CONVERGING PERSPECTIVE OF ACCOMMODATION OPERATIONS & MANAGEMENT IN SMALL SIZED COMMERCIAL HOTELS IN INDIA: A FUZZY MULTIPLE CRITERIA DECISION MAKING APPROACH

Dr. Saroj Kanta Biswal,
Assistant Professor (Finance & Control)
Institute of Business & Computer Studies
Faculty of Management Studies
Siksha 'O' Anusandhan University
Bhubaneswar 751003, Odisha, India.

ABSTRACT

The three components of tourism, universally accepted are: attraction, accommodation and access. In the present study, one of the components - accommodation is being studied here, specifically the small-sized commercial hotels. Small-sized commercial hotels in city centers are poised to grow, nurture, slowly shaping themselves to be a class to reckon with. Not being in any star category they are big enough now to function in the lines of full service hotels providing all sorts of facilities in a compact manner like their big counterparts. The principal aim of the study is to present a fuzzy multi-criteria decision making model (FMCDM) for evaluating the determinants of hotel operation & management. The proposed approach comprises of two steps. In step 1, we identify the determinants of hotel operation & management. In step 2, those determinants are assigned fuzzy numbers and a fuzzy multi-criteria decision making method is used to overcome vaguely judgment in evaluation. The crisp survey results were collected via a forty five criteria questionnaire from three hundred and twenty hotels and computed using Best non-Fuzzy Performance and Degree of Similarity. Based on the concept of the defuzzification, the ranking of determinants is obtained. Degree of Similarity provides the level of agreeableness and its degrees for each criterion. The fuzzy approach provides not only intelligence but also allows such knowledge to be effectively captured in an enterprise-wide data warehouse. In addition, it helps managers to develop a group decision making model using fuzzy logic to establish customer preferences.

Key Words: Small-sized Commercial Hotels, Fuzzy Multi Criteria Decision Making Model (FMCDM), Best Non- Fuzzy Performance (BNP), Degree of Similarity, Defuzzification

1. Introduction

Looking at the basic premise, the fast changing market dynamics matched perfectly with Indian economy booming at an almost 10% average growth every year, a lot of business activities are expected. Most of these activities would require executives to travel more. Average Indian having more disposable income and venturing into tourist activities, coupled with foreign tourist influx, all these would result in higher increase in demand for the mid-range and economy hotels for these itinerant executives / tourists etc. on business call.

Now, they are being recognized as business class, compacted with basic facilities for the discerning business travelers, targeting a specific market segment of mid rank business executives and price sensitive corporate. This was a lack luster and dormant segment for a very long time. The inertia has given way to humming activities in their standard, style and professionalism etc. Budget /economy/ small hotels are being redefined with new concepts, innovations and strategies. Spectacular upward development can be experienced in the areas of infrastructure, accommodation, facility, food and beverage, atmosphere and professionalism exhibit a sea change in general.

2. Relevance of the Study

The new genre budget / small-sized commercial hotels in city centers are poised to grow, nurture, slowly shaping themselves to be a class to reckon with. (Florentino, 1995)[5], vividly supports the fact that the budget hotel product concept provides more value for money to the new value conscious travelers, because they represent an innovative product concept. They are now a cluster of hotels; recognised as business class, having a definite market segment, catering to the needs of mid rank business executives who are on the demand side. This segment forms the main business block. They are the repeat guests, their needs such as accommodation; conferences, meeting, convention etc. are the main stay of this operation. Ready to offer reasonably priced accommodation, offering world of facilities and

professionalism which most business executives / travelers in the above segment are on the lookout on a recurring basis.

To woo the potential guests, activities are in top gear. Successful models are getting replicated. Structural changes to existing operational properties are being done to redefine it. Many individual hotel properties are refining their product mix to come up with a winning model. Market survey of this class hotels indicates that they have been able add touches a glamour to an extent. The professional management and operations are still limited to those hotels which are being operated under the banner of established branded names. Still there is no scope or existence of professionalism in many units/multi units.

(Swig, 2000)[8] has explained candidly, how broadening the foundation of services and technology can strengthen the independent hotels. Regardless of above current trends, independent small and mid-scale hotels will continue to be a viable brand alternative. Changing customer demographics, evolving products with new environments and new technologies will add strength to this sector. The success of independent hotels depends on their ability to be distinctive in their market. They are more introspective in relation to their customers only. They seek to develop their service operation and link them to the specific consumer demand source. Use of new technology as a vehicle can lower the competitive barriers. Adequately trained staff can exploit their product more in the market and will offer more visibility, presence, marketing and distribution than others.

3. Statement of the Problem

"Converging Perspective of Accommodation Operations & Management in Small Sized Commercial Hotels in India". Managing such properties could be an extremely uphill task. Professional operations of these hotels cannot be said to be a smooth journey, because, expectations of the guests are liable to run high. Central to successful and profitable operations are right human resources.

A crystal clear need of professionally qualified managerial cadre as well as the staff team is essential. Barring few, many of these hotels face a dire shortage of trained and skilled human resource. However, this is all evasive, because staff shortage is a situation many hoteliers of all categories would admit to. Past has witnessed how this category of hotels were poles away in adopting hospitality management procedures and greater even as unwillingness of technically skilled personnel of hospitality industry to work here.

4. Objective of the Study

The principal aim of the study is to present a fuzzy multi-criteria decision making model (FMCDM) for evaluating the determinants of hotel operation & management. The proposed approach comprises of two stages.

- In stage 1, the objective is to find out the key determinants that affect the efficiency of hotel operations & management of small-sized commercial hotels.

- In stage 2, the objective is to determine the degree and level of importance of those factors in hotel operations & management those determinants are assigned fuzzy numbers and a fuzzy multi-criteria decision making method is used to overcome vaguely judgment in evaluation.

5. Research Methodology

5.1 Data Collection

5.1.1 Population:

Small-sized Commercial Hotels in India

5.1.2 Sampling Frame:

1. Metros (80) Delhi. Mumbai, Kolkata, Chennai
2. Cosmopolitan Cities (80) Hyderabad, Bangalore, Pune, Ahmedabad
3. State Capitals (80) Bhubaneswar, Ranchi, Bhopal, Raipur
4. Small Cities (80) Cuttack, Jamshedpur, Siliguri, Ludhiana

5.1.3 Sampling Unit:

Operational head of 20 small-sized commercial hotels from each city

5.1.4 Sampling Technique:

Proportionate Convenient (Random) sampling

Sample Size:

$N = \frac{Z^2.p.q}{e^2} = = 339.75$

The 'z' value represents the Z score from the standard normal distribution for the confidence level desired by the researcher. In our research, we have a 95% confidence level. Hence, our Z value is 1.96 and Z^2 is 3.8416. The 'p' is the frequency of occurrence of something expressed as a proportion. In our research, out of 3 hotels, 1 is small-sized commercial hotel. Hence, our 'p' value is 1/3 or 0.33. The 'q' is simply the frequency of non-occurrence of the same event, and is calculated as (1-p). In our research, the 'q' value is (1 – p) = 0.67. The 'e' is called tolerable error in estimating the variable in question. This can be decided only by the researcher for the study. In our research, we have a 95% confidence level. This means we can afford to have 5% error or e = 5% or .05, thus e^2 = 0.0025. Now, putting the values of Z^2, p, q and e in the above equation we get the sample size N = 339.75. But for our convenient and uniformity we have take the sample size of 320

5.2 Research Instrument

A structured questionnaire was developed to collect data on the variables in this study. The questionnaire forty five in number includes various items that are related to the characteristics of hotel operation & management in a five point rating scale. The items are refined and paraphrased in both wording and contextual application as appropriate to suite research purposes. A pilot study was conducted which administered to 50 respondents.

5.3 Statistical Analysis

In the first phase, the interdependence techniques used for the present research is Factor Analysis, which was used for examining variable interdependence. This is done via a forty five criteria questionnaire from three hundred and twenty hotels and the determinants of hotel operations and management is determined. Then in the second phase, the crisp survey

results collected via questionnaire is computed using Best non-Fuzzy Performance and Degree of Similarity. Based on the concept of the defuzzification, the ranking of determinants is obtained. Degree of Similarity provides the level of agreeableness and its degrees for each criterion. The fuzzy approach provides not only intelligence but also allows such knowledge to be effectively captured in an enterprise-wide data warehouse. For the above computation SPSS 19 and MATLAB is used.

6. Analysis and Discussion

6.1 Reliability Analysis

According to the table below, the Cronbach's alpha value for overall scale is equal to 0.898 and Cronbach's alpha based on standardized items is .901.

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.898	.901	45

The reliability coefficient for all 45 items is displayed as a simple Alpha, and a Standardized alpha. An Alpha score above 0.70 is generally taken to indicate a scale of high reliability, 0.5 to 0.70 is generally accepted as indicating a moderately reliable scale, while a figure below this generally indicates a scale of low reliability. Since our overall alpha coefficient (standardized) is 0.898 and alpha coefficient of each question is above 0.80, we may conclude that our questions are reliable enough to making the measurements correct and accurate.

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q1	95.55	357.985	.570	.639	.894
Q2	95.16	364.402	.377	.543	.896
Q3	95.21	350.421	.671	.653	.892
Q4	95.31	356.382	.563	.601	.893

Q5	94.93	350.503	.619	.649	.892
Q6	94.70	350.576	.491	.589	.894
Q7	95.19	352.824	.598	.587	.893
Q8	94.88	359.158	.448	.554	.895
Q9	94.62	346.125	.572	.630	.892
Q10	94.99	352.868	.564	.518	.893
Q11	95.41	355.516	.563	.591	.893
Q12	95.03	359.610	.388	.496	.895
Q13	94.90	366.075	.273	.425	.897
Q14	94.94	364.002	.376	.411	.896
Q15	95.03	356.516	.467	.524	.894
Q16	95.28	352.717	.584	.624	.893
Q17	95.22	354.454	.514	.650	.894
Q18	95.14	351.204	.621	.620	.892
Q19	94.73	346.892	.612	.669	.892
Q20	94.88	349.714	.601	.643	.892
Q21	94.89	358.825	.429	.511	.895
Q22	95.64	368.744	.303	.366	.896
Q23	95.67	366.603	.351	.464	.896
Q24	95.77	370.203	.244	.506	.897
Q25	95.78	369.038	.268	.455	.897
Q26	95.20	352.883	.614	.564	.892
Q27	94.83	358.546	.365	.428	.896
Q28	95.03	363.099	.376	.482	.896
Q29	94.59	351.408	.491	.542	.894
Q30	95.24	366.541	.292	.572	.896
Q31	95.33	365.195	.296	.520	.896
Q32	94.89	357.387	.393	.599	.895
Q33	94.48	365.128	.234	.477	.898
Q34	95.47	367.284	.303	.360	.896
Q35	94.51	388.376	-.311	.489	.905
Q36	93.92	390.376	-.307	.452	.907
Q37	95.04	368.331	.206	.387	.897
Q38	94.47	369.955	.111	.527	.899
Q39	95.00	372.762	.059	.334	.900
Q40	95.41	374.105	.048	.384	.899
Q41	95.11	356.424	.458	.588	.894
Q42	95.63	364.542	.411	.442	.895
Q43	94.68	350.984	.436	.530	.895
Q44	94.17	342.778	.600	.608	.892
Q45	95.18	360.145	.356	.444	.896

6.2 Factor Analysis

Factors Affecting the Efficiency of Hotel Operations

The primary data consisted of 320 replied questionnaires with 45 separate metric variables pertaining to operation of small-sized commercial hotel related factors. In this research, the perceptions of operation of small-sized commercial related factors on forty five attributes are examined to first understand if these perceptions can be grouped and secondly reduce the forty five variables to a smaller number.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.845
Bartlett's Test of Sphericity	Approx. Chi-Square	6520.778
	df	990
	Sig.	.000

Bartlett's Test of Sphericity lets us know if there is a relationship between the variables. If no relationship is found then there is no point proceeding with the factor analysis. Considering the data in this research, the correlations, when taken overall, are significant at the 0.0001 level (according to KMO and Bartlett's Test table) which is 6520.778. Since we have found $p<0.001$ we can conclude that there are relationships with our variables and it does makes sense to continue with the factor analysis.

By observing the above results we can see that it falls in the acceptable range of (above 0.5) with a value of 0.845. Therefore, we can proceed with our factor analysis.

In factor analysis we are looking for variability in one variable common to other variables, as this indicates that they are linked by an underlying factor.

Using our criterion of selecting eigen values over 1, we can see from the highlighted numbers in the Total Variance Explained table that twelve components (or factors) have been produced that have eigen values greater than 1 so we therefore have twelve factors which can explain a cumulative 65.39 percent of the variance in the data.

Total Variance Explained

Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.620	23.600	23.600	10.620	23.600	23.600	4.406	9.792	9.792
2	3.423	7.606	31.206	3.423	7.606	31.206	3.919	8.710	18.501
3	2.523	5.606	36.812	2.523	5.606	36.812	3.430	7.622	26.123
4	2.225	4.944	41.756	2.225	4.944	41.756	2.501	5.557	31.680
5	1.869	4.153	45.909	1.869	4.153	45.909	2.354	5.231	36.912
6	1.614	3.588	49.497	1.614	3.588	49.497	2.105	4.677	41.589
7	1.488	3.308	52.805	1.488	3.308	52.805	2.087	4.637	46.226
8	1.328	2.950	55.755	1.328	2.950	55.755	1.936	4.301	50.528
9	1.177	2.615	58.370	1.177	2.615	58.370	1.854	4.119	54.647
10	1.110	2.467	60.838	1.110	2.467	60.838	1.840	4.088	58.735
11	1.046	2.324	63.161	1.046	2.324	63.161	1.518	3.373	62.108
12	1.003	2.230	65.391	1.003	2.230	65.391	1.477	3.283	65.391
13	.985	2.189	67.580						
14	.893	1.983	69.563						
15	.837	1.860	71.424						
16	.821	1.823	73.247						
17	.763	1.696	74.943						
18	.749	1.664	76.606						

19	.683	1.518	78.125						
20	.663	1.472	79.597						
21	.630	1.400	80.997						
22	.591	1.313	82.310						
23	.576	1.281	83.590						
24	.554	1.231	84.821						
25	.530	1.178	85.999						
26	.523	1.163	87.162						
27	.494	1.097	88.259						
28	.471	1.046	89.305						
29	.426	.948	90.253						
30	.391	.870	91.122						
31	.387	.860	91.982						
32	.364	.810	92.792						
33	.339	.754	93.545						
34	.330	.734	94.279						
35	.326	.724	95.003						
36	.295	.655	95.658						
37	.286	.635	96.293						
38	.256	.570	96.863						
39	.246	.547	97.410						
40	.233	.518	97.928						
41	.218	.484	98.412						
42	.207	.460	98.872						
43	.188	.418	99.290						
44	.173	.385	99.675						
45	.146	.325	100.000						

Extraction Method: Principal Component Analysis.

Rotated Component Matrix[a]												
	Component											
	1	2	3	4	5	6	7	8	9	10	11	12
Q1	**.682**											
Q2	**.635**											
Q3	**.662**											
Q4	**.583**											
Q5	**.602**											
Q6									**.567**			
Q7	**.556**											
Q8	**.593**											
Q9		**.523**										
Q10		**.514**										
Q11	**.470**											
Q12					**.537**							
Q13	**.537**											
Q14												**.635**
Q15						**.446**						
Q16		**.657**										
Q17		**.712**										
Q18		**.638**										
Q19		**.593**										
Q20			**.530**									
Q21						**.651**						
Q22				**.649**								
Q23				**.604**								
Q24				**.838**								
Q25				**.591**								

Q26		**.381**									
Q27									**.770**		
Q28										**.687**		
Q29			**.556**								
Q30										**.709**		
Q31					**.792**						
Q32					**.766**						
Q33											**.606**
Q34										**-.369**	
Q35							**-.730**				
Q36							**-.707**				
Q37						**.751**					
Q38			**.574**								
Q39										**-.757**	
Q40								**.740**			
Q41								**.560**			
Q42								**.528**			
Q43			**.737**								
Q44			**.614**								
Q45										**.425**	

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 18 iterations.

Factor	Variables
1	technology adoption
2	employee training
3	employee morale

4	experience of the employee
5	maintenance of hotels
6	accessibility of hotels
7	promotional aspects
8	hotel tariffs
9	legal aspects
10	service quality
11	the taxation policy by the government
12	socio-political change in hotel operation

6.3 Fuzzy Multiple Criteria Decision Making

Step 1: **Setting a triangular fuzzy number**

Based on responses from questionnaire, first of all we assign triangular fuzzy number to the linguistic scale as given below
Chang and Yeh, (2002)[4], (Bademar & Gottwald, 1995 p. 56)[2]

No.	Linguistic Scale	Score	TFN
1	Strongly Disagree	1	(1, 1, 2)
2	Disagree	2	(1, 2, 3)
3	Undecided	3	(2, 3, 4)
4	Agree	4	(3, 4, 5)
5	Strongly Agree	5	(4, 5, 5)

Step 2: Computation of Aggregate Fuzzy Weight

Hassall (1999)[6]

Let W_i^1 represents the Triplet Fuzzy Number (TFN) assigned by the 1st respondent to the decision element C*i*, W_i^2 represents the Triplet Fuzzy Number (TFN) assigned by the 2nd respondent to the decision element C*i*, W_i^3 represents the Triplet Fuzzy Number (TFN) assigned by the 3rd respondent to the decision element C*i* and so on up to W_i^k which represents the Triplet Fuzzy Number (TFN) assigned by the k^{th} respondent to the decision element C*i*. If there are *n* numbers of decision elements, and *k* numbers of respondents, we can generalize the function as W_i^j . Where, *i* is the

decision element i = 1, 2, 3… n (In our case n = 45) j number of respondents j = 1, 2, 3, …, k (In our case k = 320)

Let W_{1k} represents aggregate fuzzy weights vector representing the fuzzy importance weights of decision element C_1 perceived by k respondents, W_{2k} represents aggregate fuzzy weights vector representing the fuzzy importance weights of decision element C_2 perceived by k respondents and so on. Then, W_{ij} represents aggregate fuzzy weights vector representing the fuzzy importance weights of decision elements C_i (i = 1, 2, 3… n) perceived by R_j (j = 1, 2, 3… k) number of respondents.

The TFN score or the aggregate fuzzy weight for given decision element C is given by:

$$W_{ij} = (L_{ij}, M_{ij}, U_{ij}) \quad (1)$$

If W_{ik} represents the aggregate fuzzy weight of i^{th} criteria given by k number of respondents, the aggregate fuzzy weights W_{ik} is given by the following equation:

$$W_{ik} = \frac{1}{k} \otimes (w_i^1 \oplus w_i^2 \oplus w_i^3 ..... \oplus w_i^k) \quad (2)$$

$$W_{ik} = (L_{ik}, M_{ik}, U_{ik}) \quad (3)$$

$\otimes$ Represents fuzzy multiplication

$\oplus$ Represents fuzzy addition

Decision Elements (C_i) i = 1, 2, 3… n	**Respondents (R_j) j = 1, 2, 3, …, k**							**Aggregate Fuzzy Weights (W_{ij})**
	1	**2**	**3**	**4**	**---**	**---**	**k**	
1	W_1^1	W_1^2	W_1^3	W_1^4	---	---	W_1^k	$W_{1k} = (L_{1k}, M_{1k}, U_{1k})$
2	W_2^1	W_2^2	W_2^3	W_2^4	---	---	W_2^k	$W_{2k} = (L_{2k}, M_{2k}, U_{2k})$
3	W_3^1	W_3^2	W_3^3	W_3^4	---	---	W_3^k	$W_{3k} = (L_{3k}, M_{3k}, U_{3k})$

4	W_4^1	W_4^2	W_4^3	W_4^4	---	---	W_4^k	$W_{4k} = (L_{4k}, M_{4k}, U_{4k})$
---	---	---	---	---	---	---	---	---
---	---	---	---	---	---	---	---	---
n	W_n^1	W_n^2	W_n^3	W_n^4	---	---	W_n^k	$W_{nk} = (L_{nk}, M_{nk}, U_{nk})$

In our study, it is observed that for the decision element C_1 under aspect C^1 represented by C^1_1 (The hotel should be equipped with up to date instruments) given by 320 (k = 320) respondents, following table shows the decisions of the respondents.

As we know that $W_{11} = (L_{11}, M_{11}, U_{11})$, hence it is calculated as follows:

Hence, the aggregate fuzzy weight or the TFN score of decision element C_{11} given by 320 respondents is given by (15.22, 19.55, 21.47).

Step 3: Defuzzification

Defuzzification is a technique to convert the fuzzy number into crisp real numbers; the procedure of defuzzification is to locate the Best Non-fuzzy Performance (BNP) value. In other words, defuzzification is a technique to convert the fuzzy number into crisp real numbers. This helps in ranking the decision criteria according to their importance. The procedure of defuzzification is locating the Best Non-fuzzy Performance (BNP) value. In this paper, the formula to get the Best Non-fuzzy Performance that is defined as:

$$BNP_{ij} = \frac{1}{3}[(U_{ij} - L_{ij}) + (M_{ij} - L_{ij})] + L_{ij} \quad (4)$$

(i = 1, 2, 3… n & j = 1, 2, 3… k)

As we have calculated the aggregate fuzzy weight of decision element C_{11} given by 320 respondents [$W_{11} = (L_{11}, M_{11}, U_{11})$] as (15.22, 19.55, 21.47). This implies L_{11} = [15.22], M_{11} = [19.55] and U_{11} = [21.47]

Hence, the BNP value for decision element C_{11} is calculated as:

$$BNP_{11} = \frac{1}{3}[(U_{11} - L_{11}) + (M_{11} - L_{11})] + L_{11} \quad = 18.75$$

Sl. No.	Aspects (C^p) (p = 1, 2, …12)	Decision Elements (C^p_i)	Aggregate Fuzzy Weights (W_{ij})	Defuzzification (BNP_{ij})	Rank
1	C^1	C^1_1	(15.22, 19.55, 21.47)	18.75	6
2		C^1_2	(12.26, 16.19, 19.18)	15.88	19
3		C^1_3	(12.98, 16.96, 19.20)	16.38	15
4		C^1_4	(13.51, 17.60, 19.83)	16.98	11
5		C^1_5	(11.29, 14.99, 17.40)	14.56	26
6		C^1_6	(12.88, 16.83, 19.14)	16.29	17
7		C^1_7	(10.75, 14.39, 17.29)	14.14	32
8		C^1_8	(14.36, 18.55, 18.55)	17.79	8
9		C^1_9	(10.78, 14.45, 17.55)	14.26	31
10	C^2	C^2_1	(10.07, 13.37, 15.48)	12.97	37
11		C^2_2	(11.66, 15.41, 17.88)	14.98	25
12		C^2_3	(13.59, 17.64, 19.70)	16.98	11
13		C^2_4	(13.23, 17.22, 19.25)	16.56	12
14		C^2_5	(12.60, 16.50, 18.78)	15.96	18
15		C^2_6	(10.46, 13.92, 16.14)	13.51	35
16		C^2_7	(12.93, 16.90, 19.20)	16.34	16
17	C^3	C^3_1	(11.15, 14.77, 17.20)	14.37	28
18		C^3_2	(9.74, 13.04, 15.35)	12.71	38
19		C^3_3	(8.77, 11.95, 14.65)	11.79	41
20		C^3_4	(10.71, 14.05, 15.94)	13.56	34
21		C^3_5	(7.99, 10.79, 12.67)	10.49	42

22	C^4	C^4_1	(15.61, 20.05, 22.05)	19.24	4
23		C^4_2	(15.95, 20.42, 22.15)	19.51	3
24		C^4_3	(16.60, 21.16, 22.69)	20.15	2
25		C^4_4	(16.75, 21.32, 22.72)	20.26	1
26	C^5	C^5_1	(11.91, 15.72, 17.95)	15.19	22
27		C^5_2	(13.73, 17.83, 20.09)	17.22	10
28		C^5_3	(11.34, 14.96, 17.32)	14.54	27
29	C^6	C^6_1	(11.95, 15.75, 18.01)	15.24	21
30		C^6_2	(10.93, 14.57, 17.41)	14.30	30
31		C^6_3	(11.64, 15.46, 18.37)	15.15	23
32	C^7	C^7_1	(8.85, 12.12, 14.71)	11.89	39
33		C^7_2	(6.66, 9.11, 11.38)	9.05	43
34	C^8	C^8_1	(14.07, 18.26, 20.72)	17.68	9
35		C^8_2	(12.51, 16.38, 18.55)	15.81	20
36		C^8_3	(15.63, 20.05, 21.88)	19.18	5
37	C^9	C^9_1	(10.48, 13.86, 16.07)	13.47	36
38		C^9_2	(10.96, 14.53, 16.83)	14.11	33
39	C^{10}	C^{10}_1	(11.58, 15.38, 18.31)	15.09	7
40		C^{10}_2	(12.90, 16.91, 19.76)	16.52	13
41		C^{10}_3	(14.44, 18.70, 21.02)	18.05	7
42	C^{11}	C^{11}_1	(11.69, 15.44, 18.13)	15.09	7
43		C^{11}_2	(13.08, 17.02, 19.09)	16.39	14
44	C^{12}	C^{12}_1	(10.84, 14.56, 17.69)	14.36	29
45		C^{12}_2	(8.73, 11.93, 14.73)	11.80	40

Step 4: Value of Membership Functions

Membership Functions for Linguistic Variables

No.	Linguistic Scale	1	2	3	4	5
1	Strongly Disagree	1	0.75	0.5	0	0
2	Disagree	0.5	1	0.75	0.25	0
3	Undecided	0	0.5	1	0.5	0
4	Agree	0	0.25	0.75	1	0.5
5	Strongly Agree	0	0	0.5	0.75	1

The overall value of membership functions for the decision elements (C^p_i), where i = 1, 2, 3…45 and p = 1, 2, 3…12, is computed by the help of the following formula:

$$\mu_x(x) = \sum_{j=1}^{k} \mu_{x_j} \quad (5)$$

To find out the overall value of membership functions first of all we need to calculate the membership value of the total respondents for a given decision element (μ_{xj}).

$$\mu_{x_j} = \sum_{j=1}^{k} V_j \otimes M_s \quad (6)$$

Where, V_j is the value of weights and M_s is the membership functions for linguistic variable of scores (s = 1, 2, 3…5) of each respondents.

$$V_j = \frac{U_j}{\sum_{j=1}^{k} U_j} \quad (7)$$

Where U_j is weight of each score and it is given as:

$$U_j = \sum_{j=1}^{k} S_j \quad (8)$$

The overall value of membership functions of all the 45 decision elements (C^1_1 to C^{12}_2) for all the 320 respondents is represented as follows:

Sl. No.	Aspects (C^p) (p = 1, 2, …12)	Decision Elements (C^p_i)	The overall value of membership functions for the decision elements μ_x (x)				
1	C^1	C^1_1	0.00719	0.12563	0.61862	0.83411	0.75557
2		C^1_2	0.01345	0.22943	0.71163	0.87263	0.56329
3		C^1_3	0.02109	0.19629	0.66875	0.7998	0.64141
4		C^1_4	0.01372	0.18197	0.66311	0.81021	0.66006
5		C^1_5	0.03523	0.25545	0.70889	0.7651	0.54698
6		C^1_6	0.01962	0.19643	0.67347	0.80867	0.63344
7		C^1_7	0.03146	0.28019	0.73937	0.81463	0.4898
8		C^1_8	0.01634	0.15342	0.63113	0.80368	0.7214
9		C^1_9	0.02959	0.28212	0.74345	0.84827	0.48352
10	C^2	C^2_1	0.08433	0.28896	0.68515	0.71792	0.54537
11		C^2_2	0.03386	0.24216	0.69818	0.79273	0.56978
12		C^2_3	0.02224	0.17331	0.64571	0.80426	0.68635
13		C^2_4	0.03115	0.18867	0.64603	0.7903	0.67679
14		C^2_5	0.02464	0.20707	0.67607	0.79491	0.62321
15		C^2_6	0.06200	0.28056	0.70151	0.72498	0.53499
16		C^2_7	0.01955	0.1984	0.67318	0.80473	0.63409
17	C^3	C^3_1	0.04248	0.25637	0.70348	0.77443	0.55055
18		C^3_2	0.08303	0.31019	0.70434	0.72809	0.5083
19		C^3_3	0.08038	0.35622	0.75502	0.74019	0.40957
20		C^3_4	0.08461	0.25248	0.65392	0.72435	0.60756
21		C^3_5	0.15158	0.37421	0.68947	0.61737	0.46947
22	C^4	C^4_1	0.00141	0.12113	0.61901	0.84789	0.76056
23		C^4_2	0.00350	0.10892	0.6042	0.82745	0.78811
24		C^4_3	0.00137	0.09110	0.58904	0.82158	0.82055
25		C^4_4	0.00342	0.08561	0.581	0.81254	0.83459

26	C^5	C^5_1	0.03023	0.23407	0.6924	0.75735	0.58497
27		C^5_2	0.01363	0.17335	0.65632	0.82627	0.67373
28		C^5_3	0.04237	0.24195	0.69364	0.77903	0.57034
29	C^6	C^6_1	0.02776	0.23	0.69388	0.76449	0.58449
30		C^6_2	0.03986	0.27354	0.72137	0.8257	0.51739
31		C^6_3	0.02692	0.25184	0.71452	0.85012	0.54405
32	C^7	C^7_1	0.09082	0.37157	0.74172	0.71712	0.42573
33		C^7_2	0.16244	0.41849	0.74827	0.63882	0.34101
34	C^8	C^8_1	0.00817	0.16642	0.65639	0.86293	0.67905
35		C^8_2	0.02882	0.20877	0.67214	0.77922	0.6269
36		C^8_3	0.00636	0.11979	0.61025	0.83004	0.77314
37	C^9	C^9_1	0.06804	0.26791	0.68935	0.74396	0.55327
38		C^9_2	0.04996	0.26163	0.69897	0.75258	0.55211
39	C^{10}	C^{10}_1	0.01959	0.25143	0.72571	0.84163	0.52898
40		C^{10}_2	0.01162	0.20333	0.69055	0.88071	0.60728
41		C^{10}_3	0.00586	0.15623	0.64799	0.85183	0.69817
42	C^{11}	C^{11}_1	0.03045	0.2393	0.70288	0.82942	0.56379
43		C^{11}_2	0.02907	0.18696	0.65161	0.79379	0.66771
44	C^{12}	C^{12}_1	0.0201	0.28224	0.75461	0.84129	0.47069
45		C^{12}_2	0.0734	0.35867	0.76644	0.74619	0.39371

Step 5: Degree of Similarity

Degree of similarity helps the researchers in obtaining the level and degree satisfaction or importance or agreeableness as in our study. Turksen and Willson (1994), proposed a formula for calculating degree of similarity which involved the calculation of Euclidean distance between fuzzy sets given as:

$$Sim(\mu_x, M_x) = \frac{1}{1+\sqrt{\sum_{j=1}^{5}(\mu_{x_j} - M_{s_j})^2}} \qquad (9)$$

Where, μ_x represents the overall value of five membership functions (j = 1, 2, 3…5) and M_x represents the membership functions of five linguistic variables (j = 1, 2, 3…5) for the 45 decision element (C^1_1 to C^{12}_2) for all the 320 respondents.

As we know that the degree of similarity is a measure of degree of agreeableness to a particular statement, hence, The degree of similarity between the overall values of five membership functions and the membership functions of five linguistic variables for the numerical results of the degree of agreeableness of decision element C^1_1 with respect to five rating scales is given as follows:

Strongly Disagree: $Sim\ (\mu_1, M_1)$ = 0.38026
Disagree: $Sim\ (\mu_1, M_2)$ = 0.41812
Undecided: $Sim\ (\mu_1, M_3)$ = 0.50404
Agree: $Sim\ (\mu_1, M_4)$ = 0.73832
Strongly Agree: $Sim\ (\mu_1, M_5)$ = 0.76279

These ordinal results of five rating scales, then were brought to the conclusive measurement at $Sim\ (\mu_x, Ms)_{max}$ = 0.76279.

This implies that the consensus for 320 respondents is 'strongly agree' in rating the level of agreeableness for decision element C^1_1 with 0.76279 degree of agreeableness. The evaluation procedures for other criteria and customers are executed with the similar fashion.

Decision Elements (C^p_i)	Degree of Agreeableness $Sim\ (\mu_x, Ms)_{max}$	Level of Agreeableness
C^1_1	0.76279	Strongly Agree

C^1_2	0.87006	Agree
C^1_3	0.79077	Agree
C^1_4	0.78614	Agree
C^1_5	0.80279	Agree
C^1_6	0.79870	Agree
C^1_7	0.83963	Agree
C^1_8	0.74985	Agree
C^1_9	0.86290	Agree
C^2_1	0.76491	Agree
C^2_2	0.81471	Agree
C^2_3	0.76894	Agree
C^2_4	0.76847	Agree
C^2_5	0.79665	Agree
C^2_6	0.77531	Agree
C^2_7	0.79677	Agree
C^3_1	0.80666	Agree
C^3_2	0.77263	Agree
C^3_3	0.76588	Agree
C^3_4	0.75619	Agree
C^3_5	0.69676	Agree
C^4_1	0.76369	Strongly Agree
C^4_2	0.78657	Strongly Agree
C^4_3	0.81207	Strongly Agree
C^4_4	0.82471	Strongly Agree
C^5_1	0.79009	Agree
C^5_2	0.78479	Agree
C^5_3	0.80482	Agree
C^6_1	0.79447	Agree
C^6_2	0.84500	Agree

C^6_3	0.86025	Agree
C^7_1	0.75211	Agree
C^7_2	0.68549	Agree
C^8_1	0.79479	Agree
C^8_2	0.78678	Agree
C^8_3	0.77487	Strongly Agree
C^9_1	0.78276	Agree
C^9_2	0.79177	Agree
C^{10}_1	0.85910	Agree
C^{10}_2	0.84909	Agree
C^{10}_3	0.77903	Agree
C^{11}_1	0.83973	Agree
C^{11}_2	0.77411	Agree
C^{12}_1	0.85773	Agree
C^{12}_2	0.76613	Agree

In summary, the degree of agreeableness and the level of agreeableness according to all 45 criteria are presented in the following table.

Sl. No.	Decision Elements or Criteria (C^p_i)		Degree of Agreeableness	Level of Agreeableness
1	C^1_1	The hotel should be equipped with up-to-date instruments.	0.76279	Strongly Agree
2	C^1_2	Reservation and guest record keeping should be automated.	0.87006	Agree
3	C^1_3	For cash handling and accounting adequate software should be installed.	0.79077	Agree
4	C^1_4	Guest information like arrival and departure should	0.78614	Agree

		be automated.		
5	C^1_5	There should be provision of hotel booking through internet.	0.80279	Agree
6	C^1_6	Housekeeping and room service should be fully automated.	0.79870	Agree
7	C^1_7	There should be provision for currency conversion.	0.83963	Agree
8	C^1_8	The hotel should have fully automated grievance handling cell.	0.74985	Agree
9	C^1_9	The hotels should have EFT facilities.	0.86290	Agree
10	C^2_1	All the employees should be computer savvy.	0.76491	Agree
11	C^2_2	The employees should be professionally trained.	0.81471	Agree
12	C^2_3	Trained employee positively affects the overall functioning of the hotel.	0.76894	Agree
13	C^2_4	Specialized persons are required for specialized services.	0.76847	Agree
14	C^2_5	Employees handling cash should be well trained in accounting packages.	0.79665	Agree
15	C^2_6	Regular training should be provided to all the employees.	0.77531	Agree
16	C^2_7	The employees need to work in different hotels to get more knowledge on hotel operation and management.	0.79677	Agree
17	C^3_1	A team of highly motivated employee eases the hotel operation and its management.	0.80666	Agree
18	C^3_2	Employees should be given incentives to work for long hours.	0.77263	Agree
19	C^3_3	In spare time employees should be allowed for recreation to recharge themselves.	0.76588	Agree
20	C^3_4	In regular time interval, the employees should be allowed to be with their families.	0.75619	Agree

21	C^3_5	Highly satisfied staff give hundred percent to its work.	0.69676	Agree
22	C^4_1	Employees with rich experience are essential for any hotel.	0.76369	Strongly Agree
23	C^4_2	Prior knowledge in handling office automation eases hotel operation.	0.78657	Strongly Agree
24	C^4_3	Fair knowledge of customer relationship management do wonders in hotel operation.	0.81207	Strongly Agree
25	C^4_4	Experience people in food & beverage section are very essential.	0.82471	Strongly Agree
26	C^5_1	The hotel's physical facilities should be visually appealing.	0.79009	Agree
27	C^5_2	The staffs needed to be well dressed and appear neat.	0.78479	Agree
28	C^5_3	The physical facilities including the food and beverages should be excellent.	0.80482	Agree
29	C^6_1	Best place for a hotel is to be situated near bus stand, railway station or taxi stand.	0.79447	Agree
30	C^6_2	The hotel should be nearby to tourists destinations.	0.84500	Agree
31	C^6_3	The employees' should reside nearer to the hotel.	0.86025	Agree
32	C^7_1	The people should be well aware of the hotel and its facilities in order to manage the hotel.	0.75211	Agree
33	C^7_2	The hotel should promote its facilities as well as its various offers adequately.	0.68549	Agree
34	C^8_1	Pricing or tariff of hotel is a major reason of smooth operation of hotel.	0.79479	Agree
35	C^8_2	Discount offers on tariff attract more tourists to the hotel.	0.78678	Agree
36	C^8_3	The hotels spends less on promotion in order to make-up any deficiency in finance because of	0.77487	Strongly Agree

		discounts and other related facilities.		
37	C^{9}_{1}	Over emphasis on environmental issues and legal implications there after severely affects the hotel operation.	0.78276	Agree
38	C^{9}_{2}	Unexpected crack down on hotels sometimes create a negative impact on the customers' mind.	0.79177	Agree
39	C^{10}_{1}	Prompt service is a must for any efficient and effective hotel operation.	0.85910	Agree
40	C^{10}_{2}	Providing individual attention to the guests smoothen the hotel operation and management.	0.84909	Agree
41	C^{10}_{3}	There should not be any fixed operating hours in the hotel for the guests in an effectively managed hotel.	0.77903	Agree
42	C^{11}_{1}	The service tax imposed by government creates financial burden on the hotel which sometimes ceases or postpones its innovations.	0.83973	Agree
43	C^{11}_{2}	Entertainment tax or such types, creates bottleneck in holding back the tourists for more days and entertaining the guests more.	0.77411	Agree
44	C^{12}_{1}	Life-style of tourists influences the way the hotel operates.	0.85773	Agree
45	C^{12}_{2}	Changing attitude toward life directly affects the taste of tourists thus the entire hotel operation.	0.76613	Agree

The overall value of membership functions of all the 45 decision elements (C^{1}_{1} to C^{12}_{2}) for all the 320 respondents is represented as follows:

$$\mu(C_p) = \frac{1}{l}\left(\sum_{k=1}^{l} \mu_x(x)_k \right) \qquad (10)$$

Where l is number of criteria in each aspect

Sl. No.	Aspects (C^p) (p = 1, 2, …12)	The overall value of membership functions for the Aspects $\mu(C^p)$				
1	C^1	0.020854	0.211214	0.684269	0.817456	0.610608
2	C^2	0.039681	0.22559	0.675119	0.77569	0.610083
3	C^3	0.088416	0.309894	0.701246	0.716886	0.50909
4	C^4	0.002425	0.10169	0.598313	0.827365	0.800953
5	C^5	0.028743	0.216457	0.680787	0.78755	0.60968
6	C^6	0.031513	0.251793	0.709923	0.813437	0.548643
7	C^7	0.12663	0.39503	0.744995	0.67797	0.38337
8	C^8	0.01445	0.164993	0.64626	0.824063	0.69303
9	C^9	0.059	0.26477	0.69416	0.74827	0.55269
10	C^{10}	0.012357	0.203663	0.688083	0.858057	0.611477
11	C^{11}	0.02976	0.21313	0.677245	0.811605	0.61575
12	C^{12}	0.04675	0.320455	0.760525	0.79374	0.4322

Aspects (C^p)	Degree of Similarity Sim (μ_x, M_x)					Degree of Agreeableness *Sim* (C^p, Ms) $_{max}$	Level of Agreeableness
	Strongly Disagree *Sim* (C^p, M_1)	Disagree *Sim* (C^p, M_2)	Undecided *Sim* (C^p, M_3)	Agree *Sim* (C^p, M_4)	Strongly Agree *Sim* (C^p M_5)		
C^1	0.39612	0.44536	0.55229	0.81458	0.67342	0.81458	Agree
C^2	0.40260	0.45235	0.55738	0.79053	0.67312	0.79053	Agree
C^3	0.42448	0.48526	0.60136	0.76533	0.61666	0.76533	Agree
C^4	0.37613	0.41108	0.49170	0.71090	0.79608	0.79608	Strongly Agree
C^5	0.39986	0.44937	0.55604	0.79821	0.67392	0.79821	Agree
C^6	0.40309	0.45810	0.57507	0.83373	0.64007	0.83373	Agree
C^7	0.44501	0.52244	0.65776	0.71791	0.55996	0.71791	Agree
C^8	0.38770	0.43025	0.52435	0.77282	0.72181	0.77282	Agree
C^9	0.41277	0.46803	0.58115	0.78733	0.64185	0.78733	Agree
C^{10}	0.39132	0.44003	0.54672	0.83560	0.67136	0.83560	Agree
C^{11}	0.39742	0.44623	0.55108	0.80805	0.67626	0.80805	Agree
C^{12}	0.41556	0.48256	0.62343	0.81087	0.58650	0.81087	Agree

The degree of agreeableness & the level of agreeableness with variance explained according to all 12 components (criteria) are presented in the following table.

Aspects (C^p)		Initial Eigen values % of Variance	Degree of Agreeableness $Sim\ (C^p, Ms)_{max}$	Level of Agreeableness
C^1	technology adoption	23.600	0.81458	Agree
C^2	employee training	7.606	0.79053	Agree
C^3	employee morale	5.606	0.76533	Agree
C^4	experience of the employee	4.944	0.79608	Strongly Agree
C^5	maintenance of hotels	4.153	0.79821	Agree
C^6	accessibility of hotels	3.588	0.83373	Agree
C^7	promotional aspects	3.308	0.71791	Agree
C^8	hotel tariffs	2.950	0.77282	Agree
C^9	legal aspects	2.615	0.78733	Agree
C^{10}	service quality	2.467	0.83560	Agree
C^{11}	the taxation policy by the government	2.324	0.80805	Agree
C^{12}	socio-political change in hotel operation	2.230	0.81087	Agree

From the above table we may conclude that out of the twelve factors, degree of agreeableness is above 80% in five factors, i.e. technology, accessibility, service quality, taxation policy and socio-political changes. This implies, the hotel personnel should give due importance to these

factors. Again, though training is the second major contributor towards hotel operation but its degree of importance is less than 80%.

7. Limitations of the Study

The research work suffers from unavailability and paucity of data regarding, any such work done in this area as well as willingness of hospitality management professionals in developing such applications procedures. The study is generalization of the issues existing in the small sized commercial hotel segment where a great change of perception is taking place. The study has aimed at focusing on core functioning of the accommodation operations and management only. The data collected for interpretation, analysis relating to presence of small sized commercial hotels during different time intervals may be found wanting in accuracy.

8. Scope for further Research

Any research work can explore and make application of other disciplines in a limited way. In the current study, there are many aspects which need to be researched further. The present study provides considerable scope for further research and development. There is plenty of scope for further work in making the present applications into network based applications so that other can remain connected through their set of applications on terminals as users. Night auditing, an important work carried out every day as daily balancing could be taken into this ambit in network. Further study will throw light in developing applications to check and audit the accounting related work of above mentioned departments. The present study can be applicable on other types of hotels besides the small sized commercial hotels as well. There can also be comparable study among the hotels among cities in the countries.

9. Conclusion

The study and practices of hospitality operations and management has been interdisciplinary. But recently, in small sized commercial hotel segment, the negative connotation is giving way to a perception of affordability, efficiency and good experience. Sale of accommodation is prime product. Hence it is prudent for the hotel operations to match with the need. So it is to say that situation is ripe for study of other disciplines

specifically ever increasingly computer and information technology by self developed applications implementation as the other studies. This convergence, as studied here, provides sufficient ground to remain ahead, work within cost constraints still providing unmatched independence in doing the needed work professionally and provide better grip over the situation resulting in more hospitable environment. It should be noted note that suitably qualified hospitality management professionals and trained people should take up positions in these hotels. Amidst such conditions, the situation provides ample of scope for development of simple application software suiting the department need for doing the routine, repetitive paperwork of monotony into easy to use operations procedures. During the process of working, the precious time saved can be entirely used for the fulfillment of guest service. The pleasantness and goodness of front office remains maintained, giving human qualities in possession a full opportunity.

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