as a cross-over point was set to 3, and n3 was set to 1 for non-membership.

In Step 3, the Truth Table was generated, and the sufficient configurations and necessary conditions to generate high level of residents’ perceptions towards heritage tourism development in Kashan were identified. Table 3 and Table 4, show the sufficient configurations and necessary conditions to generate high level residents’ perceptions towards tourism development using intermediate solution. Table 3 shows four configurations including conf 1: high level of CAC and EAT, and low level of EG , conf 2: high level of CAC, EAT, and CAT together, conf 3: high level of EAT, and CAT, and low level of EG and NV, and conf 4: high level of CAC, CAT, and INV, and low level of EG to generate high level of RP with the consistency higher than 0.8 and the coverage greater than 0.2. The results show that these configurations are sufficient causal combinations of conditions to generate high level of residents' perceptions towards tourism development.

Table 3. Sufficient Configurations for Residents' Perceptions

	Antecedent conditions					**Coverage**		**Consistency**
	Community Attachment (CAC)	Environmental Attitude (EAT)	Cultural Attitude (CAT)	Economic Gain (EG)	Involvement (INV)	Raw coverage	Unique coverage	
Configuration 1	●	●		○		0.540	0.037	0.957
Configuration 2	●	●	●			0.857	0.356	0.955
Configuration 3		●	●	○	○	0.429	0.004	0.956
Configuration 4	●	●		○	●	0.208	0.002	0.981

●: Presence of a condition
Blank cells: Ambiguous conditions
○: Absence of a condition
Solution coverage: 0.904
Solution consistency: 0.939
Frequency threshold= 1
consistency threshold= ≥0.80

Moreover, Table 4 shows the results of necessity analysis and highlights the necessary conditions to produce high level of residents' perceptions. The results of Table 4 shows CAC, EAT, and CAT as the necessary conditions to produce high level of residents' perceptions of Kashan towards tourism development.

Table 4. Results of Necessity Analysis for Residents Perceptions

Antecedents	Consistency	Coverage
CAC	**0.943**	**0.921**
~CAC	0.232	0.955
EAT	**0.959**	**0.912**
~EAT	0.599	0.909
CAT	**0.918**	**0.919**
~CAT	0.232	0.955
EG	0.566	0.971
~EG	0.599	0.909
INV	0.527	0.961
~INV	0.625	0.902

Outcome = Residents' Perception

In Step 4, the XY plot for all sufficient configurations and outcome can be presented. Moreover, this plot can be used to assess the predictive validity of proposed configurations. In our example, we divided the data to two sub-samples and performed fsQCA based on sub-sample 1. Table 5 shows the sufficient configurations from sub-sample 1 to generate (predict) the outcome. Three configurations have been identified. Figures 3.1 – 3.3 in Appendix 3 show the results of XY plot, consistency and coverage from sub-sample 2, for three sufficient configurations identified from sub-sample 1. These three figures show the acceptable consistency and coverage for three configurations based on sub-sample 2 data, indicating the high predictive validity of proposed configurations from sub-sample 1. Appendix 1 and Appendix 2 show the raw results for Sufficient Configurations for Residents' Perceptions.

Table 5. Sufficient Configurations for Residents' Perceptions

	Antecedent conditions					**Coverage**		**Consistency**
	Community Attachment (CAC)	Environmental Attitude (EAT)	Cultural Attitude (CAT)	Economic Gain (EG)	Involvement (INV)	Raw coverage	Unique coverage	
Configuration 1	●	●		○		0.559	0.052	0.953
Configuration 2	●	●	●			0.818	0.311	0.955
Configuration 3		●	●	○	○	0.430	0.003	0.955

●: Presence of a condition
Blank cells: Ambiguous conditions
○: Absence of a condition
Solution coverage: 0.874
Solution consistency: 0.940
Frequency threshold= 1
consistency threshold= ≥0.80

5. Conclusion and Recommendations

This chapter discusses the importance and mechanisms of fsQCA as an asymmetric approach and proposes a guideline for tourism and hospitality researchers intended to apply this method of analysis. A step-by-step guideline was presented in this chapter and using an example from tourism, implementation of these steps was explained. As we discussed before, fsQCA is a set-theoretic technique, which is different with symmetric and conventional techniques to analyze quantitative data, and can provide more comprehensive and richer results for causal effects of factors on an outcome (Woodside, 2013). The fsQCA can identify various causal conditions or configurations to predict an outcome (Olya et al., 2020). In spite of initial application of fuzzy sets in tourism and hospitality studies (Olya et al., 2020, Pappas & Papatheodorou, 2017; Rasoolimanesh et al., 2021a), however, there is no well-established guidance in applying, evaluating and reporting of fsQCA.

This chapter provides a step-by-step guideline that facilitate and recommend the application of this method for hospitality and tourism researchers. Because of complex nature of studies in social science disciplines, and tourism and hospitality studies, researchers are encouraged to utilize appropriate methods to provide complex casual configurations instead of one simple causal condition provided by symmetric and conventional techniques. There is a high possibility that a hypothesis is rejected in conventional and symmetric methods, but it is supported/ conditionally supported using fsQCA method. Thus, acceptance and rejecting a hypothesis or model based on fixed numbers will result in wrong decision-making at managerial levels. In addition, researchers need to bear in mind to undertake correct steps and justifications for conducting fsQCA in terms of using the right calibration, truth table algorithm, and analysis of necessary and sufficient conditions. Hence, this chapter suggest that fsQCA is suitable for tourism and hospitality marketing research where the causality is highly multifaceted, theories and models are underdeveloped; and exploratory and descriptive studies are indispensable.

Moreover, to obtain valid and reliable results, the reliability and validity of constructs should be assessed as these assessments are not included in fuzzy set approach. As discussed in this chapter, the calculation of score of constructs as the input for fsQCA analysis is one of the challenges of application of this technique. Majority of studies have calculated the score of constructs using sum scores and they normally underestimate the measurement errors. To solve this common issue for application of fsQCA and the previous challenge for assessment of measurement model, Rasoolimanesh et al. (2021) suggested the combination of partial least squares – structural equation modeling and fsQCA. Lastly, researchers should consider other techniques like structural equation modeling (SEM) before performing fsQCA to evaluate the measurement model.

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Appendix 1. Raw results for Sufficient Configurations for Residents' Perceptions

Configurations	Raw coverage	Unique coverage	Consistency
Configurations for Residents' Perception			
Residents' Perception = *f*(CAC, EAT, CAT, EG, INV)			
Conf 1: CAC*EAT*~EG	0.540	0.037	0.957
Conf 2: CAC*EAT*CAT	0.857	0.356	0.955
Conf 3: EAT*CAT*~EG*~INV	0.429	0.004	0.956
Conf 4: CAC*CAT*~EG*INV	0.208	0.002	0.981
solution coverage: 0.904			
solution consistency: 0.939			

Notes: *Raw coverage* indicate which share of the outcome is explained by a certain alternative path. *Unique coverage* indicates which share of the outcome is exclusively explained by a certain alternative path (Schneider & Wagemann, 2012).

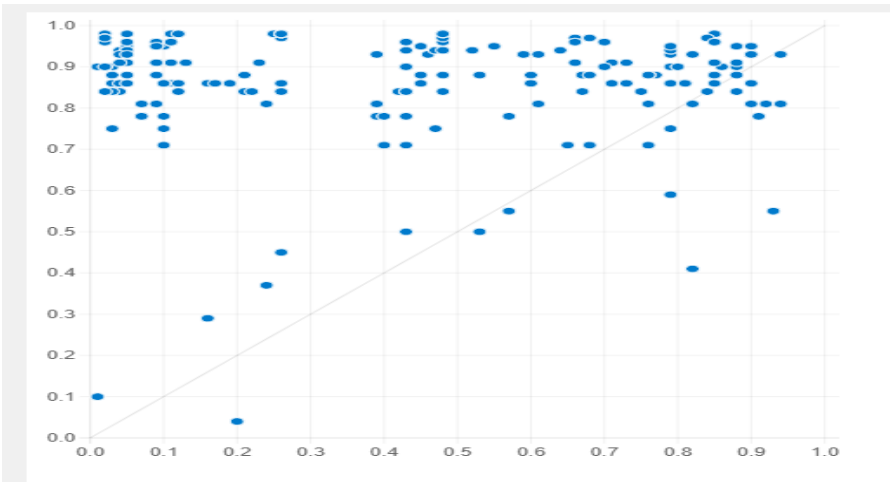
Appendix 2. Raw results for Sufficient Configurations for Residents' Perceptions

Configurations	Raw coverage	Unique coverage	Consistency
Configurations for Residents' Perception			
Residents' Perception = *f*(CAC, EAT, CAT, EG, INV)			
Conf 1: CAC*EAT*~EG	0.559	0.052	0.953
Conf 2: CAC*EAT*CAT	0.818	0.311	0.955
Conf 3: EAT*CAT*~EG*~INV	0.430	0.003	0.955
solution coverage: 0.874			
solution consistency: 0.940			

Notes: *Raw coverage* indicate which share of the outcome is explained by a certain alternative path. *Unique coverage* indicates which share of the outcome is exclusively explained by a certain alternative path (Schneider & Wagemann, 2012).

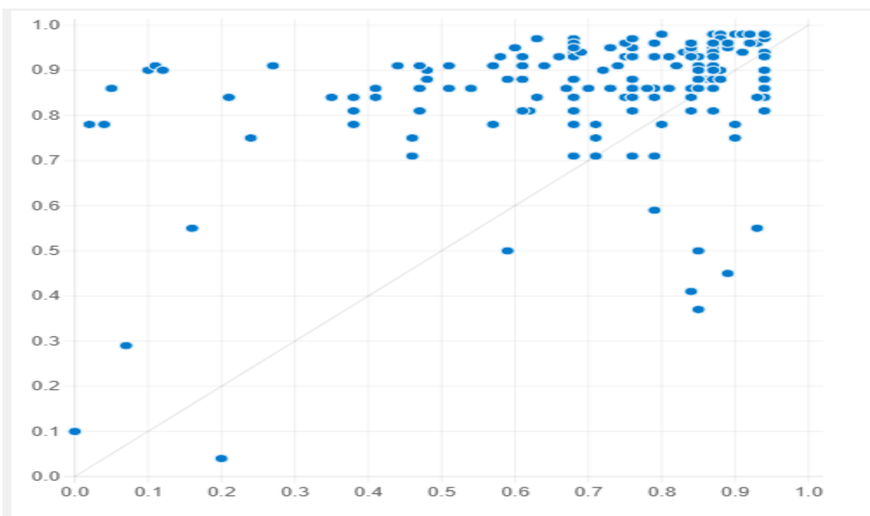
Appendix 3.

Figure 3.1. XY plot for Configuration 1 based on sub-sample 2



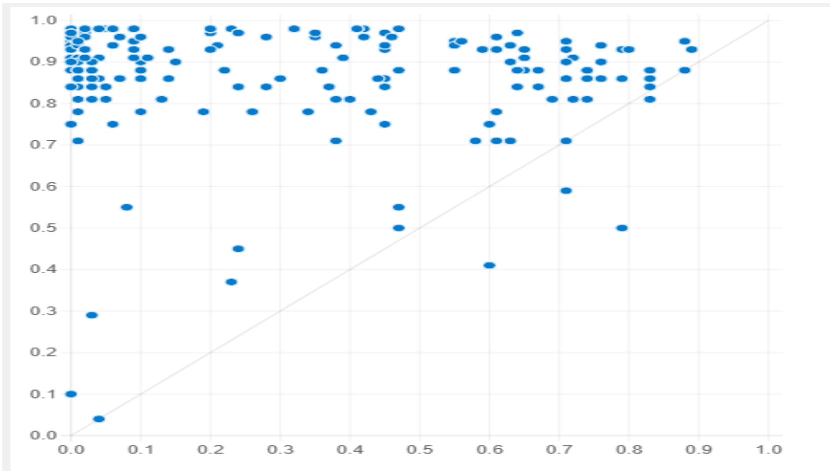
Consistency (0.977) and Coverage (0.468)

Figure 3.2. XY plot for Configuration 2 based on sub-sample 2



Consistency (0.974) and Coverage (0.819)

Figure 3.3. XY plot for Configuration 3 based on sub-sample 2



Consistency (0.989) and Coverage (0.330)