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Combining utility and regret approach with information entropy in assessing retailing potential of Indian States

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Abstract

Retailing has emerged as one of the most potent and fast paced industry; especially after the economic reforms of 1991 and more so post retail reforms in 2011 that relaxed FDI norms allowing multi brand and single brand store entry smoother in our country than before. India is now on the radar of the global retailers as an investment destination. The Indian retail market is a classical example where both conventional (unorganized) retailing co-exists with the organized retail and the former still having lion's share of the market. Every Indian state is vying to attract retail investment in their states by creating attractive and conducive international business environment. It is this context that the researcher feels the need of evaluating Indian states in terms of their retailing potential. This work stands unique and considers 15 criterions that influence retailing. Thus, ranking alternatives, here Indian states on their retailing potential, against a set of 15 mutually conflicting criterions, create a perfect environment of multi criteria decision making (MCDM). The present study uses VIKOR as it poses to be one of the most important MCDM approaches that incorporateutility and regret factor in its model. The relative importance of the criterions was derived from information entropy of Shannon and finally integrated in VIKOR rank estimation.

Key Words

Retailing Potential, MCDM, VIKOR, Shannon's Weight

A. Introduction

Retailing is probably the only industry with whom every human being has some connection or the other. This industry has undergone tremendous transformation since its inception and today it is regarded as the world's largest private industry, ahead even of finance and engineering. Over 50 of the fortune 500 and about 25 of the Asian Top 200 companies are organized retailers. In some of the countries like the US, UK, France, Germany the organized retailing accounts for more than 80 percent of the total retail business. Even countries in East and South East Asia like Japan, Malaysia, Thailand and Indonesia are in the race with the western world and have 66%, 55%, 40% and 30% organized retail contribution to their total retail sales respectively (Planet Retail Database, 2006).The scenario of Indian retail is however distinctly different from most of the countries across the globe. Retailing in India is probably the oldest industry and enjoys the status of being considered as one of the pillars of its economy with about 10% contribution to India's GDP and about 8% of total employment (IBEF, 2017). India has not only the largest numbers of retail outlets but also the highest retail density in the world and unorganized retailers dominate the Indian retail industry with 90% contribution (Industry, IBEF 2016).

The retailing story in India took a new dimension post the economic reforms of 1991 whence India came under the radar of international retailers. Since then, Indian Retail is undergoing a paradigm shift from traditional forms of retailing into a modern and organized sector. Shopping in India has witnessed a revolution with the change in the consumer buying behavior and the whole format of shopping also altering.The growth in retailing can be attributed to a host of factors that include rise in the young working population including that of women, more nuclear families in urban areas, more disposable income and customer aspiration, increasing consumer base in urban areas, easy accessibility and convenience, retailer friendly Government policies,potentially strong rural consumer market, western influences and growth in expenditure for luxury items to name a few. Other key aspects driving the sector's growth is favourable population demographics (50% of the population is less than 27 years) and rapid urbanization.Viability of any retail organization depends on the spending structure of population and their frequency of purchase. The spending pattern of Indian consumers presents a great paradox to today's marketers and retailers when it comes

to investment. The author aims to reduce such investment paradox in Indian scenario by ranking Indian states in terms of their retailing or organized retailing potential under a set of multiple conflicting criterions and in the process the relative importance of the conflicting criterions was also evaluated. VIKOR, an MCDM approach, which yields compromise ranking solution, was usedfor this purpose and the multiple criterions set was defined by 15 variables.

B. Review of Literature

Retailing, more precisely organized retailing, is a relatively newer concept in India and studies related to it are less compared to any established and older management disciplines. Researches on Indian retailing have been found to be conducted by both individuals and institutions. Considerable literature was reviewed, however not all could be captured in this section. Study on India's retailing potential***(AIII, 2005)***highlightsthat retail sector in India is still an untapped market and foreign entry is likely to be gradual with foreign partners permitted to have their stake in the venture. The research also highlights that one of the major attraction is that India has an ingrained shopping culture. Report on Retail growth in India***(KPMG, 2005)*** predictsorganized retail sector to grow stronger than GDP growth in the next five years and will be driven by changing lifestyles, strong income growth and favourable demographic patterns. The study creates expectation of retail growth in double-digits if infrastructure allows the consumer companies to reach new markets at reasonable costs. Another study on organized retail expansion ***(MCI-GOI, 2007)*** describesretailing as the sunrise sector and highlights escalating real estate cost, scarcity of skilled workforce and structured supply of merchandise as the challenge areas for retail growth. A very interesting study ***(NCAER & Future Group, 2008)***indicates that the ratio of spending to earning is higher in Tier II towns such as Nagpur, Jaipur, Surat and Coimbatore than it is in the metros. An earlier study ***(NCAER, 2004)*** had shown a higher percentage of the rich in rural India (Middle India) than in some metros. This study bolsters the case for the rise of Middle India. Study on 51 districts in India***(RK Swamy BBDO, 2008)***showsall towns with a population of more than 500,000have twice the market potential of the four metros (Mumbai, Delhi, Chennai and Kolkata) combined, indicating real retailing potential in tier II & tier III cities of India. The study on Retail realty in India: evolution and potential ***(Jones Lang LaSalle, 2014)*** highlights important indicators influencing retailing potential that includes

demographics, income and expenditure, expenditure, population, infrastructure, awareness & communication, consumerism, living conditions and government support. Analysis of retail opportunities in 21st century ***(Venketesh, 2013)***highlights amendments in FDI policy of India as the most important factor to draw international retailers in our country. Potential of organized retail in India ***(Agarwal, 2012)*** examines the relative importance of various products purchased at organized retail outlets and the expected format development. Emerging opportunities and challenges in Indian retail sector***(Singh, 2014)*** was analyzed in view of policy changes by Government of India. ***(Kahraman et al., 2003)***used fuzzy group decision making for facility location selection. TOPSIS and fuzzy condition was applied for transshipment site selection***(Onut and Sonner, 2008)***. ***(Kargi, 2016)*** applied Fuzzy TOPSIS method for supplier selection to select supplier for a textile company while ***(Dashore, 2013)*** used Entropy and MCDM methods for products evaluation. Studies on retailing potential comparison in Indian states was not found and the same was identified as the gap area by the author to conduct further studies. Also, criterions considered for comparing includes % of households having electricity and having pucca dwelling structure, overall literacy rate, households having owned occupancy, unemployment rate, road and railway network, cold storage capacity, telecommunication density, number of air ports in the state, stamp duty in the state, rural godown capacity, per capita net state domestic product, population density, number of graduates and post graduates.

C. Research Objectives

Based on the research gap the author framed two objectives.

1. Ranking Indian states on their retailing potential and finding if the solution is unique.
2. Evaluating the relative importance of criterions considered.

D. Research Methodology

VIKOR and Shannon's Entropy are used in the ensuing study to find solutions to the objectives framed. VIKOR, as a multi criteria decision making (MCDM)method focuses on ranking from a set of alternatives, and determines the compromise solution obtained with the initial weights for a problem with conflicting criteria. Assuming that each alternative is computed according to each criteria function, the compromise ranking is performed through comparing the measure of closeness to the ideal alternative. VIKOR is a compromise

decision making method which not only considers maximum group utility but also considers minimum individual regret and developed from the Lp – metric used as an aggregating function in a compromise programming method.

$$\boldsymbol{L_{pi}} = \{\sum_{i=1}^{n}\left[\frac{(a_j^* - a_{ij})}{(a_j^* - a_j^-)}\right]^p\}^{1/p};\ 1 \le p \le \infty and i = 1,2,\dots,m$$

The compromise ranking algorithm of VIKOR consists of the following steps:

I. Establishing the decision matrix for ranking.

	C_1	C_2	C_3	.....	C_n
A_1	x_{11}	x_{12}	x_{13}	.....	x_{1n}
A_2	x_{21}	x_{22}	x_{23}	.....	x_{2n}
A_3	x_{22}	x_{32}	x_{33}	.....	x_{3n}
⋮	⋮	⋮	⋮	⋮	⋮
A_i	x_{i1}	x_{i2}	x_{i3}	.....	x_{in}

where i 1, 2, … m and represents Alternatives; j 1, 2, … n and represents Criteria

II. Establishing Normalised performance matrix,

$$\boldsymbol{f_{ij}} = \frac{x_{ij}}{\sqrt{x_{ij}^2}}$$ where i 1, 2, … m and j 1, 2, … n

III. Determining the Best and Worst Values of all Criteria Functions; j = 1, 2, …, n

$$\boldsymbol{f_j^* = \max_i(f_{ij} | j \in I)} \text{ OR } \boldsymbol{f_j^* = \min_i(f_{ij} | j \in J)};$$

$$\boldsymbol{f_j^- = \min_i(f_{ij} | j \in I)} \text{ OR } \boldsymbol{f_j^- = \max_i(f_{ij} | j \in J)};$$

where **I**is associated with benefit criteria and **J** is associated with cost criteria

IV. Computation of Utility Measure and Regret Measure.

The Utility Measure $(\boldsymbol{S_i})$is given by $\boldsymbol{S_i} = \sum_{j=1}^{n} \boldsymbol{w_j}\frac{(f_j^* - f_{ij})}{(f_j^* - f_j^-)}$ and

The Regret Measure $(\boldsymbol{R_i})$is given by $\boldsymbol{R_i} = \max_j \boldsymbol{w_j}\frac{(f_j^* - f_{ij})}{(f_j^* - f_j^-)}$;

where w_j are the criteria weights expressing their relative importance

V. Computation of VIKOR Index $\boldsymbol{Q_i}$

$$\boldsymbol{Q_i} = \boldsymbol{v}\frac{(\boldsymbol{S_i} - \boldsymbol{S^*})}{(\boldsymbol{S^-} - \boldsymbol{S^*})} + (\boldsymbol{1} - \boldsymbol{v})\frac{(\boldsymbol{R_i} - \boldsymbol{R^*})}{(\boldsymbol{R^-} - \boldsymbol{R^*})}$$

where $S^* = \min_i S_i\ and S^- = \max_i S_i$

$$R^* = \min_i R_i\ and R^- = \max_i R_i$$

$$and v = weight of the decision making strategy\ (max.grouputility)$$

VI. Ranking the alternatives. It is done by sorting the values of S, R & Q in decreasing order. The results are the three ranking lists.

VII. Proposing a compromise solution, alternative A', which is ranked by Min. Q value if the following two conditions are satisfied:

(i) C1 : Acceptable Advantage: Q(A'') - Q(A') ≥ DQ where DQ = 1 / (m-1); m= no. of alternatives and A' & A'': alternatives with 1st and 2nd ranking position in the ranking list by Q-values respectively.

(ii) C2: The alternative must also be best ranked by S or/and R. This compromise solution is stable within a decision making process which could be

'voting by majority rule' when $\boldsymbol{v}$> 0.5 is needed

'by consensus' when $\boldsymbol{v}$ = 0.5 is needed

'with veto' when $\boldsymbol{v}$< 0.5 is needed

If both C1 & c2 are satisfied then the yield is most acceptable; a single optimal solution. If one of the conditions C1 & C2 are not satisfied then a set of compromise solution is proposed which consists of:

- Alternative A' & A'' if only C2 is not satisfied or
- Alternatives *A', A'', ...* $A^{(M)}$ if C1 is not satisfied. $A^{(M)}$ is determined by the relation $Q\left(A^{(M)}\right) - Q(A') < DQ$ for maximum M.

D1. Importance of Criterions

In typical MCDM environment, weights of attributes reflect the relative importance in decision making process. Shannon's entropy concept (Shannon & Weaver, 1947), also known as information entropy, is well suited for weight evaluation. It is a measure of uncertainty in information formulated in terms of probability theory. The procedure of Shannon's Weight determination involves a series of sequential steps as described below.

Step i. Normalization of the data matrix as $\boldsymbol{p_{ij}} = \frac{x_{ij}}{\sum_{j=1}^{m} x_{ij}}$, j = 1, 2, ….., m &i = 1,2,…., n

Raw data normalizing is done to eliminate the anomalies of disparate units of measurement so as allow comparison on a similar platform.

Step ii. Entropy $\mathbf{E_i}$ is calculated as $\boldsymbol{E_i} = -\boldsymbol{h_0} \sum_{j=1}^{m} \boldsymbol{p_{ij}} . \ln \boldsymbol{p_{ij}}$

i.e. $\boldsymbol{E_i} = -\boldsymbol{h_0} \sum_{j=1}^{m} \frac{x_{ij}}{\sum_{j=1}^{m} x_{ij}} \ln \frac{x_{ij}}{\sum_{j=1}^{m} x_{ij}}$, i = 1,2, …,n and

$\boldsymbol{h_0}$is the entropy constant and is defined as $\boldsymbol{h_0} = (\ln \boldsymbol{m})^{-1}$

Step iii. Defining $\boldsymbol{d_i}$as $\boldsymbol{d_i} = \boldsymbol{1} - \boldsymbol{E_i}$ and

Step iv. Defining Shannon's Entropy Weight $\boldsymbol{W_i}$ as $\boldsymbol{W_i} = \frac{\boldsymbol{d_i}}{\sum_{1=1}^{n} \boldsymbol{d_i}}$

The author used R 3.4.0 versionprogramming language and software environment for all computations made in the present study.

E. Findings & Analysis

Initially 20 variables were identified and their correlations evaluated. For variables with high correlation valuesamongst them, the author felt the need for testing of multi collinearity; a situation in which two or more explanatory variables is highly related linearly and contain almost the same information about the dependent variable. Multicollinearity was tested using VIF (variance inflation factor). Variables having VIF> 10 were identified and dropped from the study. After dropping 5 such variables, Corplot was extracted once again [Fig 1] and VIF outputsuggested absence of multicollinearity sinceits valuesfor all the 15 retained variables were found to be< 10 (Fig 2).

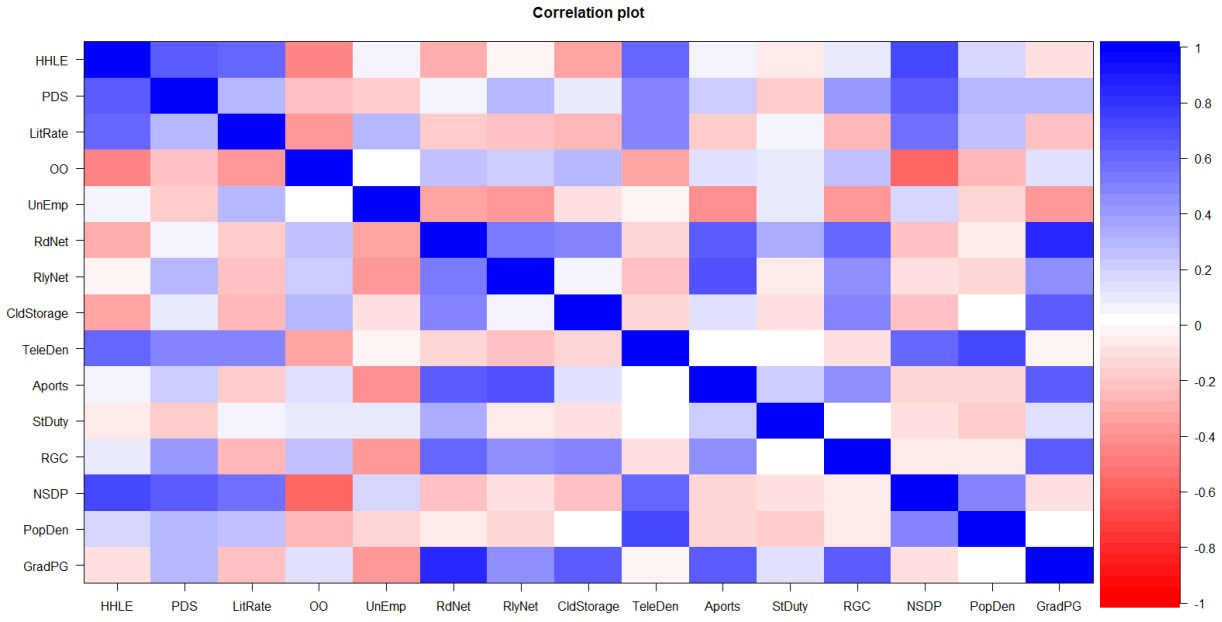

Fig 1: Correlation Plot; *Source* - R output from Secondary Data

[Notations used in study - HHLE: % of households having electricity, **PDS:** % of households having pucca dwelling structure, **LitRate:** Overall State literacy rate, **OO:** Households having Owned Occupancy (in '000), **UnEmp:** Unemployment rate (per '000), **RdNet:** Road Network (in km), **RlyNet:** Railway Network (in km), **CldStorage:** Cold Storage capacity (MT), **TeleDen:** Telecommunication density, **Aports:** No. of Air ports in the state, **StDuty:** Stamp duty in the state (in %), **RGC:** Rural Godown Capacity, **NSDP:** Per capita Net State Domestic Product, **PopDen:** Population Density, **GradPG:** No. of Graduates & Post Graduates**]**

vif(data)

HHLE	PDS	LitRate	OO	UnEmp	RdNet	RlyNet	CldStorage
7.21	4.40	2.77	1.94	1.81	8.15	3.65	6.01

TeleDen	Aports	StDuty	RGC	NSDP	PopDen	GradPG
6.02	3.89	1.80	3.28	4.41	4.79	9.00

Fig 2: VIF Table; *Source* - R output from Secondary Data

Fig 3 below presents the performance table. The actual data of the 15 variables (criterions) for all the alternatives is captured in the form of a matrix known as decision matrix or performance matrix / table. It is to be noted that many criterions have varying or different units and before making any further multi criteria decision making analysis, the effect of such disparate units need to be eliminated and the same was done by performing statistical normalization. The normalized performance table is shown in Fig 4.Subsequent calculations (Shannon's weight, group utility, individual regret and VIKOR index)were done with normalized data.

Performance & Normalized Performance Tables

STATES	HHLE	PDS	LitRate	OO	UnEmp	RdNet	RlyNet	CldStorage	TeleDen	Aports	StDuty	RGC	NSDP	PopDen	GradPG
AP	92.2	77.1	67.02	78.47	39	179022	3703.25	1782561	89.03	5	5	69.264	72301	303	2796965
ARP	65.7	33.9	65.38	68.32	89	25362	11.67	6000	85.6	1	6	0.22	76370	17	44466
ASM	37	27	72.19	87.92	61	326512	2442.57	157906	62.38	3	6	15.85	38945	397	500787
BIH	16.4	48.3	61.8	96.79	60	206010	3730.57	1415595	56.91	3	6	17.16	26948	1102	1309800
CHA	75.3	39.4	70.28	90.2	19	97534	1212.91	484087	62.49	1	7.5	35.54	53815	189	397779
DEL	99.1	94.7	86.21	68.21	36	32067	183.23	129857	236.38	1	5	4.49	185421	11297	701156
GOA	96.9	86	88.7	78.95	96	14624	69.31	7705	101.7	1	7	0.37	200514	394	61640
GUJ	90.4	75.7	78.03	83.92	9	182287	5258.49	2901807	104.05	7	3.5	47.84	93046	308	1415546
HAR	90.5	94.8	75.55	88.36	47	46287	1710.49	749830	84.08	1	5	99.5	119833	573	757974
HP	96.8	80.6	82.8	87.2	106	55593	296.26	131017	185.42	3	8	2.57	83899	123	202217
J & K	85.1	68.3	67.16	96.72	72	39096	298.19	112516	84.47	3	5	1.61	52386	57	264350
JH	45.8	43	66.41	89.28	77	42705	2394.46	236680	56.91	4	6	2.09	40238	414	327729
KAR	90.6	63.5	75.36	74.25	15	321808	3281.36	560178	106.29	5	7	60.37	77168	319	1783902
KER	94.4	80.3	94	90.68	125	194854	1045.36	80405	107.81	3	7	12.86	91567	859	706353
MP	67.1	56.9	69.32	90.87	43	288931	5000	1263665	62.49	6	8	121.89	43426	236	1166426
MAHA	83.9	78.9	82.34	81.12	21	608140	5745.48	978392	101.7	6	7	102.57	103856	365	3564610
MAN	68.3	17	79.21	93.69	57	24247	1.35	5500	85.6	1	6	0.54	37656	122	123456
MEGH	60.9	51.4	74.43	81.97	48	13372	8.76	8200	85.6	1	6	0.86	54156	132	64226
MIZ	84.2	67.1	91.33	66.06	30	9831	1.5	4001	85.6	1	6	0.39	63413	52	29846
NAG	81.6	55.2	79.55	73.75	85	37176	11.13	7350	85.6	1	6	0.5	70274	119	56346
ORI	43	40.3	72.87	90.34	50	283692	2572.16	540141	74.83	3	7	24.42	49227	269	768591
PUN	96.6	93.4	75.84	88.87	60	105368	2269.27	2155704	114.28	3	5	138.62	84512	550	628638
RAJ	67	73.8	66.11	93.22	71	248156	5893.1	555278	86.11	4	8	47.69	60844	201	1499267
SIK	92.5	62.5	81.42	64.84	181	7450	1	2100	84.72	1	6	0.1	151395	86	18815
TN	93.4	73.5	80.09	74.55	42	261100	4027.08	337625	120.6	8	8	38.98	98628	555	2384481
TRI	68.4	19.2	87.22	91.81	197	37384	192.54	45477	85.6	1	6	1.02	57402	350	63850
UP	36.8	67.8	67.68	94.7	74	415383	339.8	14176062	68.2	2	6	104.63	33482	828	3883292
UT	87	93.9	79.63	82.87	70	62945	9077.45	160419	68.2	2	4	28.56	92566	189	337806
WB	54.5	50.3	76.26	89.28	49	295997	4135.19	5947561	84.72	4	6	32.6	60318	1029	1318457

Fig 3: Performance Table; *Source* - Secondary Data

STATES	HHLE	PDS	LitRate	OO	UnEmp	RdNet	RlyNet	CldStorage	TeleDen	Aports	StDuty	RGC	NSDP	PopDen	GradPG
AP	0.2206	0.2158	0.1621	0.1723	0.0916	0.1559	0.2125	0.1107	0.1644	0.2617	0.1479	0.2383	0.1514	0.0262	0.3709
ARP	0.1572	0.0949	0.1581	0.1500	0.2090	0.0221	0.0007	0.0004	0.1581	0.0523	0.1775	0.0008	0.1599	0.0015	0.0059
ASM	0.0885	0.0756	0.1746	0.1931	0.1432	0.2844	0.1401	0.0098	0.1152	0.1570	0.1775	0.0545	0.0815	0.0343	0.0664
BIH	0.0392	0.1352	0.1494	0.2126	0.1409	0.1794	0.2140	0.0879	0.1051	0.1570	0.1775	0.0590	0.0564	0.0953	0.1737
CHA	0.1801	0.1103	0.1699	0.1981	0.0446	0.0849	0.0696	0.0301	0.1154	0.0523	0.2219	0.1223	0.1127	0.0164	0.0527
DEL	0.2371	0.2651	0.2085	0.1498	0.0845	0.0279	0.0105	0.0081	0.4365	0.0523	0.1479	0.0155	0.3883	0.9774	0.0930
GOA	0.2318	0.2407	0.2145	0.1734	0.2254	0.0127	0.0040	0.0005	0.1878	0.0523	0.2071	0.0013	0.4199	0.0341	0.0082
GUJ	0.2163	0.2119	0.1887	0.1843	0.0211	0.1588	0.3017	0.1803	0.1921	0.3664	0.1035	0.1646	0.1948	0.0266	0.1877
HAR	0.2165	0.2653	0.1827	0.1940	0.1104	0.0403	0.0981	0.0466	0.1553	0.0523	0.1479	0.3424	0.2509	0.0496	0.1005
HP	0.2316	0.2256	0.2002	0.1915	0.2489	0.0484	0.0170	0.0081	0.3424	0.1570	0.2367	0.0088	0.1757	0.0106	0.0268
J & K	0.2036	0.1912	0.1624	0.2124	0.1691	0.0341	0.0171	0.0070	0.1560	0.1570	0.1479	0.0055	0.1097	0.0049	0.0351
JH	0.1096	0.1204	0.1606	0.1961	0.1808	0.0372	0.1374	0.0147	0.1051	0.2094	0.1775	0.0072	0.0843	0.0358	0.0435
KAR	0.2168	0.1777	0.1822	0.1631	0.0352	0.2803	0.1883	0.0348	0.1963	0.2617	0.2071	0.2077	0.1616	0.0276	0.2366
KER	0.2258	0.2248	0.2273	0.1991	0.2935	0.1697	0.0600	0.0050	0.1991	0.1570	0.2071	0.0443	0.1917	0.0743	0.0937
MP	0.1605	0.1593	0.1676	0.1996	0.1010	0.2516	0.2869	0.0785	0.1154	0.3141	0.2367	0.4194	0.0909	0.0204	0.1547
MAHA	0.2007	0.2208	0.1991	0.1781	0.0493	0.5297	0.3296	0.0608	0.1878	0.3141	0.2071	0.3530	0.2175	0.0316	0.4727
MAN	0.1634	0.0476	0.1915	0.2058	0.1339	0.0211	0.0001	0.0003	0.1581	0.0523	0.1775	0.0019	0.0789	0.0106	0.0164
MEGH	0.1457	0.1439	0.1800	0.1800	0.1127	0.0116	0.0005	0.0005	0.1581	0.0523	0.1775	0.0030	0.1134	0.0114	0.0085
MIZ	0.2014	0.1878	0.2209	0.1451	0.0704	0.0086	0.0001	0.0002	0.1581	0.0523	0.1775	0.0013	0.1328	0.0045	0.0040
NAG	0.1952	0.1545	0.1924	0.1620	0.1996	0.0324	0.0006	0.0005	0.1581	0.0523	0.1775	0.0017	0.1472	0.0103	0.0075
ORI	0.1029	0.1128	0.1762	0.1984	0.1174	0.2471	0.1476	0.0336	0.1382	0.1570	0.2071	0.0840	0.1031	0.0233	0.1019
PUN	0.2311	0.2614	0.1834	0.1952	0.1409	0.0918	0.1302	0.1339	0.2110	0.1570	0.1479	0.4770	0.1770	0.0476	0.0834
RAJ	0.1603	0.2066	0.1599	0.2047	0.1667	0.2161	0.3381	0.0345	0.1590	0.2094	0.2367	0.1641	0.1274	0.0174	0.1988
SIK	0.2213	0.1749	0.1969	0.1424	0.4250	0.0065	0.0001	0.0001	0.1564	0.0523	0.1775	0.0003	0.3170	0.0074	0.0025
TN	0.2235	0.2057	0.1937	0.1637	0.0986	0.2274	0.2310	0.0210	0.2227	0.4187	0.2367	0.1341	0.2065	0.0480	0.3162
TRI	0.1636	0.0537	0.2109	0.2016	0.4626	0.0326	0.0110	0.0028	0.1581	0.0523	0.1775	0.0035	0.1202	0.0303	0.0085
UP	0.0880	0.1898	0.1637	0.2080	0.1738	0.3618	0.0195	0.8806	0.1259	0.1047	0.1775	0.3600	0.0701	0.0716	0.5149
UT	0.2081	0.2628	0.1926	0.1820	0.1644	0.0548	0.5208	0.0100	0.1259	0.1047	0.1183	0.0983	0.1938	0.0164	0.0448
WB	0.1304	0.1408	0.1844	0.1961	0.1151	0.2578	0.2372	0.3695	0.1564	0.2094	0.1775	0.1122	0.1263	0.0890	0.1748

Fig 4: Normalized Performance Table; *Source*–R Output from Secondary Data

Criterion	Shannon's Wt.
HHLE	0.90
PDS	1.27
LitRate	0.10
OO	0.11
UnEmp	3.37
RdNet	8.06
RlyNet	10.60
CldStorage	22.93
TeleDen	1.13
Aports	4.05
StDuty	0.32
RGC	12.40
NSDP	2.24
PopDen	22.52
GradPG	10.01

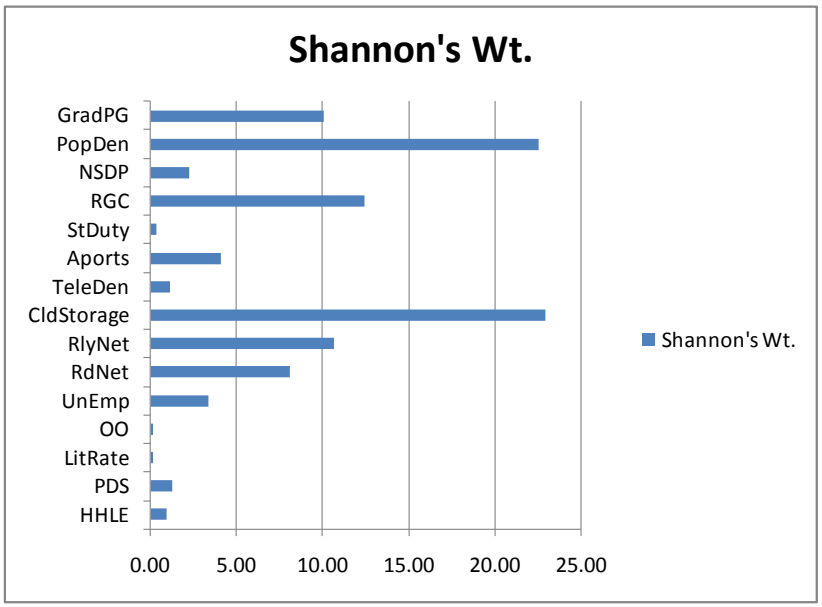

Fig 5: Shannon's Weight Table; *Source* - R output from Secondary Data

Shannon's weights also known as entropy weight have been evaluated for 15 variables included in the study and the same is shown in Fig 5. These weights indicate the relative importance of the parameters in a multi criteria environment influencing retailing. The weights vary from as low as 0.1% to 22.93%. Cold storage capacity and population density are the two most important parameters accounting for more than 45% of the overall criteria importance. Logistics support in the form of road and railway network contribute to almost 19% while rural godown/ warehousing capacity and educated portion of the population have relative importance levels at 12.4% and 10% respectively. These 6 variables account for about 86% of the total importance.

VIKOR OUTPUT				
STATES	S	R	Q	Rank
AP	0.4519	0.2005	0.6561	6
ARP	0.6284	0.2292	0.8734	24
ASM	0.5887	0.2268	0.8348	16
BIH	0.5920	0.2064	0.7852	11
CHA	0.5777	0.2215	0.8123	14
DEL	0.7840	0.2272	0.9947	29
GOA	0.6094	0.2292	0.8579	19
GUJ	0.4849	0.1824	0.6364	5
HAR	0.5098	0.2172	0.7461	9
HP	0.5950	0.2272	0.8411	17
J & K	0.6011	0.2275	0.8468	18
JH	0.6359	0.2255	0.8699	23
KAR	0.4798	0.2203	0.7296	8
KER	0.5847	0.2280	0.8348	15
MP	0.4625	0.2089	0.6863	7

VIKOR OUTPUT				
STATES	S	R	Q	Rank
MAHA	0.3703	0.2135	0.6233	3
MAN	0.6286	0.2292	0.8736	25
MEGH	0.6235	0.2292	0.8694	22
MIZ	0.6142	0.2293	0.8620	20
NAG	0.6225	0.2292	0.8685	21
ORI	0.5663	0.2206	0.8008	13
PUN	0.4464	0.1945	0.6362	4
RAJ	0.5571	0.2204	0.7926	12
SIK	0.6318	0.2293	0.8763	26
TN	0.4910	0.2239	0.7480	10
TRI	0.6560	0.2286	0.8942	27
UP	0.1687	0.0347	0.0000	1
UT	0.6725	0.2267	0.9028	28
WB	0.4774	0.1331	0.5037	2

Fig 6:VIKOR Output; *Source* - R output from Secondary Data

VIKOR output (Fig 6) shows the total utility (S), individual regret (R) and the VIKOR Index (Q). Three ranking lists (S, R & Q) have emerged. The best alternative is ranked by Min. Q–value and the overall state ranking is ascertained from the Q-values, shown separately in Figs. 8(A) and 8(B). Minimum Q-value indicatesstate with highest retailing potential and vice-versa. Fig 7 depicts scatter plot matrix of VIKOR output where the alternatives, S, R and Q divides the matrix into upper and lower triangular matrix.The upper triangle scatter plots are mirror images of the lower triangle.The lower triangular matrix yield interesting observations. B21 is an individual scatter plot of alternatives and the group utility factor "S", with B31 showing an individual scatter plot of alternatives and the individual regret "R" while B41 shows an individual scatter plot of alternatives and the VIKOR index "Q". B51 shows the overall alternative (here Indian State) ranking while B52,B53 & B54 shows individual rank scatter plots with respect to "S", "R" and "Q" values respectively. To ascertain whether the best alternative is unique and represents single optimal solution, further analysis was done. DQ which is 1/(m-1) = 1/28 = 0.0357.Q2) – Q(1) = 0.50 > 0.0357 (DQ). Thus, the first criterion (C1) of VIKOR is satisfied. Also, the first alternative is best ranked by both S (0.1687) & R (0.0317) thereby meeting the second VIKOR criteria (C2). Since both the VIKOR criterions, C1 & C2 are satisfied by the first alternative, one may conclude that a single optimal solutionexists i.e. UP, the state with highest retailing potential, is the single optimal solution.

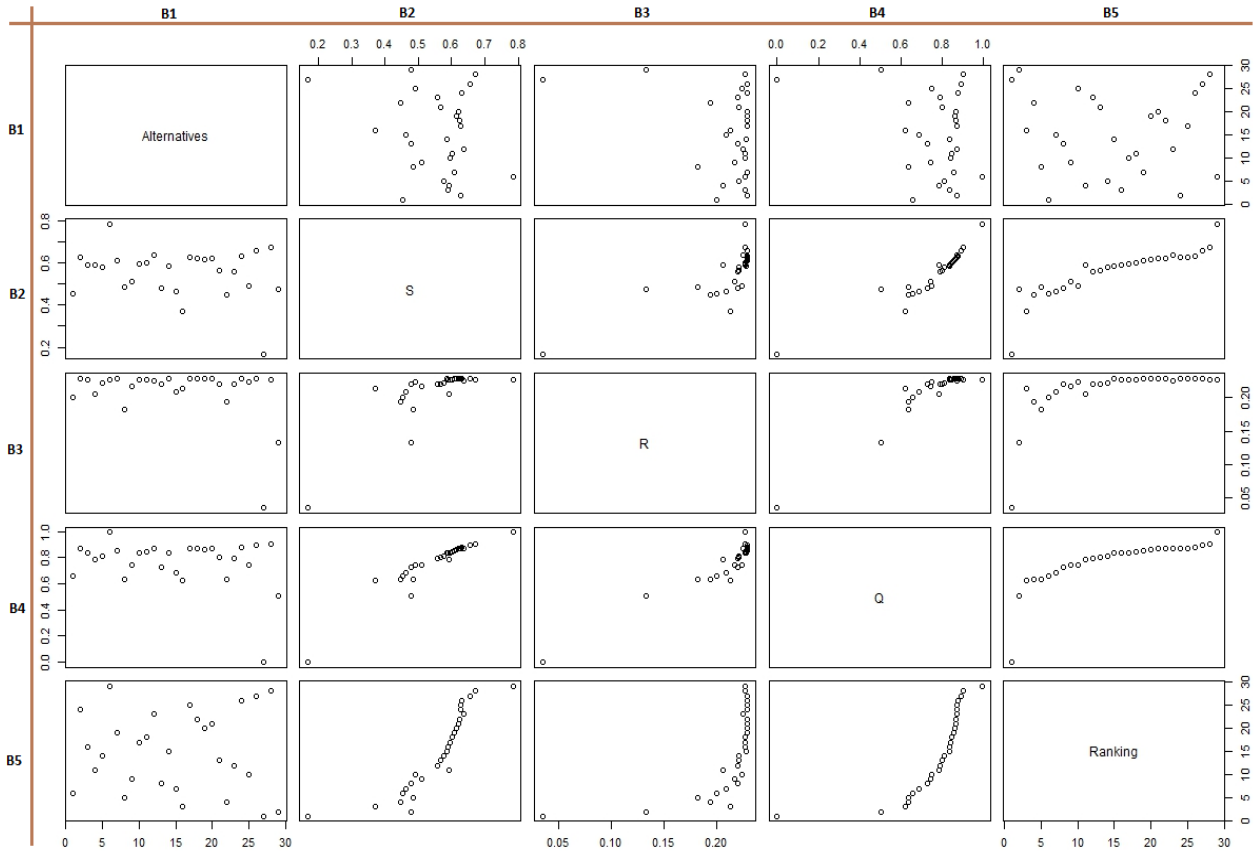

Fig 7: VIKOR Scatter Plot Matrix(S, R & Q);*Source* - R output from Secondary Data

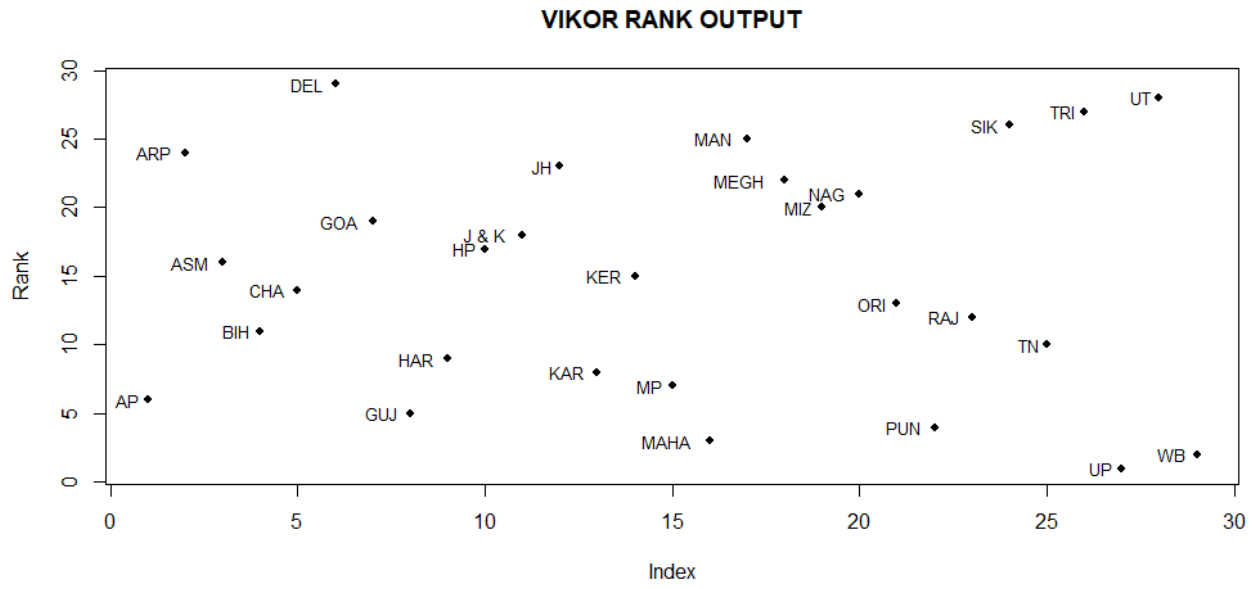

Fig 8A: VIKOR Output (Rank); *Source* - R output from Secondary Data

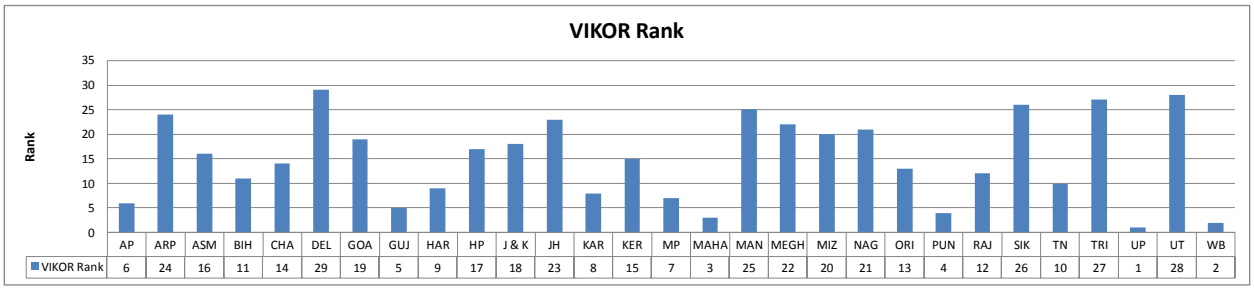

Fig 8B: VIKOR Output (State Ranks); *Source* - R output from Secondary Data

F. Conclusion

The study reveals Uttar Pradesh as the best alternative i.e. state with highest retailing potential in India and the remaining states in the list of top ten includes West Bengal, Maharashtra, Punjab, Gujarat, Andhra Pradesh, Madhya Pradesh, Karnataka, Haryana and Tamil Nadu in order of decreasing retailing potential. Cold storage, population density, rural godown capacity, education status, road and railway network have emerged as factors influencing retailing potential in order of decreasing importance.

G. Limitations & Scope of Further Study

Subjective parameters that may influence retailing, like political stability and organization's perception on industrial climate in a state, have not been considered. One may use other ranking methods to analyze the same in future and comparison made thereof.

H. Bibliograpy

- (2005). *India's Retailing Potential*, Association of Indian Individual Investors.
- (2005). *Retail Growth in India*, KPMG.
- (2007). *Organized Retail Expansion in India*, New Delhi: Ministry of Commerce & Industry, Government of India.
- (2008). Annual Report, NCAER
- (2008). RK Swamy Guide to Market Planning
- (2013). *All India Survey On Higher Education 2010-11.* Department Of Higher Education. New Delhi: Ministry Of Human Resource Development.
- (2013). *State Of Housing In India a Statistical Compendium.* Ministry of Housing and Urban Poverty Alleviation National Buildings Organisation, Government of India. Delhi: Natinal Building Organization.

- (2013-14 & 2014-15). *Basic Road Statistics Of India.* New Delhi: Ministry Of Road Transport Aand Highways Transport Research Wing.
- (2014). *Retail Realty in India: Evolution and Potential. A Comparison and Contrast with the Emerging Cities of Asia.* Retail Intelligence.
- (2015-16). *Augmenting Rural Storage Infrastructure Through Scheme Of Rural Godowns.* Department Of Agriculture, Cooperation And Farmers Welfare. New Delhi: Ministry Of Agriculture And Farmers Welfare.
- (2015-16). *Fifth Annual Employment - Unemployment Survey.* Chandigarh: Ministry Of Labour & Employment Labour Bureau.
- (2016). *Highlights of Telecom Subscription Data.* New Delhi: Telecom Regulatory Authority of India.
- (2016). *Retail.* Indian Brand Equity Foundation.
- (2017). *Indian Retail Industry - Structure & Prospects.* Mumbai: CARE Ratings Professional Risk Opinion.
- (2017). *Retail.* Indian Brand Equity Foundation.
- Agarwal, P. (2012). Potential Of Organized Retail In India. *International Journal of Engineering And Management Science, 3* (4), 456-460.
- *Cencus of India 2011*. (2011). Retrieved 2017, from http://www.censusindia.gov.in: http://www.censusindia.gov.in/2011census
- Dashore, K., Singh Pawar, S., Sohani, N., & Singh Verma, D. (2013). Product Evaluation Using Entropy and Multi Criteria Decision Making Methods. *International Journal of Engineering Trends and Technology, 4* (5), 2183-2187.
- *Executive summary of month of November 2015.* (2015). Retrieved from Central Electricity Authority: http://www.cea.nic.in/
- Kahraman, C., Ruan, D., &Dogan, I. (2003). Fuzzy group decision-making for facility location selection. information sciences, 135-153.
- Kargi, V. S. (2016). Supplier Selection for A Textile Company Using The Fuzzy TOPSIS Method. *Manisa Celal Bayar Üniversitesi İ.İ.B.F., 23* (3), 1-15.
- *List of airports in India*. (2016, November). Retrieved 2017, from Wikipedia: https://en.wikipedia.org/wiki/List_of_airports_in_India
- Onut, S., &Soner, S. (2008). Transshipment site selection using the AHP and TOPSIS approaches under fuzzy environment. waste management, 1552-1559

- *Per Capita NSDP at current prices (2004-05 to 2014-15)*. (2015). Retrieved from NITI Aayog: http://niti.gov.in/content/capita-nsdp-current-prices-2004-05-2014-15
- Rani, S. (2013). Retail Industry In India (A Study On Growth Development Opportunities And Challenges). *International Journal of Computing and Corporate Research, 3* (6).
- Shannon, C (1948). A Mathematical Theory of Communication, *Bell System Technical Journal*, 27 (July and October), pp. 379–423, 623–656.
- Singh, P. K. (2014). Retail Sector in India: Present Scenario, Emerging Opportunities and Challenges. *IOSR Journal of Business and Management, 16* (4), 72-81.
- *Stamp Duty Caluclator for Property registration*. (2017). Retrieved from TodayPriceRates:http://property.todaypricerates.com/stamp-duty-registration-percentage-value-calculator
- *State wise distribution of Cold Storage capacity.* (2017, July). Retrieved from Press Information Bureau: http://pib.nic.in/newsite/PrintRelease.aspx?relid=168990
- *Statewise Length of Railway Lines and Survey For New Railway Lines* . (2016, December). Retrieved 2017, from Press Information Bureau Government of India: http://pib.nic.in/newsite/PrintRelease.aspx?relid=155019
- Venkatesh, N. (2013). Indian Retail Industries Market Analysis: Issues, Challenges and its Opportunity for the 21st Century. *International Journal of Application or Innovation in Engineering & Management, 2* (12), 164-174.