

**INFLUENCE OF SOCIAL INTELLIGENCE ON THE ACADEMIC PERFORMANCE OF THE HIGHER SECONDARY STUDENTS IN TIRUVALLUR DISTRICT****T.Kanimozhi<sup>1</sup> and M.Vasimalairaja<sup>2</sup>**<sup>1,2</sup>Department of Education, Directorate of Distance Education, Alagappa University, Karaikudi-630003  
<sup>1</sup>kani.rufus@gmail.com, <sup>2</sup>vasimalairaja@gmail.com**ABSTRACT**

The aim of the study was found that the influence of social intelligence on the academic performance of the Higher Secondary Students in Tiruvallur district. The investigator adopted the descriptive survey method. The sample consisted of 300 XI standard students randomly selected from government and private higher secondary school levels in Tiruvallur District. A social intelligence test was administered to these selected students. Half-yearly examination scores have been taken as academic performance of students. In this study, the researcher has explained that social intelligence depends upon the factors such as social relationships and social understanding. These are the determinants of social intelligence. The findings of the study revealed that the mean score of Academic Performance, social relationship, and social understanding is above average. Students belonging to the private school scored more in social intelligence and academic performance compared to students belonging to a government school. Parent Education does not create a significant difference in social relationships. It has been found that Parent's Education creates a significant difference in social understanding. Social relationships and social understanding are significantly correlated with each other.

**Keywords:** Social Intelligence- social relationship and social understanding, Academic Performance.

**Introduction**

Education is to be the purposeful and systematic influence, exposed by the matured person upon the immature, through teaching, discipline, and overall development of Intellectual, physical, aesthetic, social, and moral power of the human being. Education helps the learners to acquire more knowledge in all subjects. Now the world is surviving on basis of human relationships, so the teachers should give more importance to teach about our society. Social intelligence test – constructed and validated by the investigator. It has 64 items to elicit information related to social relationships and social understanding.

**Social Intelligence**

**Karl(2005)**, defined social Intelligence as the ability to get along with others, by wining to the interests and needs of others sometimes called social radar, an attitude of generosity and consideration, is a set of practical skills for interacting successfully with people in any setting . In this study, the researcher has also explained that social Intelligence depends upon a variety of factors. Social relationship and social understanding are the determinants of Social Intelligence. The social relationship is referring to the connections that exist between people who have recurring interactions that are

perceived by the participants to have personal meaning. In this study, social understanding means the skills that permit people to understand and infer our and others' mental states, such as intentions, desires, and emotions.

**Academic Performance**

From Wikipedia Academic performance is to which a student, teacher, or institution has attained their short or long-term educational goals. In the present study, Academic performance means, the overall score obtained by the students in the half-yearly Examination.

**Objectives of the study**

1. To find out the level of social relationship and social understanding and Academic performance
2. To find out whether there is any significant difference in the social relationship of higher secondary students in terms of gender, type of school, and parent's education.
3. To find out whether there is any significant difference in social understanding of higher secondary students in terms of gender, type of school, and parent's education.
4. To find out whether there is any significant difference in academic performance of higher secondary students in terms of

- gender, type of school, and parent education.
- To find out the correlation between social relationship and social understanding, and Academic performance

**Null Hypothesis**

- To find out whether there is any significant difference in the social relationship of higher secondary students in terms of gender, type of school, and parent's education.

- To find out whether there is any significant difference in social understanding of higher secondary students in terms of gender, type of school, and parent's education.
- To find out whether there is any significant difference in academic performance of higher secondary students in terms of gender, type of school, and parent's education.
- To find out the correlation between social relationships, social understanding was presented below.

**Table-1: Level of social relationship and social understanding and Academic performance**

Variables	N	Mean	S.D.
Social Relationship	300	58.70	11.45
Social Understanding	300	36.04	5.78
Academic Performance	300	65.38	16.21

Table- 1 shows the level of Social relationship and social understanding and Academic performance. It is known that the students have a high level of Social relationships as revealed by the mean value of 58.70. The table also

shows that the students have a high- level of Social Understanding as revealed by the mean value of 36.04. The academic performance of the students has been found above average as revealed by the mean value of 65.38.

**Table-2: Result of 't' test the social relationship and social understanding and Academic performance based on Gender.**

S. No	Variable	Gender	N	Mean	SD	't' test	Sig (2-) at 1% level
1	Social Relationship	Male	146	59.82	11.21	1.66	0.097 (NS)
		Female	154	57.62	11.61		
2	Social Understanding	Male	146	35.73	6.15	0.885	0.377 (NS)
		Female	154	36.32	5.41		
3	Academic performance	Male	146	72.19	13.52	7.753	0.000 (S)
		Female	154	58.92	15.94		

Note. NS- Not Significant, S- Significant at 1% level.

Table- 2 shows that there is no significant difference in the social relationship and social understanding concerning their gender.

Whereas, there is a significant difference in the academic performance concerning their gender at a 1% level of significance.

**Table-3: Result of 't' test the social relationship and social understanding and Academic performance based on the type of school.**

S.No.	Variable	Type of school	N	Mean	SD	't' test	Sig (2-)
1	social relationship	Government	99	34.82	5.46	2.562	0.011* (S)
		Private	201	36.63	5.85		
2	social understanding	Government	99	53.76	53.76	5.480	0.000* (S)
		Private	201	61.12	61.12		
3	Academic performance	Government	99	58.18	58.18	5.666	0.000* (S)
		Private	201	68.92	68.92		

\*\*\*significant at 1% level, \*\* significant at 5% level

Table-3 shows the description for the variables such as social relationship and social understanding, and Academic Performance based on the type of school along with their mean, standard Deviations'' value, and level of significance. There is a significant difference in

the social relationship for their type of school at 1% level whereas there is a significant difference in the social understanding and Academic performance for their type of school at 5% level of significance.

**Table-4: Result of One way ANOVA based on parent’s education**

Variables	Sources of variation	Sum of Square	Degrees of Freedom	Mean Square	F	Significant
Social relationship	Between the group	15.343	2	7.672	0.228	0.796 (NS)
	Within the group	9999.26	297	33.647		
	Total	10008.60	299			
Social understanding	Between the group	1671.41	2	835.702	6.602	0.002*** (S)
	Within the group	37595.60	297	126.584		
	Total	39267.00	299			

\*\*\*significant at 1 percent level, NS-Not significant, and S- Significant

Results of Table-4 show that there is no significant difference in the Social relationship for parent's Education but there is a significant

difference in the scientific vocabulary ability for their Parent's Education at 1% level.

**Table-5: Result of Post Hoc Test (Scheffe)- Social relationship in terms of Parent’s Education**

Variable	Parent’s Education	Parent’s Education	Mean Difference (I-J)	Standard Error	Significance
Social relationship	Illiterate	School Education	-3.8558	1.13285	0.944 (NS)
		College Education	-0.81935	1.29007	0.817 (NS)
	School Education	Illiterate	0.38558	1.13285	0.944 (NS)
		College Education	-0.43378	0.83932	0.875 (NS)
	College Education	Illiterate	0.81935	1.29007	0.817 (NS)
		School Education	0.43378	0.83932	0.875 (NS)

NS- Not Significant

Table-5 reveals that the result of Post Hoc Testis used to test the difference between two specific Parent’s Educations on Social

relationships. The result indicates that there is no significant difference in the scores of Social relationships for Parent Education.

**Table-6: Result of Post Hoc Test (Scheffe)- Social understanding in terms of Parent’s Education**

Variable	Parent’s Education	Parent’s Education	Mean Difference (I-J)	Standard Error	Significance
Social understanding	Illiterate	School Education	-1.34936	2.19729	0.828 (NS)
		College Education	-6.92473	2.50223	0.023*** (S)
	School Education	Illiterate	1.34936	2.19729	0.828 (NS)
		College Education	-5.57537	1.62796	0.003*** (S)
	College Education	Illiterate	6.92473	2.50223	0.023*** (S)
		School Education	5.57537	1.62796	0.003*** (S)

\*\*\* Significant at 1% level, \*\*significant at 5% level, NS-Not significant, and S- Significant

Table-6 reveals that the result of the Post Hoc Test indicates that the Social understanding of higher secondary students for Parent's Education. Students whose parents are illiterate significantly differ from the students whose parents are belonging to collegiate education. It also indicates that the social understanding of

higher secondary students whose parents is school education significantly differing from the students whose parents are belonging to collegiate education. But there is no significant difference in Social understanding of the students between illiterate and school-educated parents.

**Table-7: Correlation between Social Intelligence and Academic Performance**

Variables	Statistics	Academic Performance	Social Relationship	Social understanding
<b>Academic Performance</b>	Pearson correlation Sig. (2-tailed) N	1  300	0.048 0.404 300	0.206** 0.000 300
<b>Social Relationship</b>	Pearson correlation Sig. (2-tailed) N	0.048 0.404 300	1  300	0.377** 0.000 300
<b>Social understanding</b>	Pearson correlation Sig. (2-tailed) N	0.206** 0.000 300	0.377** 0.000 300	1  300

\*\* Correlation at 1% level of significance (2-tailed)

Table-7 reveals that the correlation between Social understanding and Academic Performance is found to be 0.206 which is significant at 0.01 levels. It is concluded that there is a positive and significant correlation between scientific vocabulary ability and Academic Performance.

The above Table reveals that the correlation between Social understanding and Social relationships is found to be 0.377 which is significant at 0.01 levels. It is concluded that there is a positive and significant correlation between Social understanding and Social relationships and it is also revealed that there is no significant correlation between Social relationships and Academic Performance.

**Major Findings of the study**

1. The mean score of Academic Performance, social relationship, and social understanding is above average.
2. Students belonging to the private school scored more in Social Intelligence and academic performance compared to students belonging to a government school.
3. Parent Education does not create a significant difference in social relationships.

4. It has been found that Parent's Education creates a significant difference in social understanding
5. Social relationships and social understanding are significantly correlated with each other.
6. Social understanding and Academic performance are significantly correlated with each other.

**Suggestions for future research**

The present study is conducted in the Thiruvallur District only, hence the same study can conduct in other districts, and also it can be extended to populations like college students, and teachers. Another direction for future research is to compare rural student's level of social intelligence with urban student's level of social intelligence. Hence more research studies need to be conducted to gain a better understanding of the relationships between social intelligence and academic performance.

**Conclusion**

It is concluded that the positive way of approaching, motivating, and teaching is developing the students' attitude towards society will improve their social intelligence

and best academic performance in schools. All teachers and parents are having the responsibility to encourage their children to

achieve their potential and provide them with emotional and academic support when needed.

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## A FUZZY MATHEMATICAL MODELING BASED MODIFIED PROMETHEE METHOD FOR RANKING IN A TIE-SITUATION EVALUATION

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### ABSTRACT

The circumstances in which two or more alternatives in an evaluation have identical placed then it is known as tie-situation. So it is necessary to break the tie-situation for appropriate evaluation. A tiebreaker or tiebreak is used to determine a ranking from among all the alternatives. A new preference ranking approach is proposed in this paper for evaluation of tie-situation. Triangular fuzzy numbers are used for marking the alternatives for different criteria by multiple decision makers. Then the deviation between each alternative is obtained by using pairwise comparison and applying the preference function. Finally, the final ranking of each alternative in tie-situation can obtain by using preference index value. Validate the proposed method with the help of a case study.

**Keywords:** Fuzzy logic, Promethee, Tie-situation, Pairwise comparison, Ranking

### Introduction

It is critical to make sound decisions at all stages of life. However, some intricate situations have a lot of contradictory conditions. PROMETHEE [1], TOPSIS [2], TODIM [3,4], VIKOR [5], ELECTRE [6], and other Multi-Criteria Decision Methods (MCDM) have been created to facilitate this practice. Among the existing outranking multiple criteria satisfied methods, the PROMETHEE technique has assumed a prominent position. Furthermore, the PROMETHEE approach has been widely applied in a diverse domains [7–11]. For decision-making situations with known attribute fuzzy measures and interval hesitant fuzzy sets, Liu [12] presented a PROMETHEE multi-attribute decision-making approach based on attribute association. Liang et al. Liu and Guan [13] used the data randomness to calculate the goal weights for each indicator and the PROMETHEE-II approach to choose suppliers. Using the modified PROMETHEE, we obtain unique ranking in tie-situations. This research paper organised as follows: the next section presents the preliminaries, section 3 describe methodology, section 4 presents the case study, section 7 presents results and conclusion.

### Preliminaries

Some concepts of fuzzy logic and preference ranking organization method which are required in this research work are as below:

### Normalize the performance matrix

Any multiple criteria decision making approach can be significantly improved by using an effective normalising and weighting method. In this work, max-min method is used to normalize the performance matrix.

For benefit criterion the normalized value is calculated by using equation 1,

$$R_{ij} = w_j \times \frac{|x_{ij} - x^-|}{|x^* - x^-|} \quad (1)$$

and the normalized value is calculated by using equation 2 for cost criterion,

$$R_{ij} = w_j \times \frac{|x^* - x_{ij}|}{|x^* - x^-|} \quad (2)$$

Where,  $x_{ij}$  is a performance value of  $i^{th}$  alternative for  $j^{th}$  criteria. Also,  $x^*$  is represented highest value and  $x^-$  represented lowest value from the range.

### Deviations between each criteria

Deviations between the each alternative all the criteria should be taken into account by using equation 3,

$$d_j(A_i, A_p) = A_i - A_p \quad ; \quad \text{Where, } (3)$$

$i = 1, 2, \dots, n; p = 1, 2, \dots, n \text{ and } i \neq p$

### Preference function

Preference function translates the deviation of two alternatives into a preference degree. Preference function is defined by equation 4,

$$P_j(A_i, A_p) = F_j[d_j(A_i, A_p)]; \quad (4)$$

Where,

$$P_j(A_i, A_p) = \begin{cases} 0, & \text{if } d(A_i, A_p) \leq 0 \\ A_i - A_p, & \text{if } d(A_i, A_p) > 0 \end{cases}$$

**Global preference matrix**

Global preference value is calculated by using equation 5,

$$\pi(A_i, A_p) = \sum_{j=1}^m P_j(A_i, A_p) \tag{5}$$

Where,  $\pi(A_i, A_p)$  varies from 0 to 1 and expresses the degree of which alternative  $A_i$  is preferred over  $A_p$  based on all the criteria (m).

**Preference index value**

Preference index value ( $\phi_i$ ) is calculated by using following formula:

$$\phi_i(A_i) = \lambda \frac{\phi_{L_i}^* - \phi_{L_i}}{\phi_{L_i}^* - \phi_{L_i}^-} + (1 - \lambda) \frac{\phi_{E_i}^* - \phi_{E_i}}{\phi_{E_i}^* - \phi_{E_i}^-} \tag{6}$$

Where,  $\lambda \in [0,1]$  is the weight of the decision making strategy,  $\phi_{L_i}^*$  indicate the best value for living flow,  $\phi_{L_i}^-$  indicate the worst value

for living flow,  $\phi_{E_i}^*$  indicate the best value for entering flow,  $\phi_{E_i}^-$  indicate the worst value for entering flow,  $\phi_i(A_i)$  denotes the Preference index value for each alternative.

The preference relations are as follows:

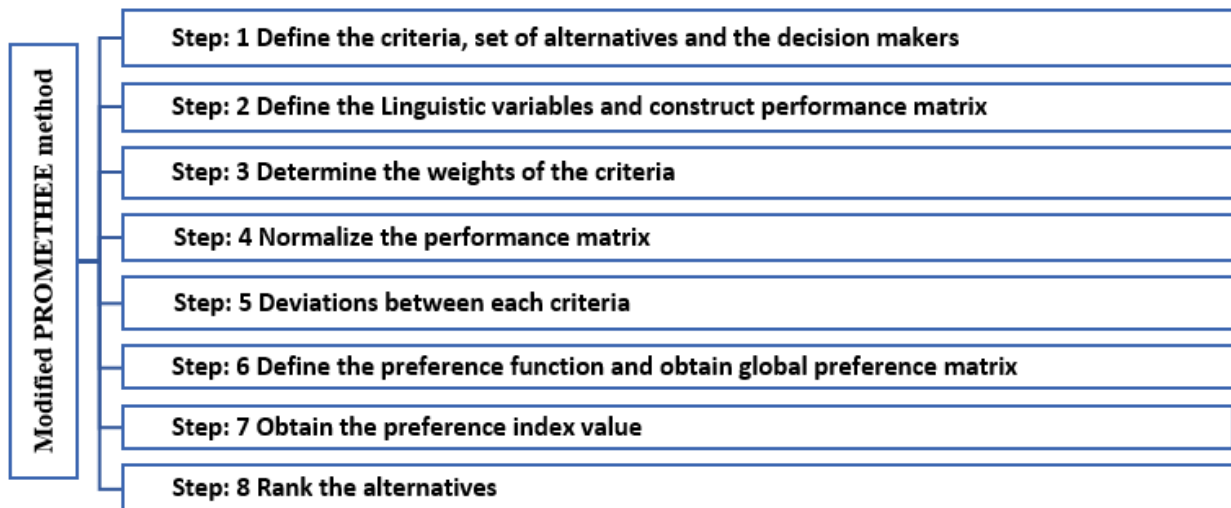
$$\phi_{L_i}(A_i) = \frac{1}{n-1} \sum_{x \in A} \pi(A_i, x) \quad \text{and} \tag{7}$$

$$\phi_{E_i}(A_i) = \frac{1}{n-1} \sum_{x \in A} \pi(x, A_i)$$

Where,  $\phi_{L_i}(A_i)$  signifies positive outranking flow or is identified as leaving flow and  $\phi_{E_i}(A_i)$  signifies the negative outranking flow or is identified as entering flow.

**Methodology**

PROMETHEE is one of the simpler method, which is very convenient in use in comparison to other multi-criteria analysis techniques feasible to implement in recent times. Considering issues regarding restricted alternatives available, PROMETHEE is an excellent option for ranking with respect to multiple and complex criteria. The basic steps of the proposed method are as follows:



**Figure: 1 Basic steps of proposed modified PROMETHEE method**

**Case study**

The purpose of this case study is to check effectiveness and accuracy of the new modified PROMETHEE method. The data has been adjusted such a way that there is a tie-situation between alternatives  $A_2, A_4$  and  $A_5$ .

**Step: 1 Define the criteria, set of alternatives and the decision makers**

Six different linguistic variables are defined for evaluation, which are shown in table 1,

Alternatives are define as  $A_i$ ; where,  $i=1,2,3,4,5$ ; criteria define as  $C_j$ ; where  $j=1,2,3,4,5$  and decision makers are denoted as  $DM_k$ ; where,  $k = 1,2,3,4,5$ .

**Step: 2 Define the Linguistic variables and construct performance matrix**

Linguistic Variable	Grade	Interval
Excellent	E	(8,10,10)
Very Good	VG	(6,8,10)
Good	G	(4,6,8)
Average	A	(2,4,6)
Bad	B	(0,2,4)
Very Bad	VB	(0,0,2)

**Table: 1 Linguistic variables for the performance rating of the alternatives**

Evaluation of the alternatives with respect to criteria assessed by decision makers in terms of Linguistic variables are defined in table 2,

	DM <sub>1</sub>					DM <sub>2</sub>					DM <sub>3</sub>					DM <sub>4</sub>					DM <sub>5</sub>				
	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>
A <sub>1</sub>	A	G	G	G	A	A	G	G	G	G	B	A	G	E	A	A	G	A	G	A	A	G	G	E	G
A <sub>2</sub>	G	G	G	A	B	B	G	A	B	A	B	B	G	G	B	G	G	A	G	B	B	G	A	G	A
A <sub>3</sub>	A	A	A	E	B	B	G	G	G	A	B	A	G	G	A	G	A	G	G	A	G	G	G	G	B
A <sub>4</sub>	B	G	B	A	A	B	G	A	B	A	A	A	B	G	G	E	B	B	A	E	G	A	B	G	A
A <sub>5</sub>	A	G	G	A	A	G	G	A	B	B	B	A	G	A	A	A	G	B	A	G	A	G	G	B	B

**Table:2 Performance matrix using linguistic variables in tie-situation**

**Step: 3 Determine the weights of the criteria**

Here, equal criteria weights are taken. i.e.  $w_i = 0.2$ , for  $i = 1,2,3,4,5 \ni \sum_{i=1}^5 w_i = 1$ .

**Step: 4 Normalize the performance matrix**

For that first convert all the values by using appropriate value of linguistic variable which define in table 2 then obtain average fuzzy alternatives are shown in table 3. score for all the alternatives. Average fuzzy scores for the

	Average fuzzy score					Total score
	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	
A <sub>1</sub>	(1.60,3.60,5.60)	(3.60,5.60,5.60)	(4.40,6.40,6.40)	(6.80,8.80,8.00)	(2.80,4.80,4.80)	28.93
A <sub>2</sub>	(1.60,3.60,5.60)	(3.60,5.60,5.60)	(3.20,5.20,5.20)	(2.80,4.80,4.80)	(0.80,2.80,2.80)	<u>22.00</u>
A <sub>3</sub>	(2.00,3.60,5.60)	(2.80,4.80,4.80)	(4.00,6.00,6.00)	(6.40,8.40,8.00)	(1.20,3.20,3.20)	26.00
A <sub>4</sub>	(2.80,4.40,6.00)	(3.20,5.20,5.20)	(0.40,2.00,2.00)	(2.80,4.80,4.80)	(3.60,5.60,5.20)	<u>22.00</u>
A <sub>5</sub>	(2.00,4.00,4.00)	(4.40,6.40,6.40)	(2.80,4.80,4.80)	(1.20,3.20,3.20)	(1.60,3.60,3.60)	<u>22.00</u>
Max.	(8,10,10)	(8,10,10)	(8,10,10)	(8,10,10)	(8,10,10)	-
Min.	(0,0,2)	(0,0,2)	(0,0,2)	(0,0,2)	(0,0,2)	-

**Table:3 Average fuzzy score in tie-situation**

**Normalize the decision matrix**

All the normalize values are shown in table 4,

	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>
A <sub>1</sub>	(0.04,0.07,0.09)	(0.09,0.11,0.14)	(0.11,0.13,0.16)	(0.17,0.18,0.20)	(0.07,0.10,0.12)
A <sub>2</sub>	(0.04,0.07,0.09)	(0.09,0.11,0.14)	(0.08,0.10,0.13)	(0.07,0.10,0.12)	(0.02,0.06,0.07)
A <sub>3</sub>	(0.05,0.07,0.09)	(0.07,0.10,0.12)	(0.10,0.12,0.15)	(0.16,0.17,0.20)	(0.03,0.06,0.08)
A <sub>4</sub>	(0.07,0.09,0.10)	(0.08,0.10,0.13)	(0.01,0.04,0.05)	(0.07,0.10,0.12)	(0.09,0.11,0.13)
A <sub>5</sub>	(0.05,0.08,0.10)	(0.11,0.13,0.16)	(0.07,0.10,0.12)	(0.03,0.06,0.08)	(0.04,0.07,0.09)

**Table:4 Normalize the decision matrix in tie-situation**



**Step: 5 Deviations between each criteria**

In this step, we compare all the alternatives with each other by using equation 3,

	$C_1$	$C_2$	$C_3$	$C_4$	$C_5$
$d(A_1, A_2)$	(0,0,0)	(0,0,0)	(0.03,0.024,0.03)	(0.1,0.08,0.08)	(0.05,0.04,0.05)
$d(A_1, A_3)$	(-0.01,0,0)	(0.02,0.016,0.02)	(0.01,0.008,0.01)	(0.01,0.008,0)	(0.04,0.032,0.04)
$d(A_1, A_4)$	(-0.03,-0.016,-0.01)	(0.01,0.008,0.01)	(0.1,0.088,0.11)	(0.1,0.08,0.08)	(-0.02,-0.016,-0.01)
$d(A_1, A_5)$	(-0.01,-0.008,-0.01)	(-0.02,-0.016,-0.02)	(0.04,0.032,0.04)	(0.14,0.112,0.12)	(0.03,0.024,0.03)
$d(A_2, A_1)$	(0,0,0)	(0,0,0)	(-0.03,-0.024,-0.03)	(-0.1,-0.08,-0.08)	(-0.05,-0.04,-0.05)
$d(A_2, A_3)$	(-0.01,0,0)	(0.02,0.016,0.02)	(-0.02,-0.016,-0.02)	(-0.09,-0.072,-0.08)	(-0.01,-0.008,-0.01)
$d(A_2, A_4)$	(-0.03,-0.016,-0.01)	(0.01,0.008,0.01)	(0.07,0.064,0.08)	(0,0,0)	(-0.07,-0.056,-0.06)
$d(A_2, A_5)$	(-0.01,-0.008,-0.01)	(-0.02,-0.016,-0.02)	(0.01,0.008,0.01)	(0.04,0.032,0.04)	(-0.02,-0.016,-0.02)
$d(A_3, A_1)$	(0.01,0,0)	(-0.02,-0.016,-0.02)	(-0.01,-0.008,-0.01)	(-0.01,-0.008,0)	(-0.04,-0.032,-0.04)
$d(A_3, A_2)$	(0.01,0,0)	(-0.02,-0.016,-0.02)	(0.02,0.016,0.02)	(0.09,0.072,0.08)	(0.01,0.008,0.01)
$d(A_3, A_4)$	(-0.02,-0.016,-0.01)	(-0.01,-0.008,-0.01)	(0.09,0.08,0.1)	(0.09,0.072,0.08)	(-0.06,-0.048,-0.05)
$d(A_3, A_5)$	(0,-0.008,-0.01)	(-0.04,-0.032,-0.04)	(0.03,0.024,0.03)	(0.13,0.104,0.12)	(-0.01,-0.008,-0.01)
$d(A_4, A_1)$	(0.03,0.016,0.01)	(-0.01,-0.008,-0.01)	(-0.1,-0.088,-0.11)	(-0.1,-0.08,-0.08)	(0.02,0.016,0.01)
$d(A_4, A_2)$	(0.03,0.016,0.01)	(-0.01,-0.008,-0.01)	(-0.07,-0.064,-0.08)	(0,0,0)	(0.07,0.056,0.06)
$d(A_4, A_3)$	(0.02,0.016,0.01)	(0.01,0.008,0.01)	(-0.09,-0.08,-0.1)	(-0.09,-0.072,-0.08)	(0.06,0.048,0.05)
$d(A_4, A_5)$	(0.02,0.008,0)	(-0.03,-0.024,-0.03)	(-0.06,-0.056,-0.07)	(0.04,0.032,0.04)	(0.05,0.04,0.04)
$d(A_5, A_1)$	(0.01,0.008,0.01)	(0.02,0.016,0.02)	(-0.04,-0.032,-0.04)	(-0.14,-0.112,-0.12)	(-0.03,-0.024,-0.03)
$d(A_5, A_2)$	(0.01,0.008,0.01)	(0.02,0.016,0.02)	(-0.01,-0.008,-0.01)	(-0.04,-0.032,-0.04)	(0.02,0.016,0.02)
$d(A_5, A_3)$	(0,0.008,0.01)	(0.04,0.032,0.04)	(-0.03,-0.024,-0.03)	(-0.13,-0.104,-0.12)	(0.01,0.008,0.01)
$d(A_5, A_4)$	(-0.02,-0.008,0)	(0.03,0.024,0.03)	(0.06,0.056,0.07)	(-0.04,-0.032,-0.04)	(-0.05,-0.04,-0.04)

**Table:5 Deviation by pair wise comparison in tie-situation**

**Step: 6 Define the preference function and obtain global preference matrix**

	$C_1$	$C_2$	$C_3$	$C_4$	$C_5$	Aggregate value
$P(A_1, A_2)$	(0,0,0)	(0,0,0)	(0.03,0.024,0.03)	(0.1,0.08,0.08)	(0.05,0.04,0.05)	(0.18,0.144,0.16)
$P(A_1, A_3)$	(0,0,0)	(0.02,0.016,0.02)	(0.01,0.008,0.01)	(0.01,0.008,0)	(0.04,0.032,0.04)	(0.08,0.068,0.07)
$P(A_1, A_4)$	(0,0,0)	(0.01,0.008,0.01)	(0.1,0.088,0.11)	(0.1,0.08,0.08)	(0,0,0)	(0.21,0.18,0.2)
$P(A_1, A_5)$	(0,0,0)	(0,0,0)	(0.04,0.032,0.04)	(0.14,0.112,0.12)	(0.03,0.024,0.03)	(0.21,0.174,0.19)
$P(A_2, A_1)$	(0,0,0)	(0,0,0)	(0,0,0)	(0,0,0)	(0,0,0)	(0,0,0)
$P(A_2, A_3)$	(0,0,0)	(0.02,0.016,0.02)	(0,0,0)	(0,0,0)	(0,0,0)	(0.02,0.016,0.02)
$P(A_2, A_4)$	(0,0,0)	(0.01,0.008,0.01)	(0.07,0.064,0.08)	(0,0,0)	(0,0,0)	(0.08,0.08,0.09)
$P(A_2, A_5)$	(0,0,0)	(0,0,0)	(0.01,0.008,0.01)	(0.04,0.032,0.04)	(0,0,0)	(0.05,0.044,0.05)
$P(A_3, A_1)$	(0.01,0,0)	(0,0,0)	(0,0,0)	(0,0,0)	(0,0,0)	(0.01,0,0)
$P(A_3, A_2)$	(0.01,0,0)	(0,0,0)	(0.02,0.016,0.02)	(0.09,0.072,0.08)	(0.01,0.008,0.01)	(0.13,0.092,0.11)
$P(A_3, A_4)$	(0,0,0)	(0,0,0)	(0.09,0.08,0.1)	(0.09,0.072,0.08)	(0,0,0)	(0.18,0.152,0.18)
$P(A_3, A_5)$	(0,-0.008,-0.01)	(0,0,0)	(0.03,0.024,0.03)	(0.13,0.104,0.12)	(0,0,0)	(0.16,0.128,0.15)
$P(A_4, A_1)$	(0.03,0.016,0.01)	(0,0,0)	(0,0,0)	(0,0,0)	(0.02,0.016,0.01)	(0.05,0.028,0.02)
$P(A_4, A_2)$	(0.03,0.016,0.01)	(0,0,0)	(0,0,0)	(0,0,0)	(0.07,0.056,0.06)	(0.1,0.072,0.07)
$P(A_4, A_3)$	(0.02,0.016,0.01)	(0.01,0.008,0.01)	(0,0,0)	(0,0,0)	(0.06,0.048,0.05)	(0.09,0.068,0.07)
$P(A_4, A_5)$	(0.02,0.008,0)	(0,0,0)	(0,0,0)	(0.04,0.032,0.04)	(0.05,0.04,0.04)	(0.11,0.086,0.08)
$P(A_5, A_1)$	(0.01,0.008,0.01)	(0.02,0.016,0.02)	(0,0,0)	(0,0,0)	(0,0,0)	(0.03,0.024,0.03)
$P(A_5, A_2)$	(0.01,0.008,0.01)	(0.02,0.016,0.02)	(0,0,0)	(0,0,0)	(0.02,0.016,0.02)	(0.05,0.038,0.05)
$P(A_5, A_3)$	(0,0.008,0.01)	(0.04,0.032,0.04)	(0,0,0)	(0,0,0)	(0.01,0.008,0.01)	(0.05,0.046,0.06)
$P(A_5, A_4)$	(0,0,0)	(0.03,0.024,0.03)	(0.06,0.056,0.07)	(0,0,0) (0,0,0)	(0,0,0)	(0.09,0.088,0.1)

**Table:6 Preference function in tie-situation**

**Preference matrix**

Preference matrix					
	$A_1$	$A_2$	$A_3$	$A_4$	$A_5$
$A_1$	-	0.1613	0.0713	0.1953	0.1893
$A_2$	0.0000	-	0.0187	0.0807	0.0467
$A_3$	0.0033	0.1120	-	0.1707	0.1460
$A_4$	0.0340	0.0807	0.0773	-	0.0900
$A_5$	0.0280	0.0467	0.0527	0.090	-

**Table:7Preference matrix in tie-situation**

**Step:7 Obtain the preference index value**

To calculate preference order, we calculate preference index value. For that, first we need to calculate leaving flow ( $\phi^+$ ) and entering flow ( $\phi^-$ ), which are shown in table 8,

	Leaving flow ( $\phi^+$ )	Entering flow ( $\phi^-$ )
$A_1$	0.1543	0.0163
$A_2$	0.0365	0.1002
$A_3$	0.1080	0.0550
$A_4$	0.0705	0.1342
$A_5$	0.0543	0.1180
Best value	0.1543	0.0163
Worst value	0.0365	0.1342

**Table:8 Leaving flow and entering flow in tie-situation**

**Preference index value**

The index  $\phi_i$  is calculated by equation 7, which are shown in table 9,

	$\lambda = 0.1$	$\lambda = 0.2$	$\lambda = 0.3$	$\lambda = 0.4$	$\lambda = 0.5$	$\lambda = 0.6$	$\lambda = 0.7$	$\lambda = 0.8$	$\lambda = 0.9$
$\phi_1$	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
$\phi_2$	0.6238	0.6656	0.7074	0.7492	0.7910	0.8328	0.8746	0.9164	0.9582
$\phi_3$	0.3640	0.3699	0.3759	0.3818	0.3877	0.3936	0.3996	0.4055	0.4114
$\phi_4$	0.9934	0.9868	0.9803	0.9737	0.9671	0.9605	0.9539	0.9474	0.9408
$\phi_5$	0.5730	0.6005	0.6280	0.6554	0.6829	0.7104	0.7378	0.7653	0.7928

**Table:9 Preference index  $\phi_i$  in tie-situation**

**Step: 8 Rank the alternatives**

Rank the alternative, sorting them by the values  $\phi_i$  in ascending order.

Alternatives are ranked based on their average fuzzy score	
$A_1 \rightarrow A_3 \rightarrow A_5 = A_2 = A_4$	
Ranking according to PROMETHEE method	
$A_1 \rightarrow A_3 \rightarrow A_5 = A_2 = A_4$	
<b>Ranking of the alternatives by using proposed method</b>	
$\lambda = 0.1$	$A_1 \rightarrow A_3 \rightarrow A_5 \rightarrow A_2 \rightarrow A_4$
$\lambda = 0.2$	$A_1 \rightarrow A_3 \rightarrow A_5 \rightarrow A_2 \rightarrow A_4$
$\lambda = 0.3$	$A_1 \rightarrow A_3 \rightarrow A_5 \rightarrow A_2 \rightarrow A_4$
$\lambda = 0.4$	$A_1 \rightarrow A_3 \rightarrow A_5 \rightarrow A_2 \rightarrow A_4$
$\lambda = 0.5$	$A_1 \rightarrow A_3 \rightarrow A_5 \rightarrow A_2 \rightarrow A_4$
$\lambda = 0.6$	$A_1 \rightarrow A_3 \rightarrow A_5 \rightarrow A_2 \rightarrow A_4$
$\lambda = 0.7$	$A_1 \rightarrow A_3 \rightarrow A_5 \rightarrow A_2 \rightarrow A_4$
$\lambda = 0.8$	$A_1 \rightarrow A_3 \rightarrow A_5 \rightarrow A_2 \rightarrow A_4$
$\lambda = 0.9$	$A_1 \rightarrow A_3 \rightarrow A_5 \rightarrow A_4 \rightarrow A_2$

**Table:10 Ranking of the alternatives in tie-situation**

**Result and Conclusion**

In this paper, modified PROMETHEE method is used for obtained ranking in tie-situations. Ranking is shown in table [10]. In this research work, there is a tie between alternative

2, 4 and 5 at 3<sup>rd</sup> position, while ranking the alternatives by averaging the scores and old PROMETHEE method. But in proposed method, according to final result (see Table 9), it is concluded that alternative 5 have obtained 3<sup>rd</sup> rank, whereas alternative 2 and 4 have 4<sup>th</sup>

and 5<sup>th</sup> rank, respectively. There is significant order of ranking when value of  $\lambda$  is between 0.1 to 0.8. Proposed method provides useful way to handle many real-world fuzzy multi-criteria group decision making problems. The approach provided a more efficient and scientific way to ascertain the ranking of the alternatives in the tie-situations.

## MATLAB analysis

MATLAB code for this work is implemented in its own function and the way to use the function. Ranking of alternatives for  $\lambda = 0.1$  calculated by using MATLAB is shown in figure 2,

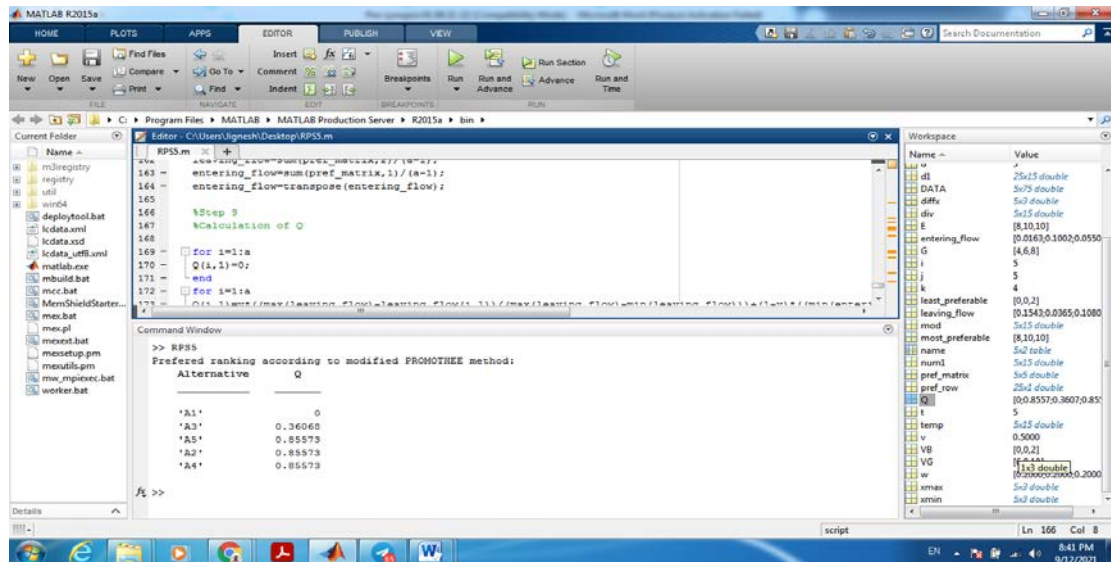


Figure: 2 MATLAB output for  $\lambda = 0.1$

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## EMERGING CONTAMINANTS IN AGRICULTURE AND THEIR IMPACTS ON ENVIRONMENT

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### ABSTRACT

"Environmental contaminant" is another name for pollution. Generally speaking it means any potentially undesirable substance (physical, chemical or biological) which at high concentrations is to have an adverse effect on the health of all living creatures. It usually refers to the introduction of toxic man-made substances produced by factories, such as DDT or toxaphene. Different kind of human activities also introduces toxic substances such as cadmium in high concentrations in ecosystems, which may have adverse effect on the environment. Industrial chemicals used worldwide enter into the upper atmosphere, spreads over a wide area and finally falls to the ground thereby polluting our homelands. Such pollutants may be found in soil, plants, air, water, sea animals, land animals, and birds. Agricultural pollution refers to the biotic and abiotic by-products of farming practices which causes environmental degradation and affects surrounding ecosystem. The pollution may come from a variety of sources, ranging from point source water pollution (from a single discharge point) to more diffuse, landscape-level causes, also known as non-point source pollution. Management practices play a crucial role in controlling impact of these pollutants. The types of contaminants measured in agriculture include: abiotic sources such as pesticides (including organochlorines), heavy metals (including radioactive elements), organic contaminants and biotic sources such as greenhouse gases from fecal waste, biopesticides, invasive species, and genetically modified organisms.

**Keywords:** Heavy metal, Pesticide, Persistent organic pollutant, Sewage sludge, Radionuclide, PPC.

### Introduction

The impact of potentially harmful chemicals in the environment that can affect the health of Humans and other organisms can be determined by considering the sources of these chemicals. These substances are typically referred to as contaminants, pollutants, or most aptly, environmental toxicants. The sources also provide clues to the transport and subsequent fate of these chemicals, including exposure pathways. There are generally two categories of environmental toxicants: naturally occurring and anthropogenic. Naturally occurring chemicals are those such as in poison ivy, poisonous mushrooms, and natural elements, such as mercury and arsenic. In particular, agricultural chemical inputs denote the different types of chemical applications in agricultural production, such as pesticides (including natural and biological pesticides), chemical fertilizers, veterinary drugs and feed additives, among others. Certain measures can be employed to avoid or limit exposures to these natural toxins. General avoidance, or identifying and cordoning off the source (if possible), represent prudent, immediate measures that can be taken. Remediation may be needed in some cases as well. Anthropogenic chemicals, conversely, are

those that human society or its industries create, use, and dispose. Some undergo transformation in the environment; generally, transformation is a detoxification process, but occasionally the transformation products are more harmful than what was initially released to the environment. A noteworthy example of this is the methylation of mercury by microorganisms to methyl mercury, which is significantly more toxic to humans than the parent compound. Unfortunately, it is difficult, and often not possible, to avoid incidental exposures to man-made chemicals without some form of regulatory action. Research suggests that the massive use of inorganic fertilizers world-wide is associated with the accumulation of contaminants, e.g. arsenic (As), cadmium (Cd), fluorine (F), lead (Pb) and mercury (Hg) in agricultural soils. In most developing countries, the pollution caused by agricultural chemicals is even more serious. Policy makers recognize that the excessive and unsystematic application of agrichemical inputs, pesticides and fertilizers in particular, is an obstacle to the development of sustainable agriculture, and poses a threat to the environment and humans alike. Several countries have enacted policies to regulate the usage volume and types of agricultural

chemicals thereby minimizing the evil impact of these harmful yet unavoidable substances that get released in the environment.

Agrichemicals particularly pesticides can enter the human body through inhalation, ingestion, or by dermal penetration through the skin. Pesticides may cause headaches, blurred vision, vomiting, abdominal pain, suppress the immune system, lead to blood and liver diseases, depression, asthma, and nerve damage. The issue with these effects is that they may appear until a while after being ingested so tracing the symptoms back to the pesticide can prove to be quite difficult. The easiest way to prevent the spread and abundance of agricultural pesticides is through education. If more farmers, especially in developing countries, knew about the risks of these pesticides, they would be more careful in the way that they use the pesticides and the protection that the sprayers wear. Another way is to adopt the Integrated Pesticide Management program which emphasizes non chemical and cultural pest control strategies such as removal of diseased plant parts, crop rotation that may disrupt the life cycle of pests, and biological control such as the use of insect predators. Particular attention needs to be paid to the developing world as their lower health status makes them more vulnerable to disease and they are usually dependent upon farming as their main source of income and economy.

### Abiotic sources

#### 1. Pesticides

Pesticides<sup>1-2</sup> and herbicides<sup>3</sup> are materials commonly practiced for eradicating insects, pests and other creatures pernicious to cultivated shrubs, trees, herbs, grasses *etc.* or that rattles manufacturing of crops. Soil contagion customarily occurs when pesticides and herbicides prevail and agglomerate in soils, which can amend microbial processes, escalate plant uptake of these toxic substances, and also have virulent effect on soil organisms. The extent to which these compounds prevail depend on their exclusive chemistry, which can influence adsorption kinetics and transit in the soil environment. Moreover, amalgamation of pesticides can also occur in animals after consumption of polluted pests and soil organisms. Furthermore, pesticides can also be

lethal to benign insects as well, such as pollinators, and to probable detractors of pests (i.e. insects that feed on or dependent on pests) compared to their direct effect on objective pests.

#### 1.1. Pesticide leaching

Pesticide leaching<sup>4</sup> is the mechanism where pesticides are blended with water and proceed wide into the numerous layers of the soil, conclusively polluting groundwater. The extent of leaching primarily depends on few components such as interrelationship to particular soil, pesticide quality, the rate of rainfall and irrigation. Most likely, leaching will take place due to higher water solubility of pesticide, granular structure of soil, occurrence of excessive watering immediately after pesticide employment and also due to less adsorption capability of pesticide to the soil. Leaching may notably emerge from treated farmlands, pesticide transfused spaces, pesticide utilization machinery washing areas, or dumping areas. Excessive concentration of nitrates in water can skeptically influence oxygen amounts for both human beings and aquatic systems.

#### 1.2. Organochlorines (OCs)

Organochlorine (OC)<sup>5-7</sup> pesticides are extensively used as synthetic pesticides all around the world. They are usually derived from chlorinated aromatic molecules or hydrocarbons, which have enormous utility in the chemical industry and in agriculture. These compounds are familiar for their tremendous lethality, passive deterioration and bioaggregation and can be used as pesticides, chemicals or industrial processes such as manufacturing plastics. They may be present either in old electrical transformers or may be generated from blazed garbages. Due to the high solubility in fats and oils, OCs are found in the fat of animals. OCs contribute to the contaminants of immense concern in the food chain. Industrial chemicals called **PCBs**, and the pesticides such as **toxaphene**, **DDT**, and **chlordan** are the most familiar OCs estimated in Arctic wildlife. Organochlorines are vapour producing compounds and can be borne by the air for far-reaching distances. Ultimately, they condense back and are accumulated on land or are diffused in water,

causing severe health risks to humans such as cancer and reduced immune systems. Some kind of deformities and irregularities developed in evolution and reproduction in fish-eating birds, which are present significantly in the food chain are often caused by organochlorines.

### 1.2.1. DDT, DDE and DDD

DDT (1,1,1-trichloro-2,2-bis(*p*-chlorophenyl)ethane)<sup>8-9</sup> is a synthesized chemical extensively applied to curb insects on agricultural crops in paddy fields and insects that transmit diseases like malaria and typhus. It does not appear commonly in the environment. DDT is an odorless and tasteless white crystalline solid. Because of its devastation to wildlife and the potential damage to human health, the application of DDT in many countries is now not being practiced, except for public health necessities. Because of exposure to high concentrations of DDT, various kind of symptoms including vomiting, tremors or shakiness, and seizures can develop in human. Effects on the liver and reproduction are also being observed in animal kept in laboratory. DDT is regarded as a potential human carcinogen. Two analogous synthetic compounds that occasionally toxicate DDT products are DDE<sup>9</sup> (1,1-dichloro-2,2-bis(chlorophenyl) ethylene) and DDD<sup>9</sup> (1,1-dichloro-2,2-bis(*p*-chlorophenyl) ethane). DDD was also used to kill pests, but its application has also been prohibited. One form of it has been used medically to treat cancer of the adrenal gland. Till date, no commercial use of DDE has been reported.

### Effects of DDT, DDE, and DDD on the environment

DDT typically is introduced to the environment when it is exploited as an insecticide. It remains in air for very short duration and 50% of it evaporates within 2 days. Nevertheless, it is almost water insoluble. DDT firmly adheres to soil particles and does not shift instantaneously to underground water. It remains in the soil for quite a long duration and 50% of it decomposes in the soil in 2-15 years. A few DDT gets dissipated from soil and surface water into the air and some of it are decomposed by sunlight or by microorganisms

in soil or surface water. DDT in soil usually undergoes disintegration to form DDE or DDD. Concentrations of DDT gets increased in plants and in the oily tissues of varied types of faunas.

### 1.2.2. Chlordane

Chlordane<sup>10</sup> is a representative of a class of synthetic compounds commonly termed as "chlorinated cyclodienes." It is applied as an insecticide, and notably as a termiticide, it is accessible in pure and technical grades. Pure chlordane is a syrupy, white, unaromatic liquid. It doesn't appear usually in the environment. It is a synthesised chemical that was treated as a pesticide in the United States from 1948 to 1988. Chlordane is a chemical compound and also component of an analogous pesticide mixture followed from synthesis of primarily three components- heptachlor, chlordane, and nonachlor. These profoundly chlorinated cyclodienes were distributed as organic toxic wastes precarious for human health. Industrial chlordane is not a sole chemical, on the other hand it is indeed a mixture of pure chlordane associated with numerous complimentary chemicals. It is a consolidated liquid whose color varies from colorless to warm and radiant colour. Chlordane has a moderate, annoying scent. A bit of its commercial names includes Octachlor and Velsicol 1068. Up to 1983, chlordane was utilized as a pesticide on crops like corn and citrus and on home lawns and gardens. In view of worry about catastrophe to the environment and casualty to human health, the Environmental Protection Agency (EPA) restricted all uses of chlordane in 1983 apart from regulating termites. In 1988, EPA prohibited all uses of chlordane.

### Environmental impacts of chlordane

Chlordane when applied as a pesticide on crops, on lawns and gardens, and to restraint termites penetrates into the soil. However, chlordane sticks completely to soil particles at the surface and is rarely enters groundwater. It can persist in the soil for more than 20 years. Greatest amount of chlordane departs soil by evaporation to the air. It decomposes very slowly. Chlordane doesn't get dissolved readily in water and deposits in the tissues of fish, birds, and mammals.

### 1.2.3. Chlorine

Chlorine<sup>11-12</sup> is a naturally occurring and exceedingly reactive gas. The name chlorine is extracted from word 'chloros' which means green, attributing to the color of the gas. The natural chemical element exists in the physical form of a green diatomic gas. Chlorine gas is two and one half times as heavy as air, has a profoundly disagreeable asphyxiate odor, and is terribly fatal. It acts as a powerful oxidizing, bleaching, and disinfecting agent in both liquid and solid form. This element is a component of the halogen family forming salts. It is obtained from chlorides through oxidation and electrolysis. Chlorine gas is greenish-yellow and reacts spontaneously with all other elements. The greatest consumers of chlorine are companies that manufacture ethylene dichloride and various chlorinated solvents, polyvinyl chloride (PVC) resins, chlorofluorocarbons, and propylene oxide. Chlorine is used in paper companies for bleaching, water and wastewater treatment plants for reducing water levels of microorganisms causing disease to humans. Due to release of chlorine to air, water, or land, chlorine exposure can take place in the workplace or in the environment. People using laundry bleach and swimming pool chemicals consisting of chlorine products usually are not exposed to chlorine itself. Chlorine is usually obtained solely in industrial settings. Chlorine is introduced in the body after breathing contaminated air or consuming contaminated food or water. Due to high reactivity, it does not persist in the body for long.

#### Effect of chlorine on the environment

Low concentration of chlorine generally affects the environment. In particular, it is especially adverse for organisms persisting in water bodies and in soil. After mixing with water it dissolves. Under specific conditions, it can leave from water and gets in air. Direct discharge of chlorine to the environment occur to air and to surface of water, where it reacts with other chemicals. In water, it reacts with inorganic substances to generate chloride salts and with organic substances to form chlorinated organic chemicals. In view of its reactivity, chlorine is not likely to do

movement through the ground and penetrates groundwater. Plants and animals are not likely to accumulate chlorine. Harmful effects of chlorine on the environment depend on chlorine content, the length and frequency of exposure and the condition of the environment at the time of exposure.

### 1.2.4. Aldrin/Dieldrin

Aldrin<sup>13</sup> is a component of the commonly named "classic organochlorines" (COC) family of pesticides. Pure aldrin is a white crystalline solid. In spite of its low solubility in water, it dissolves suitably in organic solvents, such as ketones and paraffins. Aldrin does not react with moderate acids or bases and is sufficiently stable in an environment having p<sup>H</sup> range 4-8. When exposed to temperatures above 200 °C, it becomes highly flammable. Aldrin gets transformed to dieldrin by plants and bacteria; which maintains the similar harmful effects and slow disintegrate of aldrin. Thus, aldrin and dieldrin are insecticides with analogous structures. Pure aldrin and dieldrin are white amorphous solids having a soft chemical odor. The few neat industrial powders have a tan color. Aldrin and dieldrin do not occur typically in the environment. Exposure to aldrin and dieldrin occurs usually after consumption of foods, such as root crops, fish, or seafood.

#### Effect of aldrin and dieldrin to the environment

Aldrin disintegrates very calmly once emitted into the environment. It is very easily transferred through the air by dust particles. In the presence of oxidizing agents it combines with concentrated acids and phenols. UV radiation and bacteria transforms aldrin to dieldrin, hence we frequently find dieldrin in the environment. They are firmly attached to soil and gradually vaporizes to the air. Dieldrin decomposes gradually. Plants adsorb and reserve aldrin and dieldrin from the soil. Aldrin immediately transforms to dieldrin in plants and animals. Dieldrin is accumulated in the fat and escapes the body gradually. Intoxication with aldrin gives rise to effects like neurotoxicity. Studies have shown that aldrin activates the central nervous system (CNS),



which may lead to hyperexcitation and seizures.

### 1.2.5. Polychlorinated-dibenzo-*p*-dioxins and furans (PCDD/PCDFs)

Polychlorinated dibenzodioxins (PCDDs)<sup>14-16</sup> are a family of polyhalogenated organic compounds which are powerful hazardous waste from environmental point of view. They are generally referred to as dioxins, as each PCDD molecule constitutes a dibenzo-1,4-dioxin structural moiety, along with 1,4-dioxin as the basic central ring. They are formed as side products in the synthesis of chlorinated substances, combustion procedures and in straight chlorination reactions like chlorine bleaching of paper pulp. The utmost important sources of these contaminants are municipal waste and hospital incinerators, where combustion produces large number of chlorinated products. Another paramount source of these compounds is combustion of motor vehicle fuel as in some countries leaded fuel containing chlorine scavengers are still practiced.

### Effects of Polychlorinated-dibenzo-*p*-dioxins and furans (PCDD/PCDFs) on human health

Dioxins accumulation primarily occurs in fatty tissues since years, so even minute exposures may ultimately reach critical levels. Exposure to large doses of dioxins in humans can develop serious kind of perpetual acne, known as chloracne. Epidemiological studies give further evidence of formation of tumors due to high occupational or accidental levels of exposures to dioxins. Excess doses of dioxins may cause other harmful effects in humans such as developmental abnormalities in the enamel of children's teeth and central and nervous system pathology, thyroid disorders, damage to the immune systems, endometriosis, diabetes *etc.*

### 1.2.6. Hexachlorobenzene (HBC or HCBZ)

Hexachlorobenzene<sup>17</sup>, an organochloride is a fungicide earlier practiced as a seed treatment. It is a stable, white, crystalline chlorinated hydrocarbon. On heating, it decomposes and releases hazardous fumes of CO, CO<sub>2</sub>, HCl and other chlorinated compounds. Apart from its application as a fungicide, it is also used as

a chemical intermediate in the production of dyes, manufacture of organic chemicals, rubber and in preservation of wood. HCB is obtained as a side product in the synthesis of a innumerable chlorinated compounds, especially lower chlorinated benzenes, and in the synthesis of several pesticides. It is transmitted to the atmosphere in flue gases and fly charcoal formed at waste incineration facilities. Owing to its high lipophilicity and long-half-life in biota, HCB has a relatively high bioaccumulation potential. Other chlorobenzenes (tetra- and penta-substituted) are also comparatively lipophilic, semi-volatile, and persistent specifically in the abiotic environment. Lengthy oral exposure to this substance lead to a liver disease with correlated skin lesions. Hexachlorobenzene is fairly assumed to be a human carcinogen established on cooperation between thyroid, liver and kidney cancer and oral exposure in animals.

### 1.2.7. Chlorobornanes (CHBS)

The composite assimilation of chlorobornanes (CHBs) is generally referred to as toxaphene<sup>18</sup> which has been dissipated by atmospheric transfer at the same rate as DDT and PCBs. It is produced by the chlorination of bornane. It is composed of more than 300 compounds, which are substituted with 6 to 10 chlorines, having generally an average composition of C<sub>10</sub>H<sub>10</sub>Cl<sub>8</sub>. As a result of the low level of standards and occurrence along with other interrupting OCs like PCBs, DDTs, HCHs, investigation of this mixture is very problematic. Despite the fact that it is a major environmental pollutant, the levels and effects of toxaphene in the Arctic are not well analysed.

Toxaphene is an insecticidal mixture, which is comprised of mainly chlorinated bornanes (CHBs) with a marginal percentage of chlorinated camphenes. Even if CHB mixtures have been rigorously banned in many countries, but repeated release of it to the environment by volatilization from contaminated soils is still continued at a distressing rate in non-Arctic region where it is still use is being practiced. Primarily precipitation leads to its deposition in winter season while exchange of gas with open water competencies is mainly responsible for its accumulation in summer season. The food

chain can augment the effects of deposition in atmosphere, which can lead to high levels of CHBs in top predator fish in certain lakes. One of the major difficulties in analytical methods of measuring this complex mixture of compounds is quantitative estimation of CHBs for lakes or the Arctic ocean. It is proposed that extensive effort must be done to regulate its quality and a variety of analytical methods must be developed for measuring CHBs in microlevel. Toxaphene is one of the significant toxic substances uncovered in arctic biota. Literature study predicts that even low levels of toxaphene exposure may cause lethal effects on the liver, kidneys, lungs, and nervous system.

### 1.2.8. Hexachlorocyclohexane

Hexachlorocyclohexane (HCH)<sup>19</sup> does not arise normally in the environment, it is a synthesized chemical, a mixture of stereoisomers and is used as an insecticide. It occurs in eight chemical forms known as isomers. One of these isomers,  $\gamma$ -HCH, known as lindane is a white solid substance that vaporizes into the air as a colorless vapor with a marginally moldy odor. Lindane is used as an insecticide on fruit and vegetable crops in conjunction with greenhouse vegetables and tobacco and forest crops along with Christmas trees. It is still being utilized in ointments to cure head and body lice, and scabies. Nonetheless, its application is prohibited by the Environmental Protection Agency (EPA) and can be administered only by a certified applicator.

#### Effect of Hexachlorocyclohexane on air, water and soil

In air,  $\alpha$ -,  $\beta$ -,  $\gamma$ -, and  $\delta$ -HCH can exist as a vapor or adhered to tiny particles like soil or dust. Lindane can persist in the air for up to 17 weeks and migrate to large paths. Particles with associated HCH may be eliminated from the air by rain. In soil, sediments, and water, it is decomposed by algae, fungi, and bacteria to fewer toxic substances. HCH isomers are decomposed rapidly in water; lindane does not exist in water for more than 30 days. Lindane is not usually settled in drinking water. The period of duration that HCH isomers exist in soil is unknown. It can be stored in the fatty

tissue of fish. Heptachlor and Heptachlor Epoxide Heptachlor, a synthesized chemical is not found to appear naturally. Pure heptachlor is a white powder having the same odour as that of camphor. The low unadulterated category is tan. Various commercial names of it include Heptagran, Basaklor, Drinox, Soleptax, Termide, and Velsicol 104. In the past, heptachlor was applied enormously for wiping out insects in homes, buildings, and on food crops, particularly corn. Heptachlor epoxide is a white amorphous solid and is a decomposition product of heptachlor. The epoxide is expected to be present in higher amount in the environment than heptachlor.

#### Effect of heptachlor and heptachlor epoxide on the environment

In comparison to heptachlor, heptachlor epoxide gets dissolved more readily in water. They are very firmly attached to soil particles and evaporate steadily to air. Heptachlor epoxide can persist in the soil and water for hundreds of years. Animals are primarily responsible for conversion of heptachlor to the epoxide. Plants generally pick up heptachlor from the soil. Concentration of heptachlor increases in the tissues of fish and cattle.

### 1.2.10. Polychlorinated Biphenyls (PCBs)

PCBs are a cluster of industrial synthetics which resembles each other with uniform structural moiety. Generally, they are oily liquids or solids, without having any odour or taste and is not found to appear naturally. One of the most popular trade name of a commercial PCB mixture is Aroclor. PCBs don't ignite readily and are thermally very stable mixtures. In the past, they were frequently treated as coolants, insulating materials, old microscope oil, hydraulic fluids and lubricants in electrical equipment such as transformers and capacitors. As levels in the environment increased, the potential for harmful effects increased. Pre-1977 products may still contain PCBs.

#### Environmental effect of PCBs

PCBs penetrate in air as solid or liquid aerosols or vapor and can persist in air for more than 10 days. In air, they can migrate through wind up to long distances. They transport from air to

soil and water in the form of snow or rain. Despite the fact that it does not dissolve readily in water, they are attached strongly to soil particles. They generally take many years for decomposition in soil and are stored in the bodies of fish and seafood.<sup>20</sup>

## 2. Heavy metals

In general, any metallic element with comparably high densities, atomic weights, or atomic numbers are known as heavy metals. They are natural components of the Earth's crust and thus cannot be downgraded or damaged.

The major contributors of heavy metals like lead, cadmium, arsenic, mercury *etc.*<sup>21-22</sup> into agricultural systems are fertilizers, organic wastes such as manures, and industrial wastes. Sometimes, farming processes like irrigation, contributes to accumulation of selenium (Se) in the soil. This can lead to high selenium concentrations in downstream water reservoirs, causing serious threat to wildlife, livestock, and humans. Some heavy metals such as iron, cobalt, and zinc are either essential nutrients, or relatively harmless such as ruthenium, silver, and indium, but large concentration of these metals can be very toxic. Other heavy metals, such as cadmium, mercury, and lead, are highly poisonous. Significant sources of heavy metal poisoning include mining, tailings, industrial wastes, agricultural runoff, occupational exposure, paints and treated timber. Moreover, the formation of reservoirs can also cause mercury to be released from flooded areas. Metals have a tendency to deposit in specific parts of the body. For example, lead deposits in the bones, mercury and cadmium accumulate in kidney and liver, and the derivative of mercury known as methylmercury deposits uniformly through the body.

### 2.1. Fertilizers

A fertilizer<sup>23</sup>, produced from either natural or industrial material, is applied to soils or to plant tissues for providing one or more plant minerals essential for the development and growth of plants. Most frequently used fertilizers usually contain the three major macronutrients in different proportions such as Nitrogen (N) for stimulating leaf growth,

Phosphorus (P) for augmentation of roots, flowers, seeds, fruit and Potassium (K) mainly for robust stem growth, transportation of water in plants, growth of flowering and fruiting. The nitrogen (N) and phosphorus (P) utilized for agricultural land (via synthetic fertilizers, composts, manures, biosolids, *etc.*) can provide beneficial plant nutrients. However, excess concentration of N and P can have unfavorable environmental consequences. Only a small fraction of the nitrogen-based fertilizers is transformed to produce plant matter. The residue is left either in the soil or lost as runoff. Excessive rate of usage of nitrogen-containing fertilizers provided by both synthetic fertilizers (as highly soluble nitrate) and organic sources such as manures (whose organic N is mineralized to nitrate by soil microorganisms) blended with the increased water-solubility of nitrate can bring about increased runoff into surface water as well as leaching into groundwater, hence causing groundwater pollution. The excessive use of nitrogen-containing synthetic or natural fertilizers is notably damaging, as much of the nitrogen that is not taken up by plants is converted into nitrate which is readily leached. Nitrate concentrations higher than 10 mg/L (10 ppm) in groundwater can give rise to "blue baby syndrome" (acquired methemoglobinemia). The nutrients, mainly nitrates, in fertilizers can lead to problems for natural habitats and for human health if they are washed off soil into water courses or leached through soil into groundwater. eutrophication can occur in downstream area because of excess nutrient supply from these same fertilizer sources including P, leading to anoxic areas called dead zones. Furthermore, the mistreatment of fertilizers can cause air pollution in the form of ammonia.

#### 2.1.1. Cadmium

Cadmium<sup>24-25</sup> is a natural element found in the earth's crust with no taste or odour. Cadmium (Cd) is a soft, malleable, bluish white metal found in zinc ores, and to a lower concentration, in the cadmium mineral greenockite. It is typically found as a mineral blended with other elements such as oxygen, chlorine, or sulfur to form cadmium oxide, cadmium chloride, cadmium sulfate and

cadmium sulfide respectively. All soils and rocks, including coal and mineral fertilizers, are found to possess cadmium. Industrially used cadmium is extracted during the preparation of other metals like zinc, lead, and copper. Cadmium has multiple uses as it does not undergo corrosion readily. This element is primarily applied in batteries, pigments, metal coatings, and plastics. The concentration of cadmium in phosphorus-containing fertilizers changes significantly and can be problematical. Regular usage of high-cadmium fertilizer can contaminate soil and plants. Producers of phosphorus-containing fertilizers now select phosphate rock based on the cadmium content.

### **Effects of cadmium on human health and environment**

Cadmium is introduced to air from various sources such as mining, industry, coal combustion, household wastes and Cd particles can migrate to large distances before finally gets contaminated with the ground or water. It penetrates water and soil from waste disposal and spills at toxic waste locations and thereby attached firmly to soil particles. In general, cadmium is water insoluble and non-flammable metal, whereas its amorphous form undergo combustion and generates copious amount of toxic fumes. Cadmium and its compounds are very hazardous in nature and exposure to this metal can cause cancer and may have a harmful effect on cardiovascular, renal, gastrointestinal, neurological, reproductive, and respiratory systems.

#### **2.1.2. Lead**

Lead<sup>25</sup> is a weighty metal as it has higher density than other commonly available metals. Lead in its pure form display a bright, silvery appearance with a blue tinge which gets tainted on contact with moist air. Lead is highly dense, malleable, ductile, and highly corrosion resistant. It has no characteristic taste or odor. Lead is present in all segments of our environment and has numerous uses. It is most commonly used in the production of batteries, in ammunition, metal products (solder and pipes), roofing, and devices to shield x-rays. Due to health concerns, lead from sources like gasoline, paints and ceramic products,

caulking, and pipe solder has been significantly prohibited since last few years.

### **Environmental concerns of lead and related human hazards**

Lead does not decompose on its own, its compounds are disintegrated by sunlight, air, and water.

Industry waste or fossil fuel combustion waste releases high concentration of lead in air, where it can stay for about 10 days. Maximum proportion of lead in soil accumulates from particles tumbling from air, from landfills and leaded paint. Lead gets adsorbed to soil particles and does not migrate from soil to underground or drinking water except for soft nature of water. It stays in soil and water for long duration. Numerous kind of adverse effects of lead on human health can be observed such as disruption of the biosynthesis of haemoglobin, anaemia and also of the nervous system, increase in blood pressure, damage of kidney and brain, miscarriages and subtle abortions, downturned man fertility, decreasing learning capabilities of children and disruptions in children behavioral such as aggression, impulsive behavior and hyperactivity.

#### **2.1.3. Mercury**

Mercury is a rare metal and occurs in nature having several varieties. The metallic mercury is a lustrous, silver-white liquid without having any fragrance. On heating, it changes to a colorless, odorless gas. Mercury reacts with other elements, such as chlorine, sulfur, or oxygen, to produce inorganic mercury compounds. Most of its compounds are white amorphous solids or crystals. Mercury also binds with carbon to form organic mercury compounds like methyl mercury, formed primarily by microscopic organisms in the water and soil. Metallic mercury is used to produce chlorine gas and caustic soda in chemical industry and also in thermometers, barometers, manometers, sphygmomanometers, float valves, mercury switches, mercury relays, fluorescent lamps and other devices, dental fillings, and batteries. Mercury salts are used in skin-lightening creams and as antiseptic creams and ointments.

## Mercury and the environment

Volcanic eruptions and other geological processes generate about 50% of the mercury which penetrates the environment every year and the other 50% is generated by mankind. Mercury is introduced in the air from various sources like mining ore deposits, burning coals and from manufacturing plants wastes. It infiltrates the water or soil from sources such as natural deposits, disposal of wastes, and the use of mercury-containing fungicides. Methyl mercury is formed in water and soil by microorganisms like bacteria and gets deposited in the tissues of fish and other organisms. The high concentration of this toxic metal poses a particular threat to the developing brains of young and unborn children. Its doses increase in tissues as we move up the food chain.

### 2.1.4. Arsenic

Arsenic<sup>25</sup> is a natural semi-metallic chemical that is found all over the world in groundwater at very low levels. It usually forms inorganic arsenic compounds with oxygen, chlorine, and sulfur. In plants and animals, it reacts with carbon and hydrogen to form odorless and tasteless organic arsenic compounds. Organic arsenic is comparatively less harmful as compared to inorganic arsenic. Arsenic is used industrially as an alloying agent, as well as in the processing of glass, pigments, textiles, paper, metal adhesives, wood preservatives and ammunition. Arsenic is also used in the hide tanning process and, to a limited extent, in pesticides, feed additives and pharmaceuticals. Ores of copper and lead possess minute quantities of arsenic.

### Global effect of arsenic

In spite of less rate of evaporation, most of the arsenic compounds are soluble in water. It enters air first and then from air to the ground, when contaminated materials undergo combustion. It doesn't decompose easily, but can transform from one form to another. Organic arsenic gets concentrated in the tissues of fish and shellfish, but majority of the arsenic found in fish is non-toxic in nature. Nonetheless, inorganic arsenic compounds are highly toxic and worldwide contamination of drinking water occurs due to these

compounds. The early symptoms of short-term exposure to high levels of inorganic arsenic (for example, through drinking-water and food) are generally observed in the skin, and include pigmentation changes, skin lesions and hard patches on the palms and soles of the feet (hyperkeratosis). But long-term exposure to it may also cause cancers of the skin, bladder and lungs.

### 2.1.5. Fluoride

Synthetically produced fluoride<sup>26</sup> is also found naturally in soil, water, phosphate rocks and foods. Therefore, the use of phosphate fertilizers all over the space has increased concentrations of fluoride in soil. It has been found that contamination of food from fertilizer is not of concern as plants accumulate less fluoride from the soil. But the matter of concern is the probability of fluoride toxicity to livestock that consume contaminated soils. Currently, effects of fluoride on soil microorganisms and on human health, particularly problems with bones, teeth, and neurological development are also a matter of increasing concern.

### 2.1.6. Radionuclides

Radionuclides<sup>27</sup> either occur naturally or are artificially produced in nuclear reactors, cyclotrons, particle accelerators or radionuclide generators. The radioactive content of the fertilizers varies considerably and depends both on their concentrations in the parent mineral and on the fertilizer production process. Variety of activities such as atmospheric testing of nuclear weapons, nuclear waste dumping, and incidents such as the 1986 Chernobyl nuclear accident mainly contributes to the release of radionuclides to the environment. Cesium is the man-made radionuclide that is commonly found in the north. Polonium is the most frequently found radionuclide in nature. Uranium is a radionuclide that can be found in nature at an elevated amount due to uranium mining.

The highest concentrations and risks of radionuclides in the Arctic are attributed to natural radionuclides, mainly <sup>210</sup>Po (Polonium), <sup>210</sup>Pb (Lead), <sup>228</sup>Th (Thorium), and <sup>232</sup>Th. Among the anthropogenic sources-based radionuclides, <sup>137</sup>Cs (Cesium)

contributes mainly to hazard issue but it represents merely 2% to 3% of the total doses and is derived from land-mammal consumption.

Various anthropogenic radionuclides which are of paramount interest and concern in the Arctic environment are:

**<sup>137</sup>Cesium (Cs):** This Cs isotope is produced when nuclear fission of uranium and plutonium fuels takes place. Due to worldwide increase of radioactive waste generated from atmospheric weapons testing and nuclear power production, Cs is highly abundant in the environment with long half-life of 30 years. It is universally treated in industry as closed gamma source for determination of thickness of materials and in medicine as a airtight source for therapeutics and as a tracer substance.

**<sup>90</sup>Sr:** Strontium possesses 6 radioisotopes which are emitted directly from fission products of uranium. Among these radioisotopes, <sup>90</sup>Sr is the considered to be the most important due to its long radiation half-life of 29 years. In medicine, cutaneous lesions which are a few millimeters in depth can be treated by <sup>90</sup>Sr. In industry, it is used in thickness gauges as a compact heat source for static dust elimination by air ionization procedure and also as thermoelectric source in instruments which require long-lived, independent power source. It is highly abundant in the environment because of global fallout from testing of atmospheric weapons, thereby accumulating in bones and teeth.

Some radionuclide in measured doses still exist in temperate and arctic ecosystems. In northern ecosystems, high concentrations of the long-lived fission products (<sup>137</sup>Cs (half-life 30.2 years) and <sup>90</sup>Sr) are present even now due to its slower turnover rates in a cold and dry climatic condition. The 1986 Chernobyl accident transmitted supplementary <sup>137</sup>Cs into the atmosphere. They are also conveyed by ocean currents from industrialized countries of Europe.

**<sup>131</sup>I:** Nuclear weapons tests and nuclear reactors generates large number of fissionable products such as radioactive iodines, specifically, <sup>131</sup>I, <sup>132</sup>I, and <sup>129</sup>I. After being released to the atmosphere, radioactive iodine may again condense back to land via precipitation, thus contaminating vegetation

and ultimately, the food supply. Radioiodine is very vital because of its judicious application in treatment of the thyroid.

**<sup>239</sup>Pu:** Plutonium is a human-made radioactive element which is utilized as fuel in nuclear reactors and also in explosive preparation in nuclear weapons. <sup>239</sup>Pu has a half-life of 24,390 years. Nuclear weapons testing programs have so far deposited globally more than 5,000 kilograms of plutonium, mostly as insoluble oxide particles, into the stratosphere.

**<sup>222</sup>Rn:** Radon is synthesized by the radioactive decay of radium, a universal element in rock and soil, which again is produced from the radioactive decay of uranium. Radon gas percolates from soil into buildings mainly through sump holes, dirt floors, floor drains, cinder-block walls, and cracks in bases and concrete floors. It can agglomerate remarkably, when captured indoors.

**Tritium (<sup>3</sup>H<sub>1</sub>):** Tritium is the radioactive isotope of hydrogen atom with a nucleus containing one proton and two neutrons. Tritiated water (<sup>3</sup>H<sub>2</sub>O) is the most typical form of tritium, which has a radiation half-life of 12.5 years. It is produced when heavy water (<sup>2</sup>H<sub>2</sub>O) absorbs neutrons during the mechanism of fission at moderate level in a nuclear reactor. Tritiated water can also be produced in the atmosphere due to the release of tritium gas from nuclear reactors. Till date, the maximum amount of the tritium deposited in the environment is due to atmospheric nuclear weapons tests which were conducted prior to 1963.

**<sup>238</sup>U:** Naturally occurring uranium consists of <sup>238</sup>U (99.27%), <sup>235</sup>U (0.72%), and <sup>234</sup>U (0.0054%).

<sup>235</sup>U is extracted from natural uranium and is used in nuclear reactors or nuclear weapons. The uranium left after complete eradication of <sup>235</sup>U is referred to as "depleted uranium," which remains to be a source of harmful radiation as well as a potential chemical hazard. High doses of uranium have been traced in well water in different parts of Canada.

### 2.1.7. Other metals

Fertilizers rich in zinc are commonly recycled from wastes of steel industry due to their beneficial effect for plant growth, resulting in

the emission of harmful and toxic metals such as aluminium, chromium, mercury, lead, arsenic and nickel to the environment.<sup>28</sup> Despite the fact that these probable harmful impurities can be eliminated but due to their high cost, it is very often ignored. Highly pure water-soluble fertilizers containing blue dyes practiced around households, such as Miracle-Gro are extensively available in larger packages at undoubtedly less price than retail quantities and are used in the plant nursery business. There are also some cost-effective retail granular garden fertilizers prepared with high purity ingredients.

### 2.1.7.1. Aluminum

Aluminum is the most abundant element, found in combined form with other elements such as minerals and rocks in the earth's crust. It is silver-white in colour and is light, durable and functional metal. Aluminium is extensively been practiced at an optimum level in the three major industries such as transportation, packaging, and construction. It is also used in cooking utensils, containers, appliances, and building materials. Aluminium is phenomenal due its low density and its ability to prevent corrosion through passivation process. Hence, it is widely used in different forms including aluminum nitrate, aluminum oxide, aluminum hydroxide (used in antacids), aluminum chlorohydrate (used in deodorants), and aluminum sulfate (used to treat drinking water). It is also used in paints and fireworks, and to produce glass, rubber, and ceramics.

#### **Environmental impact of aluminium:**

Huge concentrations of aluminium are found near mining sites; tiny amounts of aluminium are transmitted to the environment at the coal-fired power plants. Acidic precipitation is the primary natural factor to assemble aluminium from natural sources. But the leading factor of presence of aluminium in salt and freshwater are the industrial processes that also discharge aluminium into air. It gets attached to particles in the air and depending on the water quality, aluminium can dissolve in lakes, streams, and rivers. It can be absorbed from soil by some plants. In water, aluminium behaves as a harmful agent on gill-breathing animals like fish by causing loss of plasma-

and hemolymph ions resulting in failure of osmoregulation. In human, harmful effect of aluminium is less compared to heavy metals. Most aluminium consumed will be excreted from the body via urine. In the body, aluminium is accumulated in bone, brain, liver, and kidney. Aluminium, even if rarely, can cause vitamin D-resistant osteomalacia, erythropoietin-resistant microcytic anemia, and alterations in central nervous system. People with kidney problems are especially at a risk and adequately high doses can cause anemia. Since aluminium is excreted by kidneys, so their function may be affected by toxic amounts of aluminium. Chronic ingestion of hydrated aluminium silicates (for excess gastric acidity control) may result in aluminium binding to intestinal contents and increased removal of other metals, such as iron or zinc.

### 2.1.7.2. Chromium

Chromium is a naturally occurring element found in rocks, soil, plants, animals, and in volcanic dust and gases. Chromium exist in mainly three chromium (0), chromium (III), and chromium (VI). Chromium (III) compounds are highly stable and occur naturally, in the environment. Chromium (0) does not occur naturally and chromium (VI) occurs very rarely. It is a grey, lustrous, hard and brittle transition metal without having any taste or odor. Chromium (III) is an essential nutrient in our diet. Our bodies need only a very small amount of Chromium (III) whereas other forms of chromium are not so needed. Chromium is used for manufacturing steel and other alloys, bricks in furnaces, and dyes and pigments, and for chrome plating, leather tanning, and wood preserving. Chromium is blended with steel to make it hard and to make stainless steel. Other chromium-steel alloys are used to form armor plate, safes, ball bearings and cutting tools *etc.*

#### **Effects of chromium on our environment**

Chromium is released into air, water and soil through both natural processes and human activities such as manufacturing, disposal of products or chemicals containing chromium, or burning of fossil fuels. Chromium particles settle from air in less than 10 days and attaches

strongly to soil particles. Maximum amount of chromium sticks to dirt particles that fall to the bottom, finally moving from soil to groundwater and only a little amount of it dissolves in water. Chromium although, not known to deposit in the bodies of fish, can however destroy the gills of fish that swim near the point of discharge. In animals chromium can cause respiratory problems, a lower ability to fight disease, birth defects, infertility and tumor formation. Shortage of chromium (III) in human beings may cause heart diseases, disruptions of metabolisms and diabetes. However, the intake of excess amount of it can cause various health effects such as skin rashes *etc.* Chromium (VI) is dangerous typically for people who used to work in the steel and textile industry. People who have tobacco smoking tendency also have a higher chance of exposure to chromium. Chromium (VI) is also known to cause various health effects. When it is used as a compound in leather products, it can cause allergic reactions, such as skin rash, nose irritations and nosebleeds. Other health problems caused by it are ulcers, respiratory problems, weakened immune systems, kidney and liver damage, lung cancer *etc.*

### 2.1.7.3. Nickel

Nickel is the 24<sup>th</sup> most abundant mineral in the earth's crust. It is a naturally-occurring, hard, ductile, silvery white metal with a slight golden tinge and can be found in all types of soils. Nickel can undergo slow aerial oxidation at room temperature and is considered corrosion-resistant. It combines readily with other metals to form solid mixtures known as alloys. The most common nickel alloy is nickel-iron, used in making stainless steel. Other nickel alloys are used to manufacture coins, jewelry, plumbing and heating equipment, gas-turbine engines, and electrodes. Nickel also combines with chlorine, sulfur, and oxygen to form odourless or tasteless compounds having a characteristic green color with high water solubility. Nickel compounds are used for nickel plating, to color ceramics, and to make some batteries. They also act as catalysts to increase the rate of chemical reactions.

### Nickel and the environment

Nickel is found naturally in both food and water, and may be augmented by man-made pollution. Nickel from smoke sticks to small dust particles in the air and settles to the ground or is washed from the air by rain or snow. More than a month is required to eliminate nickel particles from the air. It may seep into groundwater in acidic soils. Nickel changes its form although it does not undergo decomposition. It doesn't store in the bodies of fish but may be stored in plants and land animals. In the workplace, people can be exposed to nickel by inhalation, ingestion, and contact with skin or eye. Nickel is not a cumulative poison, but higher doses or chronic inhalation exposure may be toxic or even carcinogenic. It may cause allergies often marked by itchy, red skin.

### 3. Organic contaminants

Herbicides, pesticides, plant and animal tissues which normally do detrimental effects on the environment are termed as organic contaminants. These types of contaminants basically comprise of dye, humic substances, phenolic compounds, petroleum, surfactants, pesticides, and pharmaceuticals and are powerful pollutants in wastewaters. These contaminants are compounds basically comprised of carbon, hydrogen, and other potential elements. The existence of organic contaminants in water normally produce hazardous chemicals during disinfection. Humic substances such as humic acid, fulvic acid, or humin, which generates from the decomposition of organic matter and pharmaceuticals such as antibiotics, are ample in farm wastewaters and these should be eliminated before release. Organic contaminants dissolve and accumulate in organic phases of animals and plants. However, the quantities of these contaminants in the environment depends on the bioaccumulation process. Bioaccumulation is the overall result of all uptake and loss processes, such as respiratory and dietary uptake, and loss by egestion, passive diffusion, metabolism, transfer to offspring and growth. When organisms absorb these contaminants, the bioaccumulation of the same significantly varies based on the organism's capability to customize the absorbed contaminant mixture.



Interestingly, some contaminants are preserved whereas water soluble or degradable ones are disposed of the body, ending up with no overall accumulation.

### 3.1. Sewage sludge

Sewage sludge<sup>29</sup> is the surplus semi-solid substance, that is produced as a by-product during sewage analysis of industrial or municipal wastewater and is not only fundamental settled organic and inorganic solids from the sewage, phosphorus precipitates, but also the biomass produced during aerobic, anoxic, and/or anaerobic degradation procedure. The sludge basically constitutes inorganic and organic process additives, which again comprises of 40-80% by dry weight, based on the extent and type of sludge treatment procedure. In domestic sewage, the organic part generates from human faecal material while certain industries can also contribute significantly to the organic loading. The organic component of sludge is a mixture of fats, proteins, carbohydrates, lignin, amino acids, sugars, celluloses, humic material, and fatty acids. Live and dead micro-organisms are composed of a remarkably high proportion of the organic material and provide a large surface area having greater number of active sites for sorption of lipophilic organic contaminants in the sludge. The properties of sludge depends on various factors such as origin (i.e., domestic, industrial, and mixed) and treatment

type. It differs in its physical (processability and handlability), chemical (presence of nutrients and contaminants), and biological parameters (microbialactivity and presence of pathogens). Application of post-treatment of the sewage sludge such as anaerobic digestion or aerobic composting can have a drastic effect on residual contaminant levels in case of their biodegradability. Over the years, the presence of more than 300 various diverse types of organic contaminants such as monocyclic aromatics, alkyl and aromatic amines/imines, organotin compounds, aliphatic hydrocarbons, carbonyls, haloethers, polycyclic aromatic hydrocarbons (PAHs), polychlorinatedbiphenyls (PCBs), polychlorinated dibenzo-para-dioxins and furans (PCDD/PCDF), pesticides and polymers of various types and surfactants within sewage sludge has been detected by several EU countries. Concentrations of these compounds ranges from the pg/kg to g/kg interval. Accumulation into the sludge from wastewater depends mainly upon sorption, degradation and volatilization. For most compounds, their presence in sludge will be influenced primarily by the presence of potential sources within the catchment of the wastewater treatment plant. Details of the concentration range of the main organic contaminants detected in sewage sludge are represented in **Table 1**.

**Table 1:** Summary of the properties, occurrence and transfer of the principal organic contaminants in sewage sludge<sup>30</sup>

Compound group	Physico-chemical properties	Concentration range in sludge (ds)	Degradation	Plant uptake
Polycyclic aromatic hydrocarbons (PAH)	limited water solubility, volatile to lipophilic	1-10mg/kg	Weeks to 10 years, strongly adsorbed by soil organic matter	Very poor, foliar absorption and root retention
Phthalate acid esters	generally lipophilic, hydrophobic and non-volatile	1-100mg/kg	Rapid, half life<50 days	root retention and translocated
Linear alkylbenzenesulphonate (LAS)	amphilic	50-15000mg/kg	Very rapid	Minimal
Alkyl phenols (NPE)	lipophilic	100-300mg/kg	Rapid <10 days	Minimal, root retention
Polychlorinated biphenyls (PCB)	low water solubility, highly lipophilic and semivolatile	1-20mg/kg	Very persistent, half life several years, strongly adsorbed by	root retention, foliar absorption, minimal root uptake and translocation

			soil matter	
Polychlorinated dibenzo- <i>p</i> -dioxins and furans (PCDD/F)	low water solubility, highly lipophilic and semivolatile	<few µg/kg	Very persistent, half life several years, strongly adsorbed by soil organic matter	root retention, foliar absorption, minimal root uptake and translocation
Organochlorine pesticides	lipophilic to hydrophilic, some volatile	few mg/kg	Slow, half life>1 year, loss by volatilization	root retention, translocation not important, foliar absorption
Monocyclic aromatics	water soluble and volatile	<1-20mg/kg	Rapid	Limited owing to low persistent, rapidly metabolized
Chlorobenzenes	water soluble/volatile to lipophilic	<0.1-50mg/kg	Lower MW compounds lost by volatilization, higher MW compounds persistent	Possible via roots and foliage, may be metabolized
Short-chained halogenated aliphatics	water soluble and volatile	<5mg/kg	Generally rapid loss by volatilization	foliar absorption and possible translocation
Aromatic and alkyl amines	water soluble and low volatility	<1mg/kg	Slow	Possible
Phenols	lipophilic and high water solubility	<5mg/kg	rapid	Possible via roots and foliage

### 3.2. Biosolids

Different types of treated sewage sludges that can be practiced as soil conditioner are known as biosolids.<sup>31</sup> The application of biosolids to agricultural soils is established as a benign agricultural process as it affords needful nutrients and organic matter which will be helpful for augmenting soil properties. Even though biosolids can provide a waste management pathway for sewage sludge but they are still considered as a disposal site for industrial and domestic chemicals that are segregated in solids during treatment of wastewater. It is already established about the existence of measurable concentrations of dioxins and pharmaceuticals in biosolids which has led to serious concerns about accumulation of dioxins and an array of emerging contaminants in soil. Although the occurrence of these contaminants in environment is typically less, but even then, toxicologists, epidemiologists, and risk assessment experts have proposed that the optimum levels of these contaminants can have adverse environmental consequences on a large scale. A combination of traditional physical, biological, and chemical processes involved in wastewater treatment for

removing solids, modern organic matter such as persistent organic pollutants, brominated flame retardants, fluorinated compounds (PFCS), or pharmaceuticals from the wastewater is not satisfactory. Hence some supplementary post treatments methods like thermal drying and composting are being implemented at a faster rate for the enhancement of sludge properties. Nonetheless, total purification of biosolids is quite difficult to accomplish, hence biosolids intended for land application may contain pathogens, heavy metals, persistent organic pollutants (POPs), and other “emerging contaminants” (ECs) consisting of veterinary medicines, nanomaterials, paints and coatings, pharmaceuticals and personal care products (PPCPs). The main spotlight of human/environmental worry has shifted from the “traditional” contaminants such as metals, dioxins, PCBs, and pesticides to PPCPs that penetrates the environment mainly through domestic routes, and finally ends up in biosolid. Although very less concentrations of these contaminants exist in the environment, but majority of these contaminants are found to have critical toxicological effect, especially as components of complex mixtures. The main

concern regarding the existence of organic contaminants in sludge is its ability to access into the human food chain by absorption into edible portions of crop plants. The increased level of human and other terrestrial organism's (birds, invertebrates, and livestock) exposure to organic pollutants and PPCPs occurs generally through the diet and the consumption of contaminated crop plants.

### 3.2.1. Persistent Organic Pollutants (POPs)

The POPs<sup>32</sup> are organic compounds that can resist photolytic, biological, and chemical degradation to a greater extent. Poor water solubility, large lipid solubility, long half-life in soils, sediments, air, or biota makes them highly potential agents for bioaccumulation. Large lipophilicity leads to the substance bio-settling from the surrounding medium into the organism coupled with environmental endurance and a protection to biological degradation. Due to this property, bio amplification of POPs occurs through the food chain. A major group of POPs is comprised of the halogenated hydrocarbons and organochlorines including industrial products like PCBs, PCDD, PCDD/Fs, and 15 pesticides. Among the POPs, dioxins (polychlorinated dibenzo-*p*-dioxins, PCDDs) and furans (polychlorinated dibenzofurans, PCDFs) are recognized as the most harmful chemical species. Different environmental processes such as oxidation, hydrolysis, and photolysis have no effect on the decomposition and conversion of POPs. The POPs have very optimum effect in polar regions, but may have significant effect in other parts of the world. Hence, the overall accumulation of POPs in the polar regions is very prominent. The transport of POPs to plants is significant due to strong absorption of these substances on soil and are hardly moved into plant roots or carried into plant tissues present above the ground. Although in small amounts, Many plant species such as lettuce, tomato, rice, maize, and soybean have the ability to absorb small amount of POPs through their roots. People and animals are exposed to carcinogenic POPs primarily through their diet, occupationally, or while growing in the womb, leading to developmental defects, breast cancer, endocrine disruption within the reproductive

system, the central nervous system, or the immune system, chronic illnesses, and death.

### 3.2.2. Pharmaceuticals and Personal Care Products (PPCPs)

Any kind of product used by individuals for personal health, cosmetic reasons, or practiced in agriculture to increase growth or health of livestock are known as pharmaceuticals and personal care products. Hence, a broad range of chemical substances including prescription and over-the-counter therapeutic drugs, veterinary drugs, fragrances, and cosmetics come under the periphery of the phrase PPCP. Unlike pharmaceuticals, personal care products are released to the environment after routine use during showering and bathing. PPCPs are likely to be present in treated wastewater sources including river, lakes, streams, and groundwater, used for drinking as well as agricultural purposes.<sup>33</sup> The extensively studied pharmaceutical groups include nonsteroidal anti-inflammatory drugs (NSAIDs), antibiotics, beta-blockers, antiepileptic drugs, blood lipid-lowering agents, antidepressants, hormones, antihistamines, and personal care products include triclosan and triclocarban. The study is based on the volume of prescriptions/use, extent of toxicity, and supporting proof for its presence in the environment. The frequently detected pharmaceutical groups in biosolids include anti-biotics, the NSAID, diclofenac, the anti-epileptic drug, carbamazepine and the blood lipid-lowering agent, gemfibrozil along with the personal care products triclosan and triclocarban. Although the up-take of PPCPs by plants is a well-known fact but the knowledge is limited to a few compounds or plants. Compounds with strong absorption and resistance to degradation persist in surface soils for long periods and have the potential to subsequently be up-taken by plants, and exhibit bio accumulative and endocrine disturbing activity.

### Biotic sources

#### 4. Greenhouse gases from fecal waste

Feces are type of biomass that can be transformed into energy by means of a range of mechanisms. Thermal and biochemical are the

two fundamental ways in which feces can be transformed to energy. Thermal processes involve the transmission of heat to the manure and subsequent conversion of biomass to chemical form by various mechanisms such as combustion, pyrolysis, gasification. Combustion of large number of carbon and hydrogen bonds present in the feces releases large amount of energy. Gasification process involves conversion of solid waste into a gaseous product, which readily undergo combustion and turned into energy. Biochemical process is generally practiced for wet waste, whereby anaerobic digestion by enzymes in bacteria take place, eventually decomposing the natural waste and producing biogas, a mixture of methane and carbon dioxide, which in turn can be transformed to energy.

Since last few year, emissions from livestock were found to be higher than that of the transportation sector. Through photosynthesis, the livestock feces are absorbed by plant and through respiration enter in the atmosphere as CO<sub>2</sub>. This type of situation gave evidence that greenhouse gases CH<sub>4</sub>, CO<sub>2</sub> and N<sub>2</sub>O were generated in environment due to burning of fossil fuels and has potential harmful effect on human health through a variety of pathways such as high frequency and intensity of heat waves, cold related deaths, increased floods and droughts *etc.* Indeed, the quantity of CH<sub>4</sub> from eructation of ruminant was higher than from the methanogenesis process in the feces. So, there has been an urgent need to substitute animal manures by fertilizers and to substitute other animal coproducts, because livestock now practice human-inedible food and fiber processing byproducts. Furthermore, people get a greater excess of energy, but still they suffer from a larger number of deficiencies in essential nutrients leading to greater obesity.

### 5. Biopesticides

Biopesticides are pesticides derived from natural materials such as animals, plants, microorganisms, certain minerals *etc.* and are used to regulate pests in agriculture by virtue of explicit biological effects rather than as extensive chemical pesticides. Biopesticides can be a potential replacement of traditional pesticides as they can curtail total agricultural

pollution as they are easy to handle and normally do not affect favorable invertebrates or vertebrates, and have a less half life. Biopesticides typically affect only the target pest and analogous organisms, whereas, commercial pesticides affect organisms like birds, insects and mammals.

### 6. Invasive species

The invasive species term generally attributes to all kind of living organism-an amphibian, plant, insect, fish, fungus, bacteria, or even an organism's seeds or eggs-which is not indigenous to an ecosystem and have a harmful effect. They are often large and small species which may pose serious risks and have disastrous effects on endemic wildlife, human health and economies. These invasive species have frightening impacts on our natural ecosystems and economy, costing billions of dollars every year. These species have the capacity of growing and reproducing at a higher rate, and spreading excessively, causing harm to environment. *Centaurea solstitialis*, an aggressively invasive weed, was apparently introduced to North America in polluted fodder seed. Agricultural practices like tilling and livestock grazing causes very fast spread of these species. These species decrease biodiversity, degrades natural ecosystems, prevents native plants from growing and creates a hurdle for movement of indigenous animals. The increased proliferation of agriculture has resulted in the unintended transit of pests, weeds, and diseases. For example, the transportation of bumble bees pollinators reared in Europe and shifted to the United States and Canada for commercial application has led to the introduction of an old parasite to the new world. This type of introduction mainly contributes to rapid declination of native bumble bee in North America. Agriculturally introduced species can also blend with native species causing a recession in genetic biodiversity, threatening agricultural production. Habitat disruption correlated with farming practices also promote the formulation of these introduced organisms. Polluted machinery, livestock and fodder, crop or pasture seed also contributes to the spread of weeds. Through biosecurity, prevention of the advancement of invasive species can be

administered at a regulated level. Biosecurity is a legal procedure that puts a restriction on the migration of invasive species from areas of their presence to areas of their absence. The World Trade Organization has laid down international regulations regarding biosecurity of pests and diseases under the agreement on the application of sanitary and phytosanitary measures.

### 7. Genetically modified organisms (GMO)

A GMO (genetically modified organism) or “transgenic” organisms are produced in laboratory, whereby genes from the DNA of one species are extracted and artificially inseminated into the genes of other non-related plant or animal. The foreign genes may migrate from bacteria, viruses, insects, animals or even humans causing an increased weediness of the plant or the total elimination of the native species. Moreover, the transgenic plant later on itself may become a weed again if the proper modification improves its robustness in a given environment. There are Some concerns are raised regarding poisoning of some non-target organisms, such as pollinators and natural enemies through accidental ingestion of plants. The use of GMO crop plants engineered for herbicide resistance can also indirectly enhance the extent of agricultural pollution. For example, the use of herbicide at a higher rate in herbicide-resistant corn fields in United States is reducing the quantity of milkweeds available for monarch butterfly larvae. Livestock are usually modified for high growth-rate, quality of milk composition and production, disease resistance and their long survival. Genetically modified fish are practiced for scientific research, as pets and as a food source. Genetic engineering has paved the way for controlling mosquitos, a vector for many deadly diseases. Taking into

consideration of relative advantages and disadvantages of the process regulation for the transmission of genetic modified organisms can vary depending upon the nature of organism and the concerned country.

### Conclusion

On the basis of a broad study of the emerging contaminants in agriculture as studied above, it is observed that the contaminants include pesticides, heavy metals, organic contaminants, biopesticides, greenhouse gases and genetically modified organisms. These compounds are generally found at very low concentrations in the wastewater, biosolids, fertilizers and manure used in agricultural systems. Furthermore, these contaminants enter the environment in various ways such as products that go down the drain from our homes, from industrial sources, and in the manure of livestock treated with antibiotics. Although extensive research and increased monitoring over the years has identified the presence of these compounds, very little is known about how these emerging contaminants move through the environment, or what impacts they may have on our environment over time. Although no sufficient data and large-scale evidence has proven causal associations between emerging contaminants and adverse effects on the human body, but it is always advisable not to ignore the harmful effects indicated by animal experiments. Further large-scale studies with improved designs are needed to provide more convincing and clear outcomes for the benefit of the ecosystems and our environment as a whole. Until and unless we come across any definite result of the impacts of these emerging contaminants on our environment, it will be a matter of great relief and an appreciated effort that we make only optimum use of these products.

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**A STUDY ON MIGRATORY BEHAVIOUR OF BIRDS AND REASON OF THEIR MIGRATION****S. Bedi<sup>1</sup> and S. Joshi<sup>2</sup>**<sup>1,2</sup>Department of Zoology, S.K.D University, Hanumangarh, Rajasthan, India<sup>1</sup>shwetabedi84@gmail.com, <sup>2</sup>swatiojhajoshi@rediffmail.**ABSTRACT**

*Moving behaviour of birds has been intensely studied for over a century now, but there is still mystery in migration, how it originated and how it evolved. Especially the use and evolution of migration routes seems to be a neglected element. Here a composition of the most widely used scientific information will be presented on migratory behaviour in birds. Most likely, migratory behaviour has evolved as a consequence of seasonal changes in food supplies. If migratory behaviour has evolved as a consequence of not enough food, also by competition, or if it has evolved in a search for more food in temperate areas, is still point of discussion. Although not all birds migrate, for the above or other reasons, all traits necessary for migrating, and thus the potential to do so, are present in all bird species.*

*Migratory routes probably have come forth out directional preferences which have become fixed by natural selection. Few birds cover the distance between their breeding and wintering grounds in a straight line, as large crossings from Europe into Africa, such as the Mediterranean Sea and the Sahara desert are avoided lowering the fuel transportation costs for birds and thus saves energy. However, migratory journeys also occur largely independent of geomorphological and landscape features i.e. broad-front migration. As many species use multiple migratory routes in Africa, there doesn't seem to be a real preferred migratory route among species. Instead it is believed here that the use of different routes is related to different populations of one species with different breeding grounds, therefore using other routes with respect to the distance they have to travel.*

**Keywords:** Evolution, Traits, Species, Natural Selection, Breeding, Migration

**Introduction**

Migration in birds has been a topic of interest to many researchers, as well as how this should be regulated and performed (Newton 1874; Wallace 1874; Pringle 1879). Though many researches have been performed since, especially with respect to the natural processes describe by Wallace (1874), there is still mystery in migration. Why birds migrate is still one of the most challenging questions in ornithology, despite a century of effort to frame a satisfactory answer (Gill 1994). About the evolution of migration Berthold (1999) states that "no one knows how bird migration began, or how it still may be evolving", and that this is "despite the tremendous theoretical efforts that have been made to explain it". How migration, but especially the routes used, developed and evolved seems to be a neglected element. Here, a composition on the available information so far on this element of migration will be made, as well as on the available information on the evolution of migration. To make an overview of how bird migration has evolved we will first try to identify the traits related to migration, how these have evolved and in turn the effect this had on the evolution of migration. The evolution of long distance and short distance migrations will be of special

interest here. Related to migration, this review will also focus on the use of different migration routes. For an examination on the development of migration routes, they will be looked into the case of migration in/from Europe to Africa used by many Eurasian birds (Berthold 1996). However, there are many migration routes that run from Europe to Africa, some which are even used by migrants from the far-east of Asia (Elphick 2007). Therefore three main routes of migration from Europe into Africa are selected and will receive special attention, namely migration over (1) the Strait of Gibraltar or Iberian Peninsula, over (2) Italy and Sicily, and over (3) Turkey (the Bosphorus) (Elphick 2007).

**Evolution of migration in various species**

Migration is actually a series of physiological and behavioural components (Zink 2002). Therefore it is equally important to discuss traits related to migration in search of how migration evolved. Among one of the first to addresses the subject the evolution of migration through related traits are Myers and Ketterson and Nolan Jr. As with the evolution of many traits, it was thought here also that a trade-off shaped the evolution patterns (including migration) of birds (Ketterson and Nolan Jr 1983). This can be derived from the



conclusion of Myers (1981), which is endorsed by Ketterson and Nolan (1983): "Where priority in time of arrival on the breeding range permits control of limiting resources there and a consequent gain in productivity, and where members of one class have more to gain by early arrival than do members of another, then the class with more to gain would be expected to evolve a migratory schedule and/or a non breeding distribution that promotes priority of arrival, provided the gain is great enough to counteract any costs associated with that schedule or distribution". However, as the benefits of early arrival are elaborated upon, the "costs" of migrating are not further discussed here. Newton (2008) agrees with the importance of timing with regard to breeding, among others. Migration cannot be seen apart from two other major events in the annual calendar of birds as well, namely breeding and moult (Newton 2008). As these vary in timing, the sequence they occur, as well as the extent in which they overlap between species (Newton 2008) the evolutionary pathways of these traits are immediately important with respect to the evolution of migration. Another important trait Myers calls attention upon is the importance of social behaviour in migrating, which is also underpinned by Newton (2008) as being an important factor. One of the main problems according to Berthold (1996), however, is differentiating between social and individual behaviour initiating migration. Birds which run a greater risk at being predated upon, are likely to migrate under social behaviour, to save energy and for safety reasons which both relate to travelling in groups. Individual behaviour is expected to occur more often in birds of prey for example, which migrate using thermals and are therefore only expected in concentrated number near bottle necks (Siepel, 2013). Large numbers of birds which migrate from the far-east of Asia west to the coastline also impose a social effect on others and might affect their migration direction/route, although the main reason for the first migrants from the far-east to Europe, of course, is not socially driven, but has a more practical reason. The first migrants usually want to spend the winter where it is ice-free. Winters (at the coast) of Western-Europe on the same latitude as the far-east, are usually

ice-free, as these are warmed by the Gulf stream (Elphick 2007). So arrival time and social behaviour are already two traits which seem to affect migration. However, there are many more traits, especially those needed to migrate in the first place such as extraordinary navigational skills, massive body reserves to fuel flights, coupled with sustained non-stop effort for many hours at a time, cope with less oxygen in the thinner atmosphere, respond to prevailing ether and correct for off-course drift, lengths of journey influenced by body size, wing size and flight powers (Alerstam 2001; Newton 2008), but also for example a larger immune system (Møller and Erritzøe 1998). For the sake of the length of this paper, not all these traits will be discussed here, but to give an impression on how some of these traits affect migration there will be elaborated on body size, wing size/design, fuel reserves and mode of flight and how these are related to each other. Body size, fuel reserves, mode of flight and wing design A major factor of importance for migration is body size, as this does not only influences the weights that the wings have to support/uphold during flight, but also determines the fuel reserves birds carry with them. Body size constrains migration in birds. With increasing body mass, flight cost increase, as does flight efficiency (energy cost per unit weight) and flight speed, but the amount of fuel (relative to body weight) that can be carried declines, reducing the maximum possible non-stop flight range (Newton 2008). From this it can be concluded that smaller birds are better fitted and therefore more likely to be among the long-distance migrating birds. Indeed, average female body weight decreases from residents, to short-distance migrants, to long distance migrants (unpublished data, Siepel & Van Turnhout, n.d.). Between heavier and lighter bird species there is also a difference in mode of flight, as heavier birds tend to migrate more often using gliding-soaring flight, while lighter species also migrate using flapping flight. The existence of thermals or other rising air currents is therefore of greater importance to heavier birds compared to lighter birds, and thus affects migration (especially the route, see below). Also, for mode of flight counts that the energy flows through the animal must at every stage

be consistent with the physiological and mechanical demands of locomotion, while the mechanical demands made by flight on anatomy and morphology must not be so excessive as to make the animal ecological non-viable. In this way natural selection and the environmental interactions experienced by the bird act to control the evolution of flight adaptations (Rayner 1985). Wing design has additional influence on flight speed efficiency, but seems to be influenced as much by the needs of everyday life as by those of migration. Wing design, as well as mode of flight, is of importance as this influences the efficiency with which bird can migrate, but simultaneously influences the daily life of birds with regard to habitat, foraging habitats and predator evasion (Newton 2008).

### **The origin and evolution of migration**

An important aspect with regard to the evolution of migration, is that it has evolved many times independently in birds (Farner 1950). More than 60 years ago, Farner (1950) already mentioned that the tendency to regard all migration as having a common origin, or at least, as the result of the same factors, to be one of the pitfalls associated with the interpretation of experimental data and observations relating to migration. He states that this assumption may be true but the available evidence, at present, generally indicates it to be improbable (Farner 1950). Though the assumption of migratory behaviour having evolved in bird multiple times, is endorsed also by others more recently (Berthold 1996), this still does not give an idea of when migration in birds first appeared. According to Alerstam 'bird migration has no doubt existed for as long as birds have been present on earth, for more than 100 million years' (Alerstam (1990) as cited in Berthold (1996)). Berthold does not give his own opinion on the matter, as not all is known of the fossil birds, but does state to find evidence of flightless *Hesperornis*, which lived 80 million years ago, to be migratory already (Berthold 1996; Berthold 2001). Another important aspect to take into account when talking about migrating and its evolution is that there is not a strict distinction between species in being migratory or being sedentary (Pulido

et al. 1996; Newton 2008). Not only is there a distinction between species in the distance birds migrate, leading to birds being split in short-distance migrant (Berthold (1996) also includes a middle-distance) and long-distance migrant (Van Turnhout et al. 2010; Siepel & Van Turnhout, n.d. ; Van Turnhout et al. 2012), but there are also differences to be found within species and even populations in migratory behaviour (Berthold 1999; Newton 2008). Many widely distributed bird species are completely migratory in the north of their breeding range, completely resident in the south, and partially migratory in between, with the proportion of birds leaving any particular locality corresponding to the degree of seasonal reduction in food supplies (Newton 2008). For example *Serinus* (*Serinus serinus*) populations in Europe can be found to be obligate sedentary, partial migratory or obligate migratory, depending on the latitude the population is found (Berthold 1999). Different points of view are also involved here, in what Salewski and Bruderer (2007) call the "northern-home-theory" and "southern-home-theory". The "northern-home-theory" assumes that due to climate changes, birds had to shift their non-breeding activities away from high latitude breeding grounds. The "southern-home-theory" assumes that bird migration evolved in tropical species that started to breed at higher latitudes (Salewski and Bruderer 2007). Besides of this, populations that were once migratory can, under influences of weather and temperature, become sedentary over time and vice versa (Berthold 1999). This implies that species that have genes for being both migratory and sedentary, are able to switch between these two behaviours rapidly and that this happens for an important part under the selection of the environment/temperature (Berthold 1999; Newton 2008). Berthold goes even further by stating the following: "I think there is a simple explanation that actually accounts for all phenomena of bird migration that have evolved independently several times or even thousands of times. It is partial migration, or more precisely, a disposition towards partial migratory behaviour, which means the possession of genes for migrating as well as genes for not migrating. A two-track

predisposition like this could enable any behaviour within the whole range to be expressed rapidly when needed. A population might thus comprise both migratory and sedentary birds, in whatever proportions, or might be (almost) purely sedentary or purely migratory (Berthold 1999)". In other words Berthold is convinced that all migration of birds, as well as the entire range between being sedentary or migratory is regulated on the gene level. Furthermore Berthold and Pulido believe there is a threshold model that decided whether birds migrate or stay as residents (Pulido et al. 1996; Pulido and Berthold 2003). According to the threshold model, all birds without phenotypic migratory activity have activity levels below a limit of expression or detection. The expression of migratory activity is then subject to selective pressures (Salewski and Bruderer 2007). As a consequence every bird population is always partially migratory/sedentary, as described above, from close to 0 (fully resident) to 1 (fully migratory) (Berthold 1999; Salewski and Bruderer 2007). However, the way in which migration evolved, does not explain the cause of the evolution of bird migration. Two possibilities are already mentioned above, (1) seasonal reduction on food supplies (Newton 2008) and (2) influence of the weather, temperature, climate (Berthold 1999; Newton 2008). Rappole (1995, as cited in Berthold (2001)) summarized all known theories on the causes of the development of bird migration. Here seasonal changes in resources and the influence of weather and temperature (environment/climatic changes) can make up for all eight theories, more or less (Rappole (1995), as cited in Berthold (2001)). However, according to Salewski and Bruderer (2007), a brief review on how migration evolved points out that a seasonal environment with variation in resource availability and competition are the two main factors discussed as being crucial to the evolution of migration. Salewski and Bruderer (2007) concluded, that most recent studies state migration as being the result of exploiting seasonal resources in temperate regions for breeding (for further reading, see Salewski and Bruderer (2007). Assuming that migration has evolved as an adaptation in seasonal environments, it may have been an important aspect of bird

behaviour for a long time. It may have occurred, or even developed, in the earliest of species (Alerstam 1990) to deal with the ice ages, which, at least in the northern hemisphere, played an major role in the development of migration (Newton 2008). But if migration is so important, this is inconsistent with the fact that some bird species are only partially migrants. According to Newton it works like describe below in short (for a complete description see Newton (2008)). Entirely migratory or resident behaviour is usually considered obligatory and under firm genetic control. In contrast, partial migration can arise in two different ways. One way is a mix of "obligatory migratory" and "obligatory resident" individuals. The second way is a group of individuals in which their behaviour is optional (facultative): staying in the breeding area in years when conditions are favorable and leaving in other years (Newton 2008). In the latter system, birds seem to be somehow capable of predicting how good the upcoming period will be for them, which with right can be called a remarkable ability. But, how is it possible that birds, after drawing a conclusion, are able to choose between staying or leaving? One might think that migrating would take a lot of effort and preparation, but if a decision can only be made last-minute, this is probably not the case. The solution to this problem is simple, all traits necessary for migrating are already present in birds and thus all birds possess the potential to migrate (Salewski and Bruderer 2007; Newton 2008). Although migration requires adaptations in morphology, physiology and behaviour, all intermediate stages of migration are presents in birds, even within species or populations (Berthold 1999; Newton 2008). Further, the main adaptations needed for long-distance migration, such as seasonal fat reserves, timing mechanisms and orientation skills, are all found in less developed form in non-migratory birds (Berthold 1996), as well as other animals (Newton 2008). An explanation with regard to building up a fat reserve, can be its necessity to survive a cold, food scarce winter, as well as migrating (Siepel, 2013). Also the ability to return to the breeding sites has been shown repeatedly in displacement experiments, even among resident birds (Berthold 1996). Some

adaptations might be needed for long distance flight, but in total there are no dramatic changes needed (Salewski and Bruderer 2007). This is consistent with stating that birds can become migratory/sedentary under the influence of genes only, as all other necessity are already present at some level in all birds (Berthold 1996; 1999).

### **Routes of migration in World Scenario**

Now that the origin and evolution of migration have been discussed, the focus will be on the use of different migration routes. In this case three migration routes from Europe into Africa are considered, namely migration over (1) the Strait of Gibraltar or Iberian Peninsula, over (2) Italy and Sicily, and over (3) Turkey (the Bosphorus) will be considered. Some migrants also pass over Greece and/or her islands like Crete, but fewer do so, with consideration to the other routes (Elphick 2007). In general the need to migrate has been addressed above and one might say that birds migrate because of seasonal differences in food availability between Africa and Europe, but there is no way that birds were able to know this before they started to migrate. So how did this directional preference from the north to the south evolved? Newton (2008) hypothesized that it is caused by a form of natural selection. If the chances of survival while moving south are more favorable compared to moving north, the number of individuals that will survive and reproduce is larger for the migrants that moved south. In this way, over generations directional preferences could become fixed by natural selection. Not only direction, but also distance can become fixed in this same way (Newton 2008). In crossing experiments between migrants and residents it is found that migratory activity or the migratory drive at the moment can be genetically transferred to the offspring (Berthold 1999). In more than 15 species, the triggering of migration has been found to depend on endogenous annual periodicity (Berthold 1999). Another important factor for migration is deteriorating environmental conditions (Berthold 1999), but these species are not affected by that, as some leave so early that the summer is still at its peak. However, the genetically fixed preferences is primarily directional and not for

an entire route. Individual migrants like young cuckoos, are of course provided with enough information to perform the entire migratory journey themselves and so are many others as they do not receive any help with this from their parents (Elphick 2007). In species where the migration is initiated by social behaviour and migration occurs in groups, newborns are able to learn the route to take when migrating. Perdeck (1958, as cited in Berthold (1996)) performed an experiment with juveniles and adults starlings that got displaced during their migratory journey. The results showed that the adults were able to correct for the displacement and found their original familiar winter quarters, but juveniles followed their prefixed migration route and reached new sites in on the Iberian Peninsula for example. In this way Perdecks experiment shows that juveniles have a prefixed migration route, but that a learning process/familiarity is also needed for juveniles to find out where their exact winter quarters are. A large amount of species migrating from Europe into Africa during the winter, use all three routes to migrate into Africa and do not seem to make a real distinction between these (Elphick 2007). However, one might wonder why these routes, which are actually "detours", are taken instead of flying strait to the destination (Berthold 1996). After all, long barrier crossings such as the Mediterranean Sea and the Sahara desert are within the birds' potential flight range capacity (Alerstam 2001). It appears that the main reason for using these routes is the energy that is saved by it, as longer crossings take more fuel and therefore higher fuel transportation costs (Alerstam 2001). Although detours mean a longer flight travel, a considerable amount of energy is saved, compared to crossings these barriers in one go (Alerstam 2001). Alerstam (2001) calculated that these detours are favorable for warblers that migrate from South Scandinavia to West Africa via the Iberian Peninsula, but also for Red-backed shrikes (*Anius collurio*) migrating between southeastern France and Tanzania via the eastern Mediterranean region (also crossing Turkey). In other words, the three migration routes selected for their frequent use, are used this frequently because of the energy that is saved by these detours avoiding (large) barrier

crossings and high fuel transportation costs (Alerstam 2001). Furthermore larger soaring land bird species that migrate through soaring instead of flapping flight, depend on thermals or other rising air currents and therefore these birds often take roundabout routes avoiding long water crossings as well (Newton 2008). However, as a large amount of species use all three (or four, Greece included) routes to migrate into Africa, it seems that there are not many species with a real preferences to one of these routes. The crossing at the Strait of Gibraltar, is popular among many migrants, but this is likely to be because in this way the most energy with respect to fuel transport costs is saved. Furthermore many species of which migrants cross the Strait of Gibraltar, also use other migratory routes into Africa (Elphick 2007), leading to the conclusion there is not ideal or perfect migratory route. The fact that migratory individuals of species use different routes probably originated from the fact that different populations of a species have different breeding grounds, which makes other routes more favorable for them, also with respect to the distance they have to travel. While Berthold (1996) also states that 'relatively few birds cover the distance between their breeding grounds and winter quarters in a straight line', he also makes another important notion. According to him there are also many birds that perform their migratory journey independently of geomorphological and landscape features, i.e. broad-front migration (Berthold 1996). Although this seems contrary to the statements of Alerstam and Newton, he continues with saying that 'others regularly use specific coasts, rivers, mountain ridges or possible chains of oases as guide lines or leading lines and move on in so-called flyways or migration corridors, i.e. narrow-front or small-front behaviour. According to Berthold (1996), intermediate forms may result in what he calls 'guided broad fronts'. After concentrated migration through such narrow-front, dispersive migration normally occurs which distributes individuals again over wider areas to winter or breed. An illustrative example is the concentrated funnel-shaped migration of many European species towards southern Spain around Gibraltar and the dispersive fan-shaped migration towards the

African winter quarters thereafter (Berthold 1996). Beside the energy costs there are many other factors affecting the costs and benefits of alternative migration routes, like differences in winds and weather, drift and disorientation, stopover and fuel deposition conditions, risks of starvation, predation and in costs of transport (Alerstam 2001). Energy cost of transport for a 230-hour 7500-kilometer flight from Antarctica to Chile for Sanderlings for example, matches the cost of living one midwinter month in Northern California (Gill 1994). Predation does not only occur by diurnal predator such as Eleonora's Falcon, but also by men which trap or shoot large number of songbirds and raptors trying to migrate to Africa, especially in the Mediterranean region (Gill 1994; Elphick 2007). In addition, migration routes may be constrained to some (as yet unknown) degree according to the orientation principles used by the birds and to the historic process of geographic range expansion and colonization (Sutherland (1998) as cited in Alerstam (2001). Because of all these cost, the benefits of migration must be and are substantial (Alerstam 1990; Gill 1994). However, the benefits of migration lie beyond the scope of this thesis.

### Conclusion and result

Migratory behaviour has and is being intensely studied for over a century, by an ever growing group of scientist and researchers. The amount of literature on migration, in the broadest sentence, is almost limitless. Although the efforts made, there still is mystery in migration, how it originated and how it evolved. Most likely, migratory behaviour has evolved as a consequence of seasonal changes in food supplies. If migratory behaviour has evolved as a consequence of not enough food, also by competition, or if it has evolved in a search for more food in temperate areas (for further reading, see Salewski and Bruderer (2007)), is still a point of discussion. In any case all traits necessary for migrating are already present in birds and thus all birds possess the potential to migrate (Salewski and Bruderer 2007; Newton 2008). This potential can be enhanced by regulation on the gene level, influenced by environmental factors. Possible there is a threshold present in every bird, which when

exceeded result in migration (Pulido et al. 1996; Berthold 1999; Salewski and Bruderer 2007). While migrating, some species save energy by taking detours and thus avoiding long crossings which take more fuel and therefore have higher fuel transportation costs. Large birds which migrate depend on thermals or other rising air currents and therefore these birds often take roundabout routes avoiding long water crossings as well (Newton 2008). In total there is no real difference between the three migration routes, as a large amount of species migrating from Europe into Africa during the winter, use all three routes to

migrate into Africa and make no real distinction between these (Elphick 2007). Probably on an individual level, birds will not use all three (or four, Greece and Crete included) routes, but as populations of a species are spread through Europe, the chance of an entire species using all three routes increases. For the sake of the length of this thesis, not all aspect of bird migration could or were treated. Therefore, beside the more interested in this subject: Alerstam (1990), Berthold (1996), Berthold (2001) and Newton (2008)

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## “PANDEMIC IMPACT OF BURNOUT ON TEACHER’S ATTITUDE TOWARDS TEACHING PROFESSION”

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### ABSTRACT

Teacher play an eminent role in shaping the destiny of the nation. He must be well adjusted with his profession. A burnout teacher is capable of producing numerous frustrated students. He must have positive attitude towards his teaching. The present study was aimed to investigate the Pandemic Impact of Burnout on Teacher’s Attitude of Secondary Schools. The Objectives of study are (1) To study the impact of different dimensions of burnout namely Non-accomplishment, Depersonalization, and Emotional Exhaustion on teacher attitude of secondary schools. (2) To study the impact of different dimensions of burnout namely Friction, Task Avoidance, and Distancing on teacher attitude of secondary schools. The study was conducted on the 100 secondary school teachers from 20 secondary school of Ghaziabad District of Uttar Pradesh (India). The descriptive survey method was used in the study. The sample of the study has been drawn by using stratified random sampling method. Burnout Inventory developed by Karuna Shankar Mishra and Teacher Attitude Inventory (TAI) by S.P. Ahluwalia was used as research tools. Data was analyzed using Mean, S.D and t test. The findings revealed that Non-accomplishment, Depersonalization, Emotional Exhaustion and Distancing dimensions of burnout have negative impact on the attitude of secondary school teachers during Covid-19. It also may be concluded that Friction and Task Avoidance dimensions of Burnout has not any impact on the attitude of secondary school teachers during Covid-19.

**Keywords:** Burnout, Teacher attitude, Teaching profession ,Covid-19.

### Introduction

The teacher is the most critical part of our teaching method. Since students and educational programmes are the cornerstone of a nation and the teacher has affected both of them even more than other elements. A teacher has to consider this career without any requirements and do the job with great dedication to be successful in the teaching profession (Cetin, 2006). The lives of individuals have been influenced by their chosen occupation (Bozdogan, Aydın, & Yıldırım, 2007). The COVID-19 pandemic has impacted the entire educational system worldwide. All schools, universities and colleges had been shut down. (UNESCO, 2020-03-04. Retrieved 2020-05-24.) In the aftermath of COVID-19, the rapid transition from in-person teaching to remote learning, including the disruption of existing instructional programmes and routines, poses unrivalled challenges for all educators. Citizens around the world face terror, anxiety and different issues caused by the spread of COVID-19 (NCIRD 2020).

Teachers' challenges were found to be related to their ability to conduct remote/online learning due to the degree of their knowledge and abilities in the use of technology, their

access to technology, and at-home isolation. In particular, countries which prior to current circumstances declared extremely low-level use of classroom technology have reported such concerns. (UNESCO, March,2020). As a result of shifting teaching to the online format, teachers in various parts of the world have raised their level of stress and anxiety (ibid. 2020). Burnout is most significant concern in modern times. In the words of Freudenberger (1974), burnout is characterised as an individual's wearing out, ineffectiveness, loss of energy and strength, and fatigue due to unmet needs. The negative psychological experience is a burnout that is a work-related response to stress. It is also an occupational hazard that is open to all members of the supporting professions, including teachers.

In addition to skills and expertise, affective competence was required by teaching. All teaching-related variables were influenced by the creation of a positive attitude towards profession of teaching. (Can, 2010).

The most important thing, therefore, is to make their behavior constructive and to decide their future career (Semerci & Semerci, 2004).

The most helpful occupation in the field of education with a high risk of burnout is considered the teaching profession during

Covid-19 (Schaufeli, Leiter, & Maslach, 2008). Due to their management of student learning difficulties and aggressive acts, the main risk of burnout for teachers is violent actions (Pepe & Addimando, 2013), peer rivalry and uncertainty, dynamic parent relationships (Pepe & Addimando, 2014), time constraints and enormous periods (Chan, 2003; Genoud, Brodard, & Reicherts, 2009).

Knowledge of teacher burnout with their attitude towards teaching in Delhi NCR will be helpful for educating the people. Burnout is reduced with their favorable attitude. This would boost the picture of teaching profession and therefore will attract other researcher as well. There is a need to encourage an atmosphere that facilitates collaborative efforts among teachers. So the present study was aimed to study the impact of Burnout on teacher attitude during covid-19. So justification of this study is derived from drawback of previous researches.

### Objectives

1. To study the impact of different dimensions of burnout namely Non-accomplishment, Depersonalization, and Emotional Exhaustion on teacher attitude of secondary schools.
2. To study the impact of different dimensions of burnout namely Friction, Task avoidance, and Distancing on teacher attitude of secondary schools.

### Hypothesis of the study

In order to achieve the above objectives, the underlying hypotheses have been formulated and tested.

1. No significant difference is exists in different dimensions of burnout namely Non-accomplishment, Depersonalization and Emotional Exhaustion among teacher attitude of secondary schools.
2. No significant difference is exists in different dimensions of burnout namely Friction, Task Avoidance, and Distancing among teacher attitude of secondary schools.

### Research Methodology

**Research Design:** Researcher had applied Descriptive method in this work.

### Research Tools

1. **Karuna Shankar Misra's Inventory of Burnout.(2005)** In order to measure the Teacher Burnout of teachers the investigator adopted the Burnout Inventory developed by Karuna Shankar Misra. This test contains 48 items and divided in eight areas. Each area represents one dimension of Teacher Burnout of secondary school teachers i.e. Non-accomplishment, Depersonalization, Emotional Exhaustion, Friction, Task Avoidance, Distancing, Neglecting and Easy Going.
2. **S.P. Ahluwalia's Inventory of Teacher Attitude (TAI), (2008):** 90 items have been introduced in the teacher attitude inventory. 43 items are favourable and 47 items are unfavourable. It measures the child centred practices, educational process pupils' understanding, classroom teaching, attitude of teacher towards teaching profession, and teacher's self concept.

**Study Sample:** A sample of 100 teachers from 20 senior secondary schools of Ghaziabad District of Uttar Pradesh (India) were focused for study.

**Analysis of Data:** Mean, SD along with t-ratio was used for analyzing the data for comparing Burnout with reference to different dimensions towards Attitude of teachers.

### Results and interpretation of the study

As the study was focused on the impact of Burnout on teacher attitude of secondary schools. The attitude of secondary school teachers were classified into favorable and unfavorable attitude. In order to test the 1<sup>st</sup> and 2<sup>nd</sup> hypothesis t test was used to compare the impact of burnout on favorable and unfavorable attitude of secondary school teachers.

### Analysis and Interpretation of Hypothesis-1

In order to verify the hypothesis that "There exists no significant difference in different dimensions of burnout namely Non-accomplishment, Depersonalization and Emotional Exhaustion among teacher attitude of secondary schools" The mean, standard deviation and 't' value of the two groups (favorable and unfavorable attitude teachers) is calculated as shown in the table no-1.



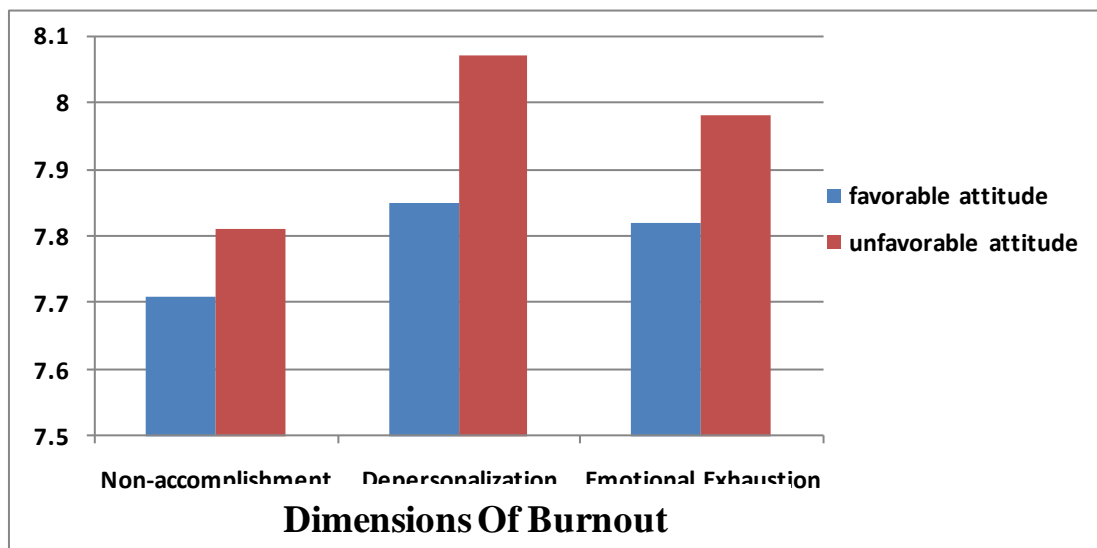
S.N.	Variables/Dimensions Of Burnout	attitude of Secondary School Teachers				t-value	Significant t Level
		favorable attitude		unfavorable attitude			
		Mean	SD	Mean	SD		
1	Non-accomplishment	34.25	7.71	32.01	7.81	2.97**	Significant t
2	Depersonalization	38.45	7.85	37.86	8.07	3.42**	Significant t
3	Emotional Exhaustion	39.32	7.82	38.11	7.98	3.11**	Significant t

On non accomplishment ,depersonalization and emotional exhaustion dimensions of burnout, the t-values, measuring the signifiacance of the mean difference between favourable and unfavourable attitudes of secondary school teachers, were 2.97, 3.42 and 3.11. At levels of 0.01, these t-values had been significant. Therefore, the hypothesis that there

is no significant difference between teacher attitudes of secondary schools in various dimensions of burnout, namely **Non-accomplishment, Depersonalization and Emotional Exhaustion**, was rejected for Burnout's dimensions of Non-accomplishment, Depersonalization and Emotional Exhaustion

Chart-1

Impact of Non-accomplishment, Depersonalization and Emotional Exhaustion on favorable and unfavorable attitude of Secondary School Teachers during Covid-19



The significant t-value between favorable and unfavorable attitude of teachers indicate that favorable and unfavorable attitude of teachers differ significantly in different dimensions of Burnout. Thus, it may be concluded that **Non-accomplishment, Depersonalization and Emotional Exhaustion** wise the unfavorable attitude of secondary school teachers have

significantly higher level in comparison to favorable attitude towards teaching during Covid-19.Hence **Non-accomplishment, Depersonalization and Emotional Exhaustion** dimensions of burnout have negative impact on the attitude of secondary school teachers during Covid-19.

Analysis and Interpretation of Hypothesis-2

**Table 2**

S.N.	Variables/Dimensions Of Burnout	attitude of Secondary School Teachers				t-value	Significant Level
		favorable attitude		unfavorable attitude			
		Mean	SD	Mean	SD		
1	Friction	35.72	8.23	40.17	13.04	2.04.	Not Significant
2	Task Avoidance	22.01	7.43	25.37	9.02	1.89	Not Significant
3	Distancing	31.63	9.83	42.01	8.67	3.42**	Significant

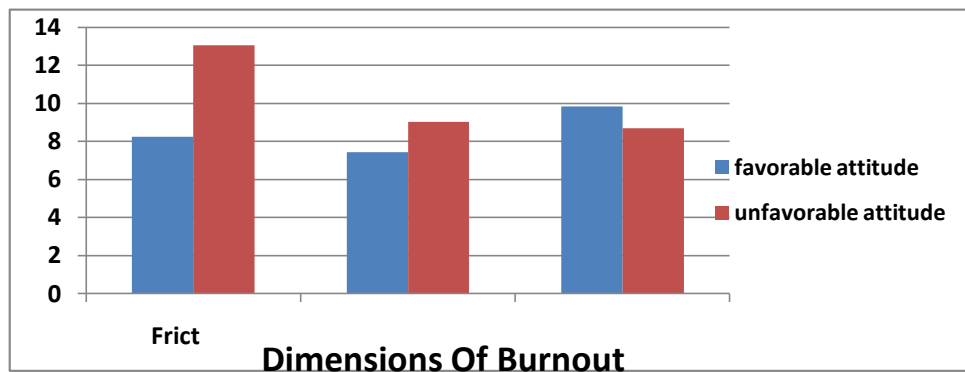
\*\* Significant at 0.01 level.

The t-values between favorable and unfavorable attitude of teachers on the **Friction and Task Avoidance** dimensions of Burnout came out to be 2.04 and 1.9. These t-values had not been significant with 0.01 levels. Thus, the hypothesis that there is no significant difference in various dimensions of burnout i.e. Friction, Task Avoidance, and Distancing among teacher attitude of secondary schools was accepted for Friction, Task Avoidance dimensions.

The t-values between favorable and unfavorable attitude of teachers on the **Distancing** dimension of Burnout came out to be **3.42**. This t-value was significant at 0.01 levels. Therefore, the hypothesis that there exists no significant difference in different dimensions of burnout i.e Friction, Task Avoidance, and Distancing among teacher attitude of secondary schools was rejected for **Distancing** dimension of burnout.

**Chart-2**

**Impact of Friction, Task Avoidance, and Distancing on favorable and unfavorable attitude**



Thus, it may be concluded that **Friction and Task Avoidance** dimensions of Burnout has not any impact on the secondary school teachers attitude during Covid-19. It also may be concluded that **Distancing** dimension of burnout wise the unfavorable attitude of secondary school teachers have significantly higher level in comparison to favorable attitude towards teaching. Hence **Distancing** dimension of burnout has negative effect on the attitude of secondary school teachers during Covid-19.

The findings of the study would be beneficial for administrators, managers and educators by concentrating during Covid-19 on reducing the negative effect of burnout on different dimensions of teaching attitude in the field of school education.

During online courses, educational administrators can create a cooperative, versatile and welcoming environment by offering support systems.

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## SURVEY OF KNOWLEDGE MANAGEMENT PRACTICES IN SELECTED TYRE COMPANIES DISTRIBUTED ACROSS TAMILNADU

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### Introduction

To gain a sustainable competitive advantage in this dynamic and competitive market, knowledge management is inevitable since it will help the organization in better managing the external and the internal factors in a way that maximizes the profit to the organization (Villar et al., 2014). In an integrated market given the world is globalized to an unimaginable extent, one has to look through the prism of everchanging market needs which helps in efficient use of knowledge management of the organization (Hsu, Lien, & Chen, 2013; Luo, 2002; Luo & Rui, 2009; Prange & Verdier, 2011). In order to overcome the competitors in this contemporary business, a new set of strategies has to be adopted by the companies. The most important among them is to implement the concept of knowledge management. The concept knowledge management includes the strategies, and utilizing the potential of knowledge to the fullest in order to sustain the growth of the organization (Shankar et al., 2006).

### Review of recent empirical literatures

The study on the Turkish SMEs reveal that a conservative organization which prevents the outflow of knowledge cannot grow in the long run given the level of globalization and a dynamic market. Since, the competition is not healthy and also the researchers has considered four important aspects such as training and mentoring their employees, organizational culture, knowledge management practices and acquisition of knowledge and their impact on the success of Turkish SMEs (Bozbura, 2007). The linkage between the performance of firm and KM practices was studied by Marqués & Garrigós-Simón, (2006) on 222 Spanish firms by testing the theoretical relations empirically. By considering six dimensions of KM he found that there is a positive incidence on the performance of the companies when there is an

effective KM practice in the company. It also helps the managers in better managing the affairs of the company. The KM practices in four UK construction companies reveal that those who have international presence are way ahead of their national counterparts in implementing the KM practices revealing that MNCs understand the importance of knowledge acquisition and utilization. Also, they proposed a STEPS model in KM practices wherein it brings out the KM maturity stages into five stages. They also explained the importance of having an organized KM structure which in turn will help in increasing the performance of the companies (Robinson et al., 2005). Robertson & O'Malley Hammersley, (2000) interestingly studied the most important dimension about the involvement of humans in the KM practices. They clearly pointed out how the evolution of HR recruiters helped in hiring experts and mainly this is because the need for knowledge was felt by the professionals. Also, how knowledge management helps in training and development was also explained. The single most important strategy for any multinational company is to retain the performing employee. For this retention strategy, it is important for a company to have knowledge from the cultural context. This in turn will also helps the employers in gaining the trust of the workforce which in turn will help in increasing the productivity of the company. The knowledge sharing is a prominent mechanism through which organizational goals can be attained and hence a reward should be put in place for knowledge sharing. Finally, the role of information technology was brought into the scenario in handling KM. The KM process in terms of leadership, technology and other important aspects in software engineering companies reveal that even though knowledge sharing through personal networks happens there should be more formalised knowledge sharing mechanism in order to sustain this

dynamic business environment. (Aurum et al., 2008)

### Objectives of the study

1. To find out the knowledge management practices in the tyre manufacturing companies.
2. To evaluate the opinions of the respondents across a set of knowledge management practices.
3. To establish relationship between the parameters considered for the knowledge management.

### Research Hypothesis

H<sub>1</sub> : There is a difference of opinion among the respondents based on the location of the organization in which they work and the knowledge management practices.

H<sub>2</sub> : There is a difference of opinion among the respondents based on the company in which they work and the knowledge management practices.

### Research Methodology

#### Source of Data

A well-structured questionnaire, which did not ask for the personal details and with apt questions regarding the knowledge management practices was framed to collect responses. Most of these questions were framed on a five-point Likert scale so that necessary statistical tool can be used. The tyre manufacturing companies were selected from almost all zones of Tamil Nadu spreading across five districts namely, Chennai, Madurai, Coimbatore, Tirunelveli and Trichy. A total of 350 questionnaires in the form of google forms were emailed to different tyre manufacturing industries throughout the state. Out of the 350 questionnaires emailed only 52 questionnaires were to be found usable. This gives an effective response rate of around 15 per cent

#### Analytical tools used in the study

To find out the distribution of respondents, we plotted a pie chart and frequency table. Then the statistical tool one-way ANOVA was used to measure the practices prevalent across the manufacturing companies. Finally, correlation was used to find out the existence of

relationship amongst the variables considered for the practices of knowledge managements.

### Findings of the survey and discussion

Before getting into findings, let's get to know about the variables considered for the study. The questionnaire captured two demographic details which disclosed the location of district and the second being about the company in which the respondent is working. The districts considered here five namely, Chennai, Madurai, Coimbatore, Tirunelveli and Trichy. The companies considered here are MRF, Michelin, Apollo and TVS. To measure the knowledge management practices there are nine variables proxied which are the following 1. can easily access information, 2. helps me in increasing my performance, 3. employees can participate in improving the knowledge management, 4. feedback is used by me to accomplish my tasks, 5. Often meetings are held, 6. free flow of information, 7. open to the ideas, 8. Employees exchange information freely, 9. strong repository. The table 1 displayed below gives the distribution of the respondents across the five districts considered. The maximum from the respondents is from Madurai standing at 28.8 percent followed by Chennai which accounts for 26.9 percent. The least is from Coimbatore amounting to only 13.5 percent (fig. 1). The table 2 describes the distribution of respondents across the companies considered here. By looking at the fig 2 it is evident that most of the respondents work in MRF and the least number of respondents is from Michelin. Nearly 91 percent of the respondents work in a company which has knowledge management department is in existence. The pie chart given in figure 3 clearly explains that. To find out the difference of opinion among the respondents about the existence of different knowledge management practices, we employ one-way ANOVA on the location of organization and the variables taken as proxy for knowledge management practices. It is evident from table 5, irrespective of location of the respondents all of the same opinion about the knowledge management practices across the tyre manufacturing companies. Hence we cannot accept our first research hypothesis and we accept the null hypothesis which says there is no significant difference of opinion among

the respondents across various locations in the state of Tamil Nadu when the knowledge management practices are considered. But when one-way ANOVA is carried out with the companies in which the respondents work there is a significant difference in opinion only in one parameter wherein the respondents had a different opinion about the frequency of meetings that happen in their company with regard to knowledge management. other than that, most the variables regarding knowledge management has the same opinion from almost all the respondents. Hence the second research hypothesis also being rejected.

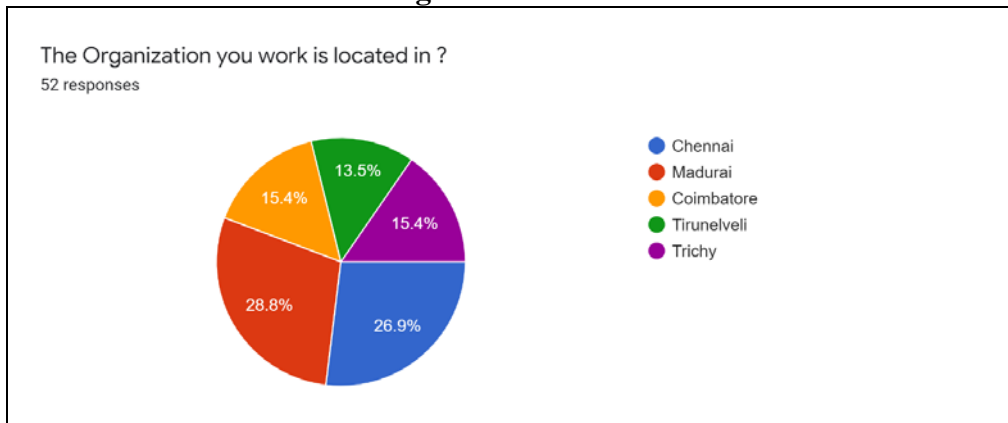
To find out the existence of relationship and the nature of relationship among the variables considered for KM practices we employ correlation. It is found that there exists a negative significant relation when easy access to information is provided it helps the employee in increasing his/her performance. Also, when employees can participate in improving the knowledge management there is a significant positive direction in increasing the performance of the employees, which implies a positive relationship among the variables. The feedback by the KM department helps the employees in increasing their performance

(significant positive relationship). When meetings are often held it positively impacts the three variables which are increasing employees performance, helps employees to participate in improving the knowledge management, and encourages the employees to give feedback. The free flow of information in the organization helps in easy access of information, increasing the performance and also the feedback in encouraging the employees in increasing their performance. When the management is open to ideas it helps the employees in increasing the performance, it encourages the employees in participating in the improvement of knowledge management and also often meetings are called upon. The exchange of information freely among the employees helps in easy access to information, encourages the employees in participating in the improvement of knowledge management, often meetings are held and makes the management also to be open to new ideas. When there is a strong repository of knowledge in the organization it helps in using the feedback to improve employee’s performance and also encourages the management to be open to new ideas.

**Table:1 Location**

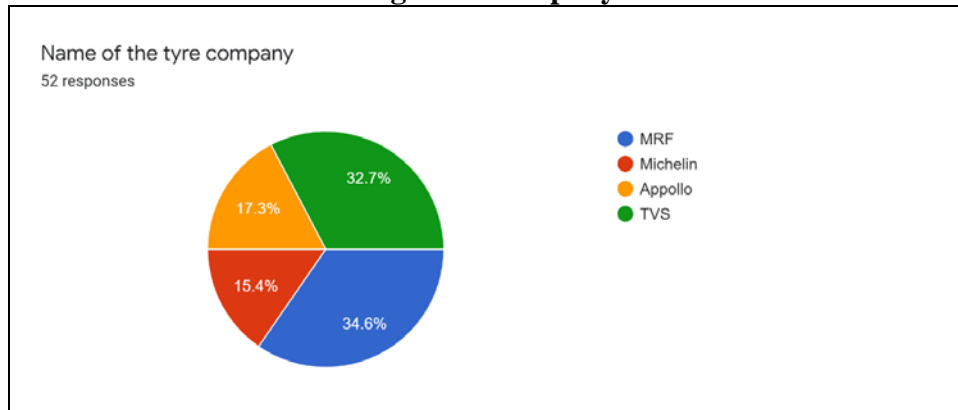
		Frequency	Percent	Valid Percent	Cumulative Percent
<b>Valid</b>	<b>Chennai</b>	14	26.9	26.9	26.9
	<b>Madurai</b>	15	28.8	28.8	55.8
	<b>Coimbatore</b>	8	15.4	15.4	71.2
	<b>Tirunelveli</b>	7	13.5	13.5	84.6
	<b>Trichy</b>	8	15.4	15.4	100.0
	<b>Total</b>	52	100.0	100.0	

**Figure: 1 Location**



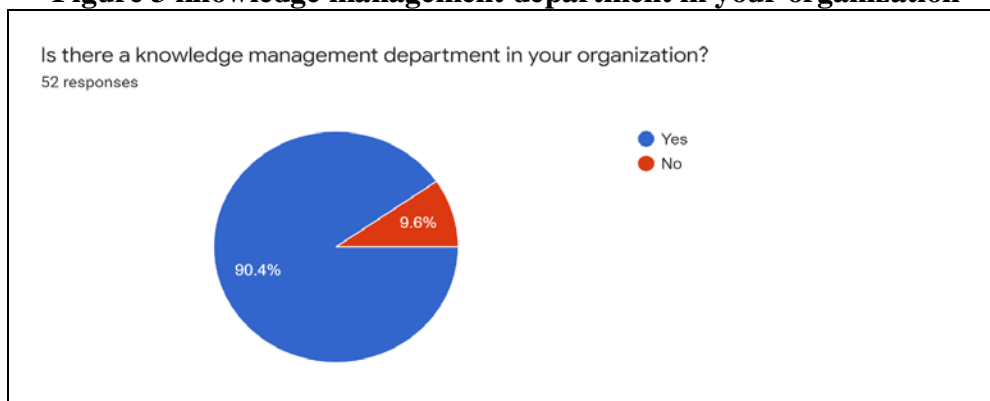
		Frequency	Percent	Valid Percent	Cumulative Percent
<b>Valid</b>	<b>MRF</b>	18	34.6	34.6	34.6
	<b>Michelin</b>	8	15.4	15.4	50.0
	<b>Apollo</b>	9	17.3	17.3	67.3
	<b>TVS</b>	17	32.7	32.7	100.0
	<b>Total</b>	52	100.0	100.0	

**Figure 2 Company**



		Frequency	Percent	Valid Percent	Cumulative Percent
<b>Valid</b>	<b>Yes</b>	47	90.4	90.4	90.4
	<b>No</b>	5	9.6	9.6	100.0
	<b>Total</b>	52	100.0	100.0	

**Figure 3 knowledge management department in your organization**



		Sum of Squares	Df	Mean Square	F	Sig.
Can easily access information	Between Groups	8.888	4	2.222	2.344	.068
	Within Groups	44.555	47	.948		
	Total	53.442	51			
helps me in increasing my performance	Between Groups	12.155	4	3.039	2.479	.057
	Within Groups	57.614	47	1.226		
	Total	69.769	51			
employees can participate in improving the knowledge management	Between Groups	8.558	4	2.139	1.431	.239
	Within Groups	70.269	47	1.495		
	Total	78.827	51			

The feedback is used by me to accomplish my tasks	Between Groups	9.872	4	2.468	2.223	.081
	Within Groups	52.186	47	1.110		
	Total	62.058	51			
Often meetings are held.	Between Groups	2.694	4	.673	.442	.777
	Within Groups	71.537	47	1.522		
	Total	74.231	51			
free flow of information	Between Groups	10.125	4	2.531	2.187	.085
	Within Groups	54.394	47	1.157		
	Total	64.519	51			
open to the ideas	Between Groups	3.810	4	.952	.747	.565
	Within Groups	59.940	47	1.275		
	Total	63.750	51			
Employees exchange information freely	Between Groups	1.587	4	.397	.325	.860
	Within Groups	57.394	47	1.221		
	Total	58.981	51			
strong repository	Between Groups	5.264	4	1.316	.990	.422
	Within Groups	62.505	47	1.330		
	Total	67.769	51			

**Table 5ANOVA (Company of the respondent)**

		Sum of Squares	Df	Mean Square	F	Sig.
can easliy access information	Between Groups	.214	3	.071	.064	.979
	Within Groups	53.229	48	1.109		
	Total	53.442	51			
helps me in increasing my performance	Between Groups	1.942	3	.647	.458	.713
	Within Groups	67.827	48	1.413		
	Total	69.769	51			
employees can participate in improving the k2wledge management	Between Groups	6.798	3	2.266	1.510	.224
	Within Groups	72.029	48	1.501		
	Total	78.827	51			
The feedback is used by me to accomplish my tasks	Between Groups	3.065	3	1.022	.831	.483
	Within Groups	58.993	48	1.229		
	Total	62.058	51			
Often meetings are held.	Between Groups	14.178	3	4.726	3.778	.016
	Within Groups	60.052	48	1.251		
	Total	74.231	51			
free flow of information	Between Groups	3.131	3	1.044	.816	.491
	Within Groups	61.388	48	1.279		
	Total	64.519	51			
open to the ideas	Between Groups	.734	3	.245	.186	.905
	Within Groups	63.016	48	1.313		
	Total	63.750	51			
Employees exchange information freely	Between Groups	5.840	3	1.947	1.758	.168
	Within Groups	53.141	48	1.107		
	Total	58.981	51			
strong repository	Between Groups	2.060	3	.687	.502	.683
	Within Groups	65.709	48	1.369		
	Total	67.769	51			



**Table 6 Correlation**

		can easily access information	helps me in increasing my performance	employees can participate in improving the knowledge management	The feedback is used by me to accomplish my tasks	Often meetings are held.	free flow of information	open to the ideas	Employees exchange information freely	strong repository
Can easily access information	Pearson Correlation	1								
helps me in increasing my performance	Pearson Correlation	-.326	1							
	Sig. (2-tailed)	.018								
employees can participate in improving the knowledge management	Pearson Correlation	-.131	.471	1						
	Sig. (2-tailed)	.356	.000							
The feedback is used by me to accomplish my tasks	Pearson Correlation	.257	-.282	.049	1					
	Sig. (2-tailed)	.066	.043	.732						
Often meetings are held.	Pearson Correlation	-.136	.308	.395	-.341	1				
	Sig. (2-tailed)	.336	.026	.004	.013					
free flow of information	Pearson Correlation	.338	-.294	.024	.469	-.150	1			
	Sig. (2-tailed)	.014	.034	.866	.000	.290				
open to the ideas	Pearson Correlation	-.133	.292	.356	.012	.356	-.051	1		
	Sig. (2-tailed)	.348	.035	.010	.933	.010	.721			
Employees exchange information freely	Pearson Correlation	-.300	.166	.380	-.014	.404	-.115	.371	1	
	Sig. (2-tailed)	.031	.239	.005	.920	.003	.417	.007		
strong repository	Pearson Correlation	.102	-.032	-.028	.284	-.012	.065	.358	.200	1
	Sig. (2-tailed)	.473	.819	.844	.041	.933	.649	.009	.155	

### Conclusion

The practices across the state of Tamil Nadu in handling the knowledge management practices have been novel and that too only with the integration of the global economies. Also, Tamil Nadu has been an interesting state for the investors since it is seen as an attractive investment destination given the availability of skilled workforce and more friendly state policies. The companies here in Tamil Nadu have either followed a same strategy and curriculum or the respondents in Tamil Nadu has to have comprehensive understanding regarding the knowledge management practices. Also, it is evident from the nature of relationship that exists among the knowledge

management practices, access to information and efficient knowledge management practices helps in gaining a competitive advantage as well as helps the organization in performing well compared to its peers. Hence the companies are in the right direction by adapting to this innovative concept. It is important for the companies in this era of global economic integration and digitalization to have a strong knowledge and also to utilize them when and where the need arises. Organizations which recognizes knowledge as an asset is an intelligent organization and perhaps can also call be as the learning organization and it is them who can be ever competing and innovating (Gupta et al., 2000).

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**“CYBER BULLYING: THE CONTEMPORARY BULLYING AND ITS REPERCUSSIONS ON CHILDREN”****N. Renuka**Department of Law, University of Technology, Jaipur, Rajasthan  
sairenuka.rk@gmail.com**ABSTRACT**

*With the growth of technological advancement, bullying expanded its wings to the cyber world too. Out of many odds of cybercrimes, Cyberbullying is also one of the burning issues which has to be immediately addressed. Cyber bullying is a crime wherein individuals use technology like mobiles, internet etc. to bully and harass others with an intention of causing harm. Such cybercrimes are not limited to a specific age group, these criminal activities do not even spare children from falling prey to such activities in cyberspace. The purpose of this research paper is to understand and evaluate the experiences of victims of cyberbullying and its impact on children. To then evaluate the different effects on the state of mind of the children and provide them with a preventive and protective framework.*

**Keywords:** Cybercrimes, Cyberbullying, Emotional, Psychological, Repercussions

**Introduction**

Bullying is unwanted behavior of a person who hurts or frightens someone smaller or less powerful, often forcing that person to do something they do not want to do. Bullying includes actions such as making threats, spreading rumors, attacking someone physically or verbally, and excluding someone from a group on purpose.

Cyber bullying is a current trend of bullying. Cyberbullying is bullying that takes place over digital devices like cell phones, computers, and tablets, it can occur through SMS, Text, and apps, or online in social media, forums, or gaming where people can view, participate in, or share content. It includes sending, posting, or sharing negative, harmful, false, or mean content about someone else. It can include sharing personal or private information about someone else causing embarrassment or humiliation. Sometimes cyberbullying also leads to criminal behavior.

There are different kinds of cyberbullying, few of them are flaming, online harassment, cyberstalking, denigration, masquerading, trickery and outing, and exclusion, frapping, dissing, catfishing, phishing, cyberstalking, blackmailing, shunning and many more.

**Statement of Purpose**

The purpose of this research paper is to know more about cyber bullying as one of the cybercrimes and to research deeper and gain knowledge about Cyber bullying and more

specifically to understand the repercussions of cyber bullying on children. Also to understand the protective and preventive methods to stop cyberbullying and safeguard children.

**Problem Statement**

Cyber bullying, a cybercrime which occurs because of aggressive behaviors in cyberspace. Bullying is a form of peer aggression which can be as damaging as any form of conventional aggression. The problem investigated in this research concerns cyber bullying that disturbs children psychologically and emotionally. It is observed that bullying not only harms the children in different ways but it also prevents students from achieving good grades. It seems that technologies are in some ways creating more stress on children in the form of cyberbullying rather than to help them progress. Research findings have shown that young children who become victims of cyber bullies suffer great stress. Hence there is an urgent need to understand the problems faced by the victims so that concrete and proactive measures can be taken by the authorities to address this cybercrime as a global issue.

**Methodology**

The research method used in this research paper is Analytical Research method. Various facts which are collected about the impacts of cyberbullying are critically evaluated to understand the repercussion of cyberbullying on children. So that it helps to bring out the

exact problem and its effects on children so that appropriate measures can be taken to prevent children from falling prey to this sought of crimes.

### Review of literature

Several studies have been attempted to understand the effects of cyberbullying on children. In an article written by Yehuda Peled (in 2019) mentioned how cyberbullying influences social, emotional, and academic development of children. In a latest reference made by UNICEF, it mentions how the cyberbullying effect lasts for a long time and affects a person in many ways like mentally, emotionally and physically and also gives methods to overcome it and regain confidence. Natalia Extremera & 3 others (2018) mentions cyberbullying victimization, self-esteem and suicidal ideation; they also mentioned psychological adjustment by EI (emotional Intelligence). Ann John & 7 others (2018) in a research paper mentioned about the concerns of cyberbullying in children and young people and also in this systematic review wrote about self-harm and suicidal behavior of a cyberbullied victim. Sherri Gordon (2021) mentioned the real life effects of cyberbullying on children. In a recent post on health direct, an Australian health advice site, mentions the effects and feelings of victims of cyberbullying as being frightened, unsafe, confused, guilty, ashamed, angry, anxious and stressed. Also sad, depressed and embarrassed, hopeless, alone and excluded and rejected. Nur Farhanah & 7 others (2019) in an International conference paper published that effects of cyberbullying on victims on development of one's character can lead to an uncomfortable behavior, they also mentioned the importance of guidance and counselling in such scenarios. In another article on cyberbullying, its concepts, dynamics, characters and health implications Taiza Ramos de Souza Costa Ferreira & 1 other (2018), states that it is seen that educational and health negative implications are there on children who are victims of cyberbullying. In a book, Family, Bullying and Cyberbullying, edited by Raul Navarro Olivas (2019) mentions the influence of family variables on cyberbullying perpetration and victimization. Ankita Mishra & 1 other (2019) states

understanding the experiences of cyberbullying victimization of young adults. Jacob Schuman (2018), in a research paper on effects of cyberbullying states that cyberbullying extended into the school affects the overall learning environment for students. In a Mini review on cyberbullying on teenagers, Mir Ali Raza Talpur & 4 others (2018) states that targeted victims may experience insecurity, poor school performance, addiction, psychosomatic disorder, retaliatory behavior, emotional distress, suicidal tendency, this altogether adds to destruction of normal psychology.

### Discussion

#### Repercussion of Cyberbullying

When bullying happens online it can feel as if one is being attacked everywhere. It might seem like no escape. The effects can last a long time and affect a person in many ways:

#### Mental & Psychological Repercussions

Any victims generally undergo a psychological problem which brings them to experience suicidal and many other thoughts as a means of escaping the torture. Some of the mental and psychological issues are -

- **Depression and anxiety** - victims of cyberbullying may succumb to anxiety, depression and other stress related conditions. The added stress of coping with cyberbullying on a regular basis can steal their feeling of happiness and contentment. It also can increase feelings of worry and isolation.
- **Low self-esteem** - Targets of bullying may begin to feel intense dissatisfaction with who they are. As a result, they can begin to doubt their worth and value. Children have an intense psychological need to be part of and accepted by a peer group, cyberbullying may cause psychological maladjustment, reduced wellbeing and ultimately low self-esteem.
- **Suicidal thoughts and self-harm** - sometimes targets of cyberbullying respond to their intense feelings by harming themselves in some way. For instance, some might engage in self-harm such as cutting or burning themselves. Children

that are constantly tormented by peers through text messages, instant messaging, social media or apps often begin to feel hopeless and that the only way to relieve the pain is ending their life.

### Emotional Repercussion

- **Humiliation** - As cyberbullying occurs in cyberspace, online bullying feels permanent. They can feel exposed, embarrassed and overwhelmed. When cyberbullying occurs, the nasty posts, messages or texts can be shared with multitudes of people. The sheer volume of people that know about the bullying can lead to intense feelings of humiliation.
- **Isolation** - cyberbullying sometimes causes children to be excluded. They often feel alone and isolated. This experience can be particularly painful because friends are crucial at this age. When kids don't have friends, this can lead to more bullying. When cyberbullying occurs, parents sometimes recommend shutting off the computer or turning off the cell phone. But for many children, using these devices is considered the most important way they communicate with others. Turning them off often means cutting off their connection with others, which can make them feel more secluded.
- **Anger**- victims of cyberbullying get angry about what is happening to them. In fact, research indicates that anger is the most common response to cyberbullying. In a few instances, victims may even plot revenge and engage in retaliation. This approach is dangerous because it can keep them locked in the bully-victim vicious circle. If a child is seen intensely angry over cyberbullying, it helps for them to speak with a counselor or therapist who can teach them to channel that anger in productive ways.
- **Powerlessness**- victims may feel vulnerable and powerless. These feelings surface because cyberbullying can invade their home through a computer or mobile at any time of the day. They no longer have a place where they can escape.

### Physical Repercussions

Being targeted by cyberbullies can be crushing, especially if a lot of kids are participating in it. Sometimes victims feel tired, loss of sleep or experiencing symptoms like stomach aches and headaches and the feelings of being laughed at or harassed by others can prevent people from speaking up or trying to deal with the problem in extreme cases of people taking their own lives. Losing weight or changing appearance, being cautious and not allowing parents or other family members to use their devices are some of the symptoms of being cyber bullied. The following are some more physical issues caused to a victim of cyberbullying.

- **Gastrointestinal issues** - stress of bullying also can cause or worsen conditions like upset stomach, abdominal pain and stomach ulcers. Children may also struggle with frequent nausea, vomiting and diarrhea.
- **Disordered eating**- victims may experience changes in eating habits like skipping meals or binge eating. Because their lives feel out of control, they look to their eating pattern as something they can control. These efforts may morph into a full blown eating disorder.
- **Sleep disturbance** - experiencing cyberbullying can impact a person's sleep patterns. They may suffer from sleep issues like insomnia, sleeping more than usual or nightmares.

### Behavioral Repercussions

Children who are cyberbullied may display some behavioral changes as those who are bullied in more traditional ways. They may exhibit a loss of interest in activities and engage in secretive behavior. Evidence of drop in the social behavior shows avoiding friend or social events, children might start isolating themselves, more than usually they do. Children might become more quiet and withdrawn, they might also feel hard to concentrate on any work might lose interest in activities, because of which their academic performance might drop. In extreme cases, when cyberbullying is prolonged, victims sometimes even exhibit more significant behavioral changes. These may be -

- **Using drugs or alcohol** - Victims who are harassed online are more likely to engage in

substance abuse. It is observed that victims engage in drinking more than their peers.

- **Skipping school** - sometimes when kids are cyberbullied, the thought of going to school is just more than they can handle. Consequently, it's not uncommon for them to skip school or even behave in such a way that results in suspension.
- **Carrying weapons** - even more concerning is the fact that kids who are cyberbullied are more likely to bring weapons to school.

### Academic Repercussion

The victims of cyberbullying are under great emotional stress and are unable to concentrate on their studies and thus their academic progress is adversely affected. Victims may lose interest in school. As a result they often have much higher rates of absenteeism than non-bullied children. They may skip school to avoid facing the kids cyberbullying them or because they are embarrassed and humiliated by the messages that were shared online. Their grades may also suffer because they find it difficult to concentrate or study. In some cases, children may either drop out of school or lose interest in continuing their education after high school.

### Preventing Cyberbullying

For bullying to be stopped, it has to be identified first. One must know what children are doing and then help them learn to respond when their well-being is threatened by dangerous online users. Parents must establish a trustful environment with the child. Parents and guardians must keep monitoring the online activities of children. Monitor all text messages, even deleted ones, call logs and general online behaviors, parents can even block and control children's online activities remotely.

Protecting accounts and devices is important, children must be guided to use passwords on everything to protect their accounts and devices. One has to emphasize that children

should never share their password with anyone including with their best friends. Another strategy is to use privacy settings for all the online apps that the children use, it also helps in preventing Cyberbullying. Another strategy is to manage location sharing, children need to be guided not to share their location with friends or on any social media. Children must be prevented from sharing their photos online. These days' pictures taken with smartphones already contain Geo tags that indicate where the photo was taken. People can use these photos to determine your child's location and misuse it. Another important thing to remember is to logout the accounts when using public devices. This includes logging out of email, social media accounts or school accounts or any shopping sites or any other account child may open. Simply closing the tab is not enough, if someone gets onto the computer immediately thereafter they may still be able to access the child's account, once they have control they can impersonate the child online by making fake posts and comments that make the child look bad. Next thing to remember is to refuse to respond to cyber bullies. Do not forget to take a screenshot of cyberbullying and save it as a proof of the encounter, this documentation may be needed when reporting cybercrime.

### Conclusion

The purpose of this research is to understand and collate the repercussions of cyber bullied children and the overall impact on their health. Cyberbullying, a cybercrime, is an ever increasing phenomenon with the increased use of technology. Thus there is a need to investigate the dynamics of cyberbullying including its repercussions on victims and a greater collaboration between research and practice in order to develop strong preventive and protective measures against cyberbullying and thus foster a more inclusive, welcoming and safe cyberspace for the children.

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**CROWDFUNDING: FINTECH APPLICATIONS IN SMALL BUSINESS FINANCING****N. Sachdev<sup>1</sup> and K. N. Singh<sup>2</sup>**<sup>1,2</sup>School of Management Studies, CT University Ludhiana<sup>1</sup>relipdts@yahoo.com, <sup>2</sup>kawal17395@ctuniversity.in**ABSTRACT**

*The micro, small and medium-sized enterprise (MSMEs) sector in India is quickly developing, and it is critical to the country's economic development. The Government estimates that they account for around 37 percent of GDP. More than 120 million people work in India's 633 million micro, small, and medium-sized enterprises (MSMEs). The Government and financial institutions must concentrate their efforts on empowering small and medium-sized enterprises and giving them the resources, they need to improve their financial standing.*

*While many programs exist to help small firms, one way to increase scalability is through crowd financing. Small quantities money collection using an internet platform or social networking site. It is a newer technique of generating cash for tiny firms, utilising small amounts of money from many investors. Financial technology initiatives (Fintech) must address the root cause of the lack of technical preparation in India's non-corporate sectors, which is a lack of financial resources. As a result of this problem, the additional advantage of technology adoption is obscured from view. Expanded public awareness and education campaigns on micro, small and medium-sized companies (MSMEs) adoption of financial technology (Fintech) in conjunction with the Government would be the most effective strategy to change the Indian MSME sector digitally.*

**Keywords:** MMSME, GDP, CROWDFUNDING, P2P LENDING, OECD, FINTECH.

**Interoduction**

**(Reserve Bank of India, 2016)** Crowdfunding is a method involving the funding of either a project or a venture with the help of a small amount of money that has been raised from a large section of people, mainly through a portal that behaves as an intermediary. The range of crowdfunding sources includes charitable donations, which specifically provide intangible benefits to the individual interested but with no financial returns coming their way; others, the equity crowdfunding her would be categorised into the domain of the financial markets.

When considering the cases of crowdfunding financing, the reserves involved are purchased in low amounts from several investors by taking an e-platform or social platform as an intermediating platform targeting towards a particular aim such as a business venture or a for a relative kind cause (**Devasenapathy, 2019; Emma, 2018; Salim & Kassim, 2019**). The funds mentioned above, when being raised from its investors, are done in small amounts. These have managed to place themselves as significant financing sources for the present and near past MSMEs.

The first one is known as donation crowdfunding which means that the funding is allocated without a substantial return on

interest. The next option is reward crowdfunding which involves the inclusion of a considerate expectation that must be tangible. These advantages can be in immediately actionable premise or anytime in the future. The next component is peer-to-peer lending, where the funding process is done between two parties using the platforms on the internet. The investors and lenders credit the sums and the costs involved in the loans through the aid of the forum. The last one to include is equity-based Crowdfunding, where the financing is facilitated using the issuance of value portions of the equity shares of a particular association. Crowd financing of this nature works best for firms with potential for return and would work for the growth and development of such organisations.

Crowdfunding acts as a financial supporter to the MSME and start-ups in India and the people associated with opportunities to build and process the customary model designed for their businesses. It is worth mentioning the names of some of the highly recognised crowdfunding ventures in the country who have extended their support to building the dreams of several budding entrepreneurs & start-ups; these are **ImpactGuru, Ketto, BitGiving, Catapult, etc.**

Crowd funding's objective is to raise small amounts of money from a large number of

individuals. It stands out because of its technical accessibility. This technology-based network connects entrepreneurs and investors, providing data on investment opportunities. These tools aid firms not just with operational finance but also with strategic planning. Crowdfunding is divided into four categories:

**1. Crowdfunding using a reward system**

This method is used to determine the return on a specific amount of money invested. This incentive might be in the form of a percentage rate of return on investment or a particular amount of money, as chosen by the fundraiser. This serves as a motivator for investors.

**2. Crowdfunding based on equity**

The company seeking money distributes shares to investors who may become shareholders using an online CrowdFunding platform.

Private equity, individual investors, and bank loans provide funding. Once the Business is profitable, the shares can be sold to the general public. Regulation is required because it is strict. At the moment, there is no regulatory structure in place to oversee platforms that provide equity-based Crowd Funding.

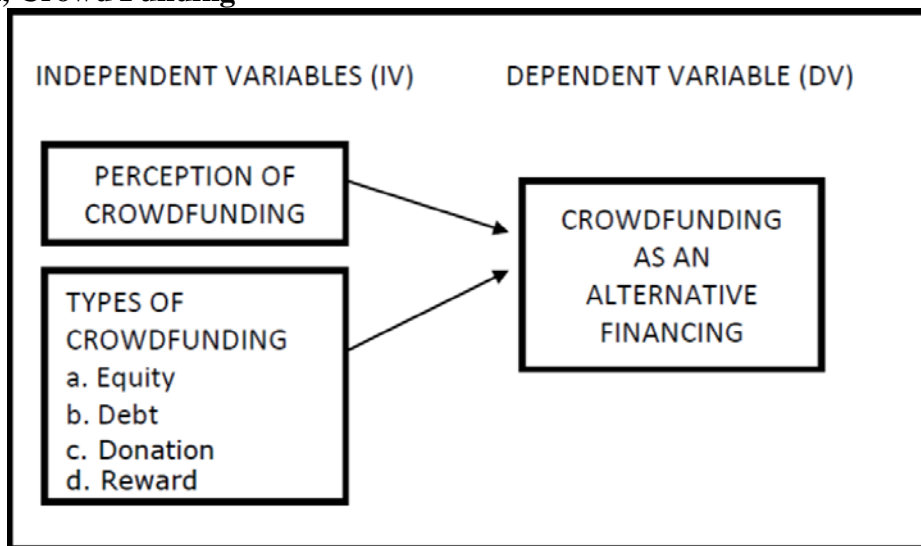
**3. Crowdfunding based on donations**

This method involves soliciting investors for funding. In this Business, prizes may or may not be monetary. Raise financing for specialised research, disaster relief, and humanitarian concerns.

**4. Crowdfunding based on debt**

Debt-based Crowdfunding is similar to getting a bank loan. Rather than giving them a portion of the earnings, companies borrow money from individuals and pay them interest on the money borrowed.

**In a nutshell, Crowd Funding**



**Crowd Funding (Figure 1)**

**Need for Crowd Funding**

Crowdfunding allows individuals to simplify their usual business operations while simultaneously offering financial support to small and medium-sized businesses. Entrepreneurs typically spend months sifting through a variety of sieves to improve their business operations. On the other side, these aspirants may be able to use Crowd Funding to develop their businesses in new ways while also gaining access to more invested individuals eager to help them.

**In India, small enterprises have been sponsored by Ketto, Catapult, BitGiving,**

**ImpactGuru, and other well-known Crowd Funding organisations.**

Because of the Government's focus on Digital India, crowd finance is undoubtedly the next big thing, boosting micro, small, and medium-sized businesses. MSMEs must make a significant investment choice, ranging from cutting-edge technology to completely embracing digital in all forms. Entrepreneurs are urged to take advantage of the many Crowd Funding options available to small and medium-sized businesses and allow money to flow into their businesses. In Crowd Funding models, companies must adapt to new technology and keep up with altering marketing

standards, and MSME's must not be scared to change essential behaviour to stay on top of their game.

It is a way of raising money that enlists the assistance of friends, family, clients, and individual investors to raise funds. This technique brings together the actions of many individuals, which are mainly carried out online through social media and crowdfunding platforms. It leverages its networks to increase reach and visibility for the cause.

### **Crowdfunding differs from traditional types of financing in several ways.**

Traditional corporate finance is the polar opposite of Crowdfunding. Previously, if someone wanted to raise money to start a firm or launch a new product, they had to pitch their idea to a few wealthy individuals or organisations.

With only a few key persons involved, the cash was raised from banks, angel investors, and venture capital firms. The entrepreneur and their pitch are at one end of the fundraising funnel, while the investor audience is at the other. An entrepreneur is wasting time and money if they don't guide that funnel toward the right investor or company at the right time. On the other side, Crowdfunding keeps the wheels turning. This technique simplifies the traditional paradigm by providing a platform for entrepreneurs to produce, present, and exchange pitch resources.

Entrepreneurs usually spend months scouring their contacts, researching possible angel investors, and investing their own time and money to get in front of potential investors. Entrepreneurs may utilize Crowd Funding to get their idea in front of a broader audience and expand their business development possibilities.

### **India's MSME**

The economy of India has been recognised as one of the upcoming economies of the world, along with achieving the third rank in being the most extensive base for start-ups globally. The effort put in from the Government of India has enabled the country to achieve higher rankings comparatively in the index measuring Ease of Doing Business in 2020 by the World Bank. The country has managed to secure a position

of 63 among the contesting 190 countries, which is a remarkable transition from the rankings for the country in the previous year. One of the key contributors to this growth has been the critical role played by the MSME in the country. The Government of India in the past years has taken significant steps to develop the MSME sector and strengthen the ecosystem. The total contribution made by the MSME sector is 29% to the GDP, while the export contribution stands at 49% (India Brand Equity Foundation IBEF, 2019). Notable initiatives such as Make in India introduced by the Government of India have helped promote the Indian manufacturing brand to global companies. They have attracted them towards investing in India to find a way of engagement with the MSME. The MSME sector stands a high potential of creating almost 10 million new job vacancies in the next four to five years for the country's residents while significantly adding to the economy a significant USD 5 trillion \$. The context of reviving the cottage industries of India and following an incentivizing scheme for the entrepreneurs residing in the rural and semi-urban areas would help address the dual purpose of creating a higher number of employment scopes. It also does include adding positive numbers to assist in the economic growth of the country eventually. It is worthy of mentioning here that there arises a need to address the underlying factors which can be considered of utmost necessity to adapt to the contemporary technologies introduced into the production system by the MSME. This does include the components enabling provisions in the sector such as requirements for infrastructure, financial parameters, availability of skilled workforce, and others into the designed schemes made for technological adoptions by MSME and start-ups.

It is pretty evident from the above discussion that MSMEs play an essential role in the Indian economy, and it almost constitutes 95 percent of it. This acknowledges the importance of the development of the MSME sector, which would contribute towards meeting the national objectives of the financial inclusion system and the employment generation process conducted across the urban and rural areas of the country. This can especially be of great help and support

for the development and nurturing of the new-age entrepreneurs. They possess the potential of creating a competitive businesses environment for the country.

Many MSMEs' sales and profit margins are affected by factors like late payments, seasonality, natural disasters, input and labour costs, unanticipated expenses, and a host of other variables. Lending money becomes impossible for banks without collateral or sufficient credit information. So MSME's run the risk of becoming non-performing assets. Currently, these financial institutions' thinking is shifting to allow MSME's and start-ups to get loans. Unlike traditional asset-backed loans, the loan size and term are now determined by the value of the collateral given to the lender.

According to the stated data by DPIIT, 41,317 start-ups have been recognised in India from 601 districts as of December 30, 2020. Although there are challenges encountered in the growth and development of these start-ups, the active role played by the Government is the eventual solution to all such concerns. The requirement for the Government to build start-ups to enhance the culture would help achieve recognition for the country at a global level. Moreover, the establishment of tech hubs must be encouraged by the Government as well. These acts of the government help in forming India as a growing hub for start-ups in the world. The three top-ranked countries in the field include the U.S., U.K., and China. However, the Indian Government aims to ease the nature of the prevailing business environment for the start-ups and MSME in the country. The present regulatory framework for start-ups and MSMEs can be explained as a complex, inefficient, and unpredictable process (Nasscom I.T. Industry Body, 2015). The number of procedures, including legal work involved in establishing a business entity in India in the present times, is quite tiresome, which must be aimed to reduce into a more straightforward process. It is essential to mention that the OECD (Organization for Economic Co-operation and Development) countries take around 12 days to complete the formalities involved in developing a new business. The same takes nearly a month to be completed in India. Here, the primary

challenge is to overcome these problems and make way for progress and innovation in realistic terms through the aid of the existing MSME and start-ups in India. Here the most effective suggestion in the context of the application of FinTech would be to increase the awareness among the concerned individuals and make strategies accordingly with the use of financial technology & achieve digitization of the Indian MSME sector and start-ups.

Emerging financial technology (FinTech) players across the globe are redefining the way MSMEs access their cash flow finance and working capital. After acknowledging that MSMEs and start-ups cannot give financial reports to enable financial institutions to assess the repayment capacity of these institutes and individuals and the associated default risk, they are using certain agile technologies to understand the related cash conversion cycle. The cycle is when MSME must convert investments in the inventory and resource inputs processes to cash flows using the sales of their goods and services. This helps establish the cash generation aspect for the Business and thereby helps them determine their concerned repayment capacity. Liquidity is the only factor that can repay a loan, while collateral is the second way out of money that cannot be gathered from the operations.

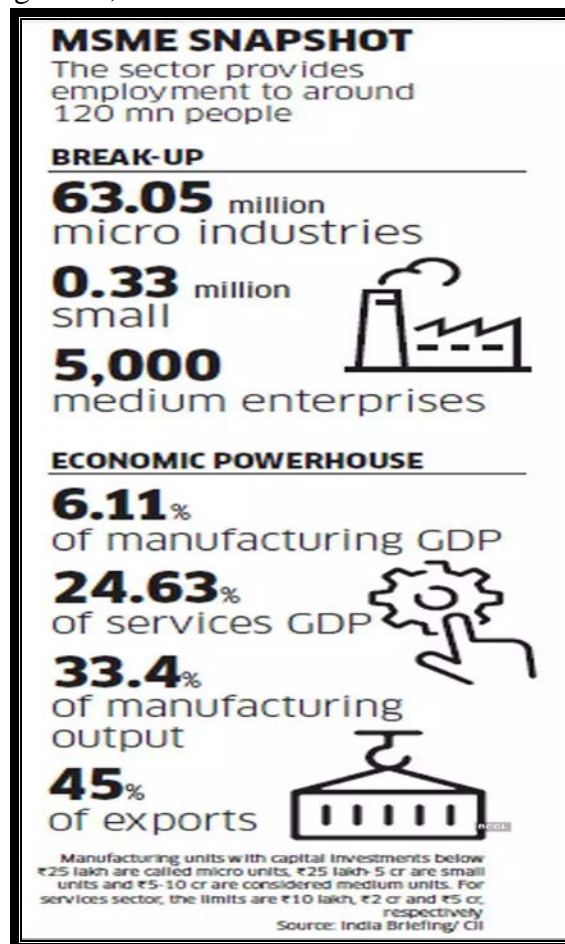
The banks and financial institutions in the past had adopted some processes related to digital lending. Still, the era of FinTech start-ups has accelerated its growth and development in the industry. These start-ups, along with digitising the lending process, have gone for the preference towards contactless lending. All verifications and checks regarding the transaction would be done using digital scopes, and in the same method, the loan would be disbursed. However, with the traditional means in banks and the banking system in general, the borrower must be physically present at almost every stage of the loan process, right from application to disbursal.

**(North, 2020; Sanicola, 2017)** The highlighted features led to the merging of finance and technology, resulting in dramatic changes in several finance sectors, such as trading, banking, cryptocurrencies, and investing. The word "FinTech" was coined as a short version

of "Financial Technology" due to its evolution. The first of these are loans, which are the most significant part of FinTech. Undeniably, loans have transformed banks' operating techniques and created a large market for lenders in MSME and start-ups. P2P lending and Crowdfunding, the two FinTech instruments discussed here, are critical tools for disbursing loans to these businesses.

The second component is the payment services in which the FinTech services have managed to make a huge impact. The payment systems in today's world are made chiefly using online transfer systems, smartphones, bank transfers using the internet, diminishing the use for accounts in the non-corporate sector. The next component is wealth management, which has

increased the demand for FinTech services. The fourth component is remittance transfers, where people in the past years have struggled entirely with the traditional methods used for remitting purposes as they were both complex and expensive. The last aspect is that of insurance services. With the help of FinTech services, the customised plans made available on the internet, things are made easier for the customers. According to a report by NASSCOM in 2019, about 400 firms in India having foreign investments of the handsome amount made their investments in the FinTech market. The report further stated that the FinTech market in India would expectedly grow into an \$8 billion market by the year 2020.



**MSME Snapshot (Figure 2)**

MSMEs employ more people than agriculture and contribute considerably to India's GDP. Largely dependent on traditional financial institutions for funding, MSMEs can't get their fair share for many reasons. Because cash flow is a significant barrier to growth for MSMEs, companies are looking for new funding

sources, and Crowd Funding is one such alternative. Crowdfunding is the practice of soliciting public financial contributions for a new initiative via online donations (with or without rewards), loans, or equity participation. A global success story, including India, shows crowd funding's attractiveness as a new source

of money for creative and socially conscious businesses. Despite the apparent advantages, India has failed to allow Crowdfunding. Crowdfunding is expected to gain in popularity.

The most common cause for micro, small, and medium-sized enterprises (MSME) not developing or scaling up is a lack of money. Commercial banks perceive micro, small, and medium-sized businesses (MSMEs) as high-risk due to a lack of collateral, a small asset size, and a short track record. Reduced interest rates, collateral-free loans, partial credit guarantees, credit insurance, and matching subsidies are strategies utilised by Indian governments to increase institutional lending.

As a result of technological advancements, alternative finance has emerged as a new financial intermediation channel outside the present economic system. P2P lending and crowdsourcing are two examples of technology-based companies that can aid small and medium-sized enterprises (MSMEs) meet their financial obligations. An entrepreneur or small or medium-sized firm seeking cash, supporters of a cause or project, and a moderating organisation promoting interaction between the three parties are all involved in Crowdfunding. Those who work for the moderating organization have access to a diverse variety of expertise and financial resources for the creation of new products and services. The most prevalent business models for Crowd Funding include reward-based, donation-based, and equity-based models, with the first being the most popular. Lending to small and medium-sized enterprises (MSMEs) is always a challenge. Because of their limited assets and lack of credit history, they are considered high-risk customers by banks and other traditional lending institutions. Crowdfunding may be a viable working capital alternative for small and medium-sized enterprises (MSMEs) in India.

### **Benefits of Crowdfunding**

With Crowdfunding, enterprises have access to a broader pool of possible investors and more fundraising options than traditional methods. Thousands of verified investors may observe, engage with, and share an

entrepreneur's fundraising efforts utilizing a business Crowd Funding platform.

### **Presentation**

Starting a crowdfunding campaign allows entrepreneurs to focus on their company's history, traction, services, target market, value proposition, and more.

### **P.R. and Marketing**

Using social media, email newsletters, and other internet marketing tools may help entrepreneurs communicate and promote their ideas.

### **Conceptual Validation**

Putting a firm or concept in front of a broader audience helps build a product. As potential investors express interest and inquire, entrepreneurs may quickly assess whether anything is missing to entice them to invest.

### **Efficiency**

Online Crowd Funding can simplify and speed up fundraising processes.

### **Low-threat**

Crowdfunding for finance helps validate market sentiment while lowering start-up risk.

### **Marketing Exposure**

Enterprises may solicit public input and use community financing to promote their product and concept. The Oculus Rift is one such gadget, which gained attention because of its unusual look and image. It linked with Microsoft and its XBOX gaming business following the success of its Kickstarter campaign. Similarly, without spending money on promotion, Crowd Funding may help MSME gain industry recognition before launching products.

### **The future funding will be simple.**

Crowdfunding is challenging to succeed. If enterprises grow, it may open up several business opportunities.

### **Brainstorming is a choice.**

Potential investors can express their thoughts and concerns about company ideas on crowdfunding platforms like Kickstarter and Indiegogo. The necessity to seek prospects and prospective investors is eliminated by creating

a single, comprehensive profile to which enterprises may refer all of their options and possible investors.

### **Limitations on Crowdfunding**

After examining its needs and establishing whether Crowd Funding satisfies those expectations, a company should use a popular Crowd Funding website. The entire approach will be for naught if the entrepreneur fails to raise the set amount of money. As a consequence, you'll be able to make an informed platform choice.

Before suggesting a funding source, it is advisable to assess the budget. To achieve the goal, take into account the platform's contribution and any unexpected costs in the budget. It's not a good idea to ask for a large sum of money since if the entrepreneur fails to meet the set conditions, the funds will be wasted. Furthermore, instead of raising funds all at once, it is proposed that funds be introduced in stages. As a result, the goal may be met, and the cash obtained will be put to good use. Set different limits for each and offer a compelling incentive to encourage the investor to donate more. The openness of the firm plan will enable them to invest openly.

### **Opportunities for Crowdfunding**

India is estimated to be the world's second-largest internet market, enabling rapid online payments and therefore growing Crowd Funding. Some Indian crowdfunding sites:

#### **Kickstarter**

This is India's first creative crowdfunding platform. It seeks money for projects ranging from health to filmmaking. One of its most successful advertisements is Sweet Requiem, a video about Indian Tibetan women. This project raised USD 33,889 in total.

#### **Wishberry**

This platform focuses on creativity & raises funding for creative projects in India, with an emphasis on bringing new ideas in performing arts and music.

#### **The Ketogenic Diet (K.D.)**

In India, this website raises funds for women's empowerment and animal care. The prospect of profit lures donors.

### **Sukarma Trust**

An Indian non-profit MSMEs chose alternative financing over a bank or other institution loan to construct an eco-friendly sanitary napkin factory. Small businesses have struggled to get money due to limited financing options and associated limitations. However, alternative financing is driving much-needed reform. Other than licensed banks and stock exchanges, alternative finance refers to a wide range of funding sources.

Invoice trading third party payment systems and Crowd Funding online market platforms are examples of new-age alternative finance sources. These sources are anti-traditional because they utilize technology to disintermediate. However, the micro and small business sector are still uninformed of the diversity and potential of non-traditional fundraising techniques that help organisations raise funds.

### **Conclusion**

While there are other investment options, if the idea is understandable, distinct, and solid, Crowd Funding could be a rewarding investment. Because of the benefits it provides, Crowdfunding may be the most excellent option for a business. Furthermore, organisations will require constant access to funds to operate successfully. Banks should give low-interest business loans to help companies to solve their financial problems.

The Micro, Small, and Medium Enterprises (MSME) sector in India is expanding rapidly. However, various obstacles must be overcome to develop its market and compete in the commercial world. This study aimed to provide one solution to MSME's funding challenges using a Crowd Funding-based application to strengthen the local industry and boost global competitiveness successfully. The study looked into MSME's challenges and potential solutions through a literature review. The data was compiled from a variety of sources and analyzed using GAP analysis. After that, the primary difficulties were rectified. According to the study's conclusions, the best strategy to

solve this problem is to use an Electric-Business Crowd Funding (E-BC) application. Several MSMEs are detailed in detail inside the application. Investors and bankers have access to every information mentioned in the application because they are both financing

sources. MSMEs or other trade entities are expected to be in control of the application's innovation. To increase local efficiency and boost global competitiveness, Crowd Funding can address financial access challenges in MSME.

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## COMPARATIVE ANALYSIS OF RISK PROFILES OF INDIAN PUBLIC AND PRIVATE SECTOR BANKS POST GLOBAL FINANCIAL CRISIS

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### ABSTRACT

*Purpose-* Main purpose of this paper is to create a risk profile of selected Indian public and private sector banks.

*Design/ Methodology/ Approach –* The study is conducted with the help of cluster analysis on selected financial variables of the sample banks for a period of 2008-2019. The paper classifies these banks into high, medium, and low risk clusters over a period of time.

*Findings-* Main findings of the study indicate that public sector banks as a group are more risky than private sector banks. Among the crucial variables which effect the risk clusters are Loans to Deposit Ratio and Deposits to Total Liabilities ratio. NPAs have become increasingly important during later part of the study due to change in RBI policies. *Research Limitations –* The research is limited to 20 banks of India. Some of the bigger banks were merged during the study period which affected availability of their data. A more detailed analysis including foreign banks can be performed.

*Practical implications –* the findings of current research are useful for investors who want to keep a track of their bank's performance and policymakers to take necessary actions to save risky banks

*Originality/ value –* There is a lack of usage of data mining and cluster analysis studies on banks' financial data. A detailed study spread over a period of more than a decade would help future researchers in understanding the risk profile of banks of emerging market economy like India.

**Keywords:** Risk profiling, Cluster Analysis, Banking, Emerging economies.

### Introduction

Being in the business of money, banks are inherently a risky business. The investors need to understand the banks' risk profile because it signifies banks' ability to handle risks via the soundness of their financial performance (Cahyaningtyas, Sasanti, & Husnaini, 2017). They face multiple types of risks in their day-to-day business, including credit risk, market risk, operational risks, etc. Apart from these, environmental risks also affect the performance of the banks in a crucial manner. One of the most significant environmental factors in the 21st century has been the 2008-09 financial crisis, which shaped the various risk management guidelines to be followed by banks and increased government attention towards the functioning of banks and their risk management practices.

There are multiple reasons for studying the risk profile of banks in emerging economies. The trend of deregulation is picking up in these, leading to increased diversification among commercial banks, which has increased their business income as well as business risk (Lukmawijay & Kim, 2015). Among the world's emerging economies, the growth rate of

assets is the fastest in the Asian emerging economies, making them a very important area to study in terms of risk management and profiling (Lee & Hooy, 2020).

While the risk management need is same for banks across the globe, some factors including turbulent economic times, overambitious budget estimates, reckless lending and loopholes in legal system make it crucial to study risk profile of banks of emerging economies (Onyiriuba, 2016). Hargarter & Vuuren, (2017) goes on even further and hints that such difference in regulations exist because the focus areas like consumer protection and financial inclusion have far more importance in these countries due to long history of difficult banking access.

The importance of risk management can be understood from the fact that it is also a requirement under pillar 2 of Basel Norms to have a mechanism of risk profiling or stress testing to predict the financial strength of the bank (Bank of International Settlement, 2006). When it comes to risk profile, it is important to consider the impact of ownership on risk profile because public sector banks are often found lagging in the risk management because of the excessive government control and lack

of efficiency. Not only that, it is difficult for public sector banks to earn more non interest incomes because of their lack of diversification. Indian public sector banks have been struggling with their high NPAs in the recent past. In such scenarios, it is important to compare the risk profile of public and private sector banks.

There are various methods of risk profiling used in terms of bankers' risk. While some of the sophisticated approaches like VaR (Value at Risk) deal with market risk, more common approaches include financial ratios like Capital Adequacy ratio and most widely used CAMEL framework. Central bank in India has also been using the CAMEL based approach for risk management which has now been improved by including certain other parameters to get the current risk based supervisory mechanism (RBI, 2012). The third category of risk profiling approach is based on data mining and classification, of which cluster analysis is one of the most popular techniques.

Use of cluster analysis can help the central banks in improving the supervisory mechanism by grouping banks into various clusters depending upon various parameters effecting their risk profile (Kovalenko, et al., 2019). It also allows the researchers to perform inter and intra category comparisons with the banks of a country. Similarly, Farnè & Vouldis, (2019) found that cluster analysis was a better way to group the banks together when it comes to variables like business models which are not measured in traditional methods of profiling based out of financial statements.

Most of the existing researches on the risk profiling of banks have been done in European context where the system of bank regulation is quite different from an emerging economy like India. Therefore, the present paper tries to perform a cluster analysis on Indian banks in order to check soundness of their risk management. This will also help in comparing the risk profile of public and private sector banks during the last decade to see how have they improved post the financial crisis of 2008-09. The paper performs cluster analysis on a selected group of public and private sector banks from 2008-2019 to divide them into clusters depending upon their respective risk profiles.

The paper aims to add to the existing body of methods on risk profiling by taking such a large data set spanned over a period of more than a decade as well as using a multivariate analysis for the analysis of the strength of risk profiling of Indian banks. The results are expected to be of help to the central banks as well as policy makers in improving the supervisory mechanism for the banks in question.

The results indicate that public sector banks as a category are riskier than private sector banks in India and the risk has increased in the recent years. SBI has been consistently performing better than the category peers even after merger with its subsidiaries and the same is true for big banks like Axis and HDFC in private sector category. In case of private sector banks, IDBI is the worst performing bank. When it comes to variables causing the difference in risk profile, profit margin is most significant variable in both the categories and NPA does not come out as an important variable in risk profile except in recent years.

The present paper is divided into multiple sections. After reviewing the literature on risk profiling and cluster analysis approach, the third section deals with the research methodology of the study. Fourth section of the paper deals with the results and their analysis and the last section of the paper deals with the discussion and concluding remarks.

## **Review of literature**

### **Risk management and profiling of banks**

Risk is the probability of occurrence of loss and risk management is the systematic process which involves identification, analysis and management of various types of risk being faced by a firm (Sushmitha & Nagaraja, 2019). Primary function of the bank is borrowing and lending which makes identification of risk and its measurement very important. If a bank is not aware of the risk possessed by it due to the nature of its transactions, it would put itself in the danger of distress and bankruptcy (Chakraborty, 2019).

It is more important to manage risks in banks than other industries because bank failure will have wider spillover access in the economy (Risal & Panta, 2019). Not only that, it is

expected that supervisor mechanism of banks should also be based on the riskiness of banks for better regulation (Risal & Panta, 2019).

When it comes to financial institutions, credit risk is the most important risk arising out of defaults or delays in payment (Boumediene, 2011). However, it is not the only risk being faced by the banks, some of the other risks being faced by them include liquidity and operational risks (RozzaniIntan, Mohamed, Norzehan, & Yusuf, 2017). It is important for regulators as well as bank management to know its risk profile in order identify institutions which might be in trouble and cause financial crisis for themselves or for economy. As a result, in international regulatory agencies like BCBS have made it mandatory for banks to have a supervisory framework based on the risk profile of banks.

### **Risk profiling measures**

In most of the economies there is an integration of the stress tests in terms of the ones prescribed by Basel committee, by regulators and the ones adopted by banks themselves (Gambetta, García-Benau, & Zorio-Grima, 2019). Risk is measured using various types of stress tests, most common out of them being CAMELS approach. The approach suggested by US Fed has been used by banks in developed and developing economies alike was also the basis of risk based supervisory mechanism suggested by RBI till recent times. Various studies have used the approach for measuring the risk profiles of banks including those by (Gambetta, García-Benau, & Zorio-Grima, 2019), (Gambetta, García-Benau, & Zorio-Grima, 2017), (Gambetta, Zorio-Grima, & García-Benau., 2015) etc. In their study on effectiveness of CAMELS on risk management of banks, Risal & Panta, (2019) found that the Capital adequacy element of CAMELS is least effective in predicting riskiness as compared to other elements of the approach. When it comes to measuring the risk profile of a group of banks, some studies use the sectoral risk indices for measuring their risk profile (Vallascas & Hagedorff, 2011), (Hagedorff & Vallascas, 2011), (Furfine & Rosen, 2011) However, this approach is not suitable when it comes to average out the risk profile and fails to highlight the individual differences in the

variables effecting the risk profile of the banks (Sghaier & Hamza, 2018). Similarly, when the objective is to study a group of banks for their similarity or difference in their performance, one of the key technique to be used is data mining. Out of the various techniques of data mining like neural networks, cluster analysis, decision trees etc. a researcher can choose on the basis of his expertise (DARDAC & BOITAN, 2009). One of the most commonly used data mining tool is classification which helps the researcher to group the variables and cases and assign them to certain class which will help in the formation of a model for future data (PASC, 2018). It also helps in building association among the data, especially the relationship between different set of variables or participants of a study. Clustering is a similar technique as of classification, and used to form models on the basis of homogeneity of data sets. Retail bankers have been using this technique to group together similar type of transactions which is in turn used to detect frauds (PASC, 2018).

### **Cluster analysis on banking data**

The present study uses cluster analysis for the purpose of finding out similarity and dissimilarity between the group of banks in India. The main reason for the same is that clustering is useful in cases with high variability and small sample size but with detailed information comprising of different variables associated with data (Forte & Santos, 2015), which is true for the current study. Among cluster and factor analysis, the former is considered better when it comes to analysing financial institutions as it is a test of discovery which helps in discovering natural patterns among data.

Cluster analysis is a popular multivariate analysis technique used to find patterns in data and divide them into groups so that further analysis like logit can be used to assign observations to these groups (Alam, D. Booth, & Thordarson, 2000). One of the most common clustering techniques is agglomerative hierarchical cluster analysis which assumes each observation to be separate cluster in the beginning and moves towards one cluster for the entire data set. These clusters club together different cases possessing similar

characteristics (Hawkesby, W. Marsh, & Stevens, 2007) while this similarity acts as a measure of difference for the data set (Forte & Santos, 2015). Similarly, when the data is ambiguous, special type of clustering called fuzzy clustering is used.

In past some of the researchers have used cluster analysis on the banking sector of Europe and USA to perform various types of analysis. Some of these studies included using cluster analysis for supplementing balance sheet analysis for checking banking fragility by Gropp, Vesala, & Vulpes, (2006), commonality of factors causing comovement of stock prices between share prices of financial institutions of USA, Europe and Japan (Hawkesby, W.Marsh, & Stevens, 2007), to identify the banks which have the higher risk of failure across Europe by Alam,Booth, & Thordarson, (2000), classifying different economies of Latin America on the basis factors affecting their FDI inflow by Forte & Santos, (2015) etc.

Cluster analysis was used for risk profiling of banks by Safdari, Scannell, & Ohanian, (2003) on his study on Armenian banks. One of the other prominent works on the use of cluster analysis technique was done by Dardac & Iustina, (2009) who used cluster analysis on risk profiling for banks in Romania on the basis of certain ratios indicating the financial strength of the banks. One of the rare studies that used cluster analysis for risk profiling was conducted on a set of 33 Vietnamese banks by Binh & Khanh, (2014) by taking some financial ratios to identify systematic risk among these banks. Cluster analysis is considered a good option to identify level of systematic risk as it has the tendency to cause the collapse of entire banking system if it is present at higher levels in a group of banks. (Binh & Khanh, 2014)

From the above review, it can be seen that cluster analysis has been used by various researchers when it comes to financial institutions, especially risk profiling of these institutions. However, almost the entire work has been done in the developed market, that too mostly in European countries. Since the monetary policy regime of European nations is very different from that of emerging economies like India, there is a need to check the

usefulness of cluster analysis on the profiling of risks of Indian commercial banks.

### Research Objectives

The primary objective of the current paper is to conduct the risk profiling of the selected public and private sector banks of India. The paper also aims to classify the and find out the difference between the risk profiles of the public and private sector banks of India. The main aim of such study is to analyse whether there is any significant difference in the financial health of the two categories of Indian commercial banks.

### Methodology

The scope of the study is from 2008 -2019. This period has been selected because financial crisis made it very important for the regulators to access the riskiness of the bank in terms of quality of assets and liquidity management (Nelson & Katzenstein, 2014) (Asongu, 2013). This further led to the series of new regulations including Basel 3 norms, risk-based supervision and NPA related clean-up by RBI. Since the world is around another economic recession because of the current pandemic, it is important to access the risk management position of banks as of now.

### Data Analysis

The primary technique used in the present paper is cluster analysis. The present study uses K-means clustering. Agglomerative is one of the most used hierarchical clustering techniques which is often used to determine the number of clusters in the data with the help of graph called dendrogram (Soni & Kodali., 2017). There are different methods of measuring the distance between the data points, but since no prior information is required about the clusters, this approach is simple to apply and hence is used in most of the researches (Dash & Misra, 2018). In the present study also, the same approach was used where dendrogram giving a hint as to how many clusters can be formed with the help of given data.

K-means clustering is one of the most widely used technique of clustering. In this technique which divides the observations into K clusters where each item is placed in a cluster having

nearest mean values (Soni & Kodali., 2017). K means clustering generates ANOVA tables which were used to find out the significant variables which went on to decide the behaviour of every cluster.

The present study divides the banks in 3 different clusters indicating high, moderate and low risk profile on the basis of values of different factors present in each cluster.

### Sample banks

For the purpose of conducting the study, a total of 20 banks have been selected, 10 each from public and private sector. The banks have been

Public Sector Banks	Private Sector Banks
Bank of Baroda	Axis Bank Limited
State Bank of India	HDFC Bank Limited
Punjab National Bank	ICICI Bank Limited
Canara Bank	YES Bank Limited
Bank of India	Kotak Mahindra Bank Ltd.
Union Bank of India	IndusInd Bank Limited
Central Bank of India	Federal Bank Limited
Indian Bank	IDFC First Bank Limited
Indian Overseas Bank	Jammu & Kashmir Bank Ltd
UCO Bank	South Indian Bank Limited

### Variables

For determining the risk profile of the banks, a set of 11 variables were considered in the study. Out of these 11 variables, 9 were taken from the study of risk profiling by Dardac & Iustina, (2009), and in order to indicate another variable from income side of financial statement, one variable related to interest

selected on the basis of asset size as on 31-03-2019 since the scope of the study is from 2008-2019. The main purpose for selecting the banks on the basis of asset size is because it makes them comparable. While selecting the sample, banks which have been merged or acquired have been ignored because their data would not have been available for the entire study period. Also, IDBI has been considered to be a part of private sector bank because it has been de-nationalized before the data collection period. The list of banks is given in table 1.

income was added on the basis of study by (Binh & Khanh, 2014). The last variable was specifically taken considering the huge influence of NPAs in Indian banking scenario as indicated by (Arora & Kumar, 2015)

The final list of 11 variables are listed in the table 2 with an indication of what aspect of risk they intend to measure.

Variable	Implications for risk profile
Capital and reserves to total Assets	It is an indication of main cushion of banks and hence indicator of its risk aversion (Dardac & Iustina, 2009).
Cashholdings to Total assets	Measure of managing liquidity risk of banks
Loans to deposit ratio	It indicates how much of internal resources can be utilized to meet the deposit demands
Loans to total asset ratio	It is an indicator of credit risk of bank
Operational expenses to total assets	It indicates efficiency of banks in terms of controlling its operating costs
Return on Assets	It indicates the returns generated over per unit of assets
Return on Equity	Indicates the return of the shareholders on their money
Profit margin	Measure of banks' profitability
Deposits to total liabilities	Indicates the sentiments of public towards the banking system of the country (Dardac & Iustina, 2009)
Non-interest income to interest income	Indicator of systematic risk and non-traditional income of banks (Binh & Khanh, 2014)
Gross NPAs to total assets	Indicator of credit risk and bad loans for the bank

Data on these variables was collected from the annual publications on the assets and liabilities of banks published by RBI. For the purpose of data standardization, the above-mentioned

variables have been converted into percentages so that the effect of asset size of banks is further averaged out from the analysis.

The analysis of the data was conducted in the following manner.

- Both public and private sector banks were divided into three clusters on the basis of above mentioned variables for each year of study period. ANOVA was used to select the significant variables which caused the difference among the clusters of these banks
- Clusters were categorized as high risk, moderate risk and low risk on the basis of values of significant variables as suggested by literature.

### Analysis

#### Public Sector Banks

If we look at the analysis results of public sector banks over the study period, it can be seen that some of the big banks like SBI have been performing well, despite the economic recession and the change in RBI policies over non-performing assets. The first table shows p values of the various risk profiling indicators during ANOVA table generated in K means clustering. The variables highlighted in each year are the once for which p values are significant ( $p < 0.05$ ) and as a result, they were used to categorize the banks into high, moderate or low risk categories which are in turn shown in the next table.

It can be seen that the three variables which were most significant throughout the period of study were profit margin, return on equity and return on assets, followed by deposits to total liabilities and loans to deposits ratio. The variables like capital and reserves to total assets do not appear significantly different during the period of the study, which can be attributed to the guidelines of Basel norms which mandate a minimum ratio of capital to assets to be maintained. Similarly, operating expenses to total assets do not appear to be significantly different among the banks because these expenses are known to be high throughout the public sector banks across India.

The variable of nonperforming assets is often considered a serious problem in Indian public sector banks and is considered to be a very crucial parameter in the credit risk of Indian public sector banks and their overall financial performance (Mishra, 2013). However, the variable appeared to be significantly different only in 4 years, 3 out of which were last 3 years of the study. This can be attributed to the clean-up mission of Reserve Bank of India which pushed many PSBs to declare high non-performing assets while some of the big banks suffered some major scams and crisis regarding big-budget loan defaults like Neerav Modi scam which in turn again created a significant difference in the NPA status of the category.

**Table -Variables showing significant difference during K-means clustering**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
ROA	<b>0.01</b>	<b>0.01</b>	<b>0.00</b>	<b>0.01</b>	<b>0.00</b>	<b>0.01</b>	0.49	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	0.19	<b>0.01</b>
ROE	<b>0.00</b>	<b>0.01</b>	<b>0.01</b>	<b>0.02</b>	<b>0.00</b>	<b>0.02</b>	0.58	<b>0.00</b>	<b>0.01</b>	<b>0.00</b>	0.22	<b>0.00</b>
LTDR	0.10	<b>0.02</b>	<b>0.06</b>	<b>0.03</b>	0.91	<b>0.03</b>	<b>0.02</b>	0.16	<b>0.05</b>	0.12	0.51	<b>0.06</b>
OETA	0.48	<b>0.05</b>	0.55	0.10	0.87	0.10	0.15	0.22	0.21	0.30	0.79	0.90
LHTA	0.59	<b>0.01</b>	<b>0.04</b>	0.11	0.83	0.11	0.11	0.74	0.11	0.25	0.48	0.10
NP	<b>0.03</b>	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	<b>0.00</b>	<b>0.01</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.02</b>
CHTA	0.61	0.52	0.85	0.99	0.82	0.99	0.35	0.04	0.29	0.42	0.87	0.81
DEPT L	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	<b>0.02</b>	0.83	<b>0.02</b>	<b>0.03</b>	<b>0.02</b>	<b>0.01</b>	<b>0.00</b>	0.84	0.18
CRTA	0.32	0.06	0.16	0.15	0.91	0.15	0.55	0.85	0.25	0.15	0.17	0.71
NII	0.36	<b>0.04</b>	<b>0.01</b>	0.13	0.11	0.13	<b>0.00</b>	<b>0.05</b>	<b>0.02</b>	0.20	0.75	0.82
NPAT A	0.15	0.12	0.11	<b>0.03</b>	0.22	<b>0.03</b>	0.21	<b>0.01</b>	0.16	<b>0.04</b>	0.28	<b>0.02</b>

**Table – Risk profile of Public Sector Banks 2008-2019**

Bank	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Bank of Baroda	High	Low	Low	Medium	High	Medium	Medium	Medium	High	Medium	Medium	Low
Bank of India	Low	Low	High	High	High	Medium	Medium	Medium	High	High	Medium	Medium
Caanra Bank	Low	Low	Low	Medium	High	Medium	Medium	Medium	High	Medium	Medium	Low
Central Bank of India	High	High	High	Low	Low	High	High	Medium	Medium	High	Medium	Medium
Indian Bank	Low	Low	Low	High	High	High	High	Medium	Medium	Medium	Low	Low
Indian Overseas Bank	Low	Low	High	High	High	High	High	High	High	High	High	Medium
PNB	Low	Low	Low	Medium	High	Medium	Medium	High	High	Medium	High	High
SBI	Medium	Medium	Medium	Medium	Medium	Low	Low	Low	Low	Low	Medium	Low
UCO Bank	High	High	High	High	High	High	High	Medium	High	High	Medium	Medium
Union Bank of India	Low	Low	Low	High	High	High	High	Medium	Medium	Medium	Medium	Medium

When it comes to bank-wise performance in the category, the largest bank is the best performer of the category, and has been a part of low or medium risk categories throughout the period of study. Other large banks of public sector like PNB and Bank of Baroda had a more fluctuating performance, with occasional presence in the high-risk category. The last two years' high-risk performance of PNB can be attributed to Nirav Nodi scam which was valued at more than Rs. 11,000 crores causing a huge strain on its NPAs as well as the reputation as a whole (Srinivas, 2018). When it comes to worst performing banks, UCO bank and Central Bank of India have been a part of high-risk clusters for most part of the study and have never been a part of low risk cluster. These findings coincide with the recent action of RBI on UCO bank due to its high NPA and poor management or its risk profile. These actions included putting a check on branch expansion and management compensation (Rey, 2017) which led to the bank improving upon its asset quality.

### Private sector Banks

If we look at the analysis of private sector banks during the period of study, it is clear that the two most important variables which have been significantly different across clusters Risk profile of Private Sector Banks 2008-2019

Bank	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
South Indian Bank	Low	Low	Medium	High	Low	Low	High	High	Medium	Low	Medium	Medium
J & K Bank	Low	Low	Medium	High	Low	Low	High	High	Medium	High	Medium	Medium
IDBI	High	High	Low	Medium	Medium	Medium	Medium	High	High	High	High	High
Federal Bank	Low	Low	Medium	Medium	Medium	Medium	High	High	Medium	Low	Medium	Medium
Indusind Bank	Low	Medium	Low	Medium	Medium	Medium	Medium	Medium	Low	Medium	Low	Medium
Kotak Mahindra Bank	Medium	High	High	Low	High	High	Medium	Medium	Low	Low	Low	Medium
Yes Bank	Low	Medium	Low	Medium	Medium	Medium	Medium	Medium	Low	Medium	Low	Medium
ICICI Bank	Medium	High	High	Low	High	High	Low	Low	Low	Medium	Low	Medium
HDFC Bank	Low	Medium	Low	Medium	Medium	Medium	Medium	Medium	Low	Low	Low	Low
Axis Bank	Low	Medium	Low	Medium	Medium	Medium	Medium	Medium	Low	Medium	Low	Medium

throughout the period of study were deposits to liabilities ratio and loans to deposits ratio. This shows that confidence of general public in terms of deposits and loans varied across different private sector banks making some of them high risk. These variables are followed by capital and reserves to total assets ratio which was significantly different in 6 years out of 12-year duration of the study.

The behaviour of non-performing assets is same in the category of private sector banks as well, where the significant difference is found in the last 4 years, similar to the case of public sector banks. This Asset Quality Renewal which was initiated by RBI in 2016 led to tremendous increase in NPAs in the balance sheet of banks which further led to the amendments in insolvency position in Indian laws by the government and central bank which led to lot of fluctuations in the non-performing assets in both public and private sector banks (Financial Express, 2017).

It can also be seen that category wise difference resulting in formation of clusters is based on a smaller number of variables in case of private sector banks in comparison to public sector banks indicating a greater degree of uniformity across the sample banks.



In case we look at the risk profile of private sector banks over the course of study duration, it can be seen that IDBI appears to be riskiest bank with it performing in high-risk category for most part of the duration. It is expected that the performance of bank might improve in future years after the decision of government to privatise the bank in 2019.

When it comes to best performing banks in the category, two largest banks, Axis and HDFC bank have been best performers having never been a part of high-risk category during the

period of the study, followed by IndusInd bank. Yes Bank also performed well except in the year 2018-19, where it became a part of high-risk category which is coincidental to its management and financial struggle still continuing at the time of writing of this paper. Other banks in the moderate to high risk categories are comparatively smaller banks which are more vulnerable to the economic shocks and public confidence fluctuations leading to significant difference in the risk profile variables and resulting risk profiles.

**Table – Variables showing significant difference during K-means clustering**

Variable	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
ROA	0.39	0.44	0.70	0.39	0.54	0.55	0.67	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
ROE	0.33	<b>0.05</b>	0.29	0.15	0.17	0.42	0.93	<b>0.01</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
LTDR	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	<b>0.00</b>	<b>0.01</b>	<b>0.01</b>	<b>0.01</b>	0.16
OETA	0.08	0.55	0.38	0.43	0.54	0.56	0.60	0.16	0.09	0.57	0.82	0.54
LHTA	0.28	<b>0.04</b>	0.10	0.42	0.59	0.82	0.71	0.98	<b>0.04</b>	<b>0.04</b>	<b>0.00</b>	<b>0.00</b>
NP	0.62	0.24	0.95	0.58	0.54	0.51	0.58	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
CHTA	0.47	0.19	0.53	0.31	0.59	0.25	0.52	0.69	0.59	0.88	0.73	0.97
DEPTL	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.05</b>	<b>0.00</b>	0.94
CRTA	0.06	0.29	<b>0.04</b>	<b>0.00</b>	<b>0.00</b>	<b>0.03</b>	0.28	<b>0.05</b>	<b>0.05</b>	0.12	<b>0.05</b>	0.19
NII	0.68	0.07	0.09	0.15	0.14	0.09	<b>0.01</b>	<b>0.00</b>	<b>0.01</b>	<b>0.00</b>	<b>0.00</b>	0.92
NPATA	0.30	0.07	<b>0.00</b>	0.31	0.62	0.82	0.77	0.07	<b>0.03</b>	<b>0.01</b>	<b>0.00</b>	<b>0.00</b>

If we look at the variables which come out to be of significant difference during the analysis, Loans to Deposit Ratio and Deposits to Total Liabilities ratio are significant for 11 out of 12 year period of the study. On the other hand, variables like ROA, ROE and NPA are significant during the later part of the study only. Level of NPA indicates the preparedness of banks in handling credit risk and the recent actions of the central bank towards NPA clean-up is an attempt to reach international standards

of credit risk management (Sharifi, Haldar, & Rao, 2019). As a result, the banks' risk profile is affected by difference in levels of NPA and banks like IDBI fall into high risk category due to high credit risk. This difference was mainly caused by change in policies of RBI over bank clean-up as well as scandals in banks like Yes Bank and ICICI bank along with high losses of IDBI during the recent year. Return on equity as well as loans to asset ratio has not shown significance in any year of the study period.

Year	No. of Public sector banks in each cluster			No. of private sector banks in each cluster		
	Low	Medium	High	Low	Medium	High
2008	6	1	3	7	2	1
2009	7	1	2	3	4	3
2010	5	1	4	5	3	2
2011	1	4	5	2	6	2
2012	1	1	8	2	6	2
2013	1	4	5	2	6	2
2014	1	4	5	1	6	3
2015	1	7	2	1	5	4
2016	1	3	6	6	3	1
2017	1	5	4	3	4	3
2018	1	8	1	6	3	1
2019	4	5	1	1	8	1
Sum	30	44	46	39	56	25
Average	3	4	4	3	5	2

If we look at the number of banks in each cluster, public sector banks have lesser number of banks in low risks category as compared to private sector banks. Similarly, the number of banks in high risk category in private sector is almost double in case of private sector as compared to public sector banks. Both these show that on an average, more banks fall into high risk category in public sector than in

private sector. In case of public sector banks, it is SBI which was the only bank in low-risk category for most part of the year, but the performance of public sector banks is improving in the recent years as number of banks in high risk. Similarly, in case of private sector banks, the only bank in high-risk category is IDBI.

	Public Sector banks	Private Sector Banks
ROA	10	5
ROE	10	5
LTDR	7	11
OETA	1	0
LHTA	2	4
NP	12	5
CHTA	0	0
DEPTL	9	11
CRTA	0	7
NII	5	5
NPATA	5	5

When it comes to the most important variables across the categories, Loans to deposit ratio and Deposits to total liabilities are significant for most part of the study in both the categories. Loans to deposit ratio is an indicator of liquidity risk of the bank and too high ratio is often considered a sign of poor liquidity position of the banks (Onyiriuba, 2016). This ratio is also related to the net interest income margin and other profitability measures (Azad, Azmat, & Hayat, 2019). Deposits to liabilities ratio indicates how much of assets come from deposits. Since deposits can be attracted by banks by various means, it is important to understand how much of it can be backed by the total assets of the bank.

As discussed above, NPA has recently become significant as post change in RBI's asset clean-up policy, banks with good quality of assets are separated from those with not so good quality of assets. ROE, ROA and profit margin are related to the efficiency in bank's performance (Greuning & Bratanovic., 2003). These ratios are more crucial in case of public sector banks as compared to private sector banks. The main reason for the same is the huge operating and net losses accumulated by some banks in the category which leads to negative returns for the investors ultimately leading to high risk profile.

On the other hand, capital reserves to total assets ratio is more significant in case of private sector banks.

### Conclusion

Risk is inherent part of banking business and banks take all possible steps to minimise and manage the same. Understanding risk profile of a particular bank is very important for investor because it will affect the performance of the bank. However, very few studies have focused on profiling the banks on the basis of various risk parameters so as to ascertain their risk profile as compared to their peers. When it comes to emerging markets, it is often assumed that due to government interference, public sector banks have more problems in their performance and are less efficient as compared to private sector banks. Apart from these, there are some other fundamental differences between emerging economies and Western developed nations and as a result, it becomes important to study their risk behaviour separately.

There is a lack of evidence when it comes to use of cluster analysis on risk profiling of banks in emerging economies. Even in the existing studies, the time period of study is relatively small which does not provide enough

window to understand the long-term trend of banks. Cluster analysis is a popular data mining approach which classifies items on the basis of similarity/ differences in the data. Present study conducts a long-term analysis of risk for Indian public sector and private sector banks for a period of 12 years from 2008-2019. This period indicates the recovery from financial crisis and new policy of RBI on asset clean-up which significantly impacted the risk profile of these sample banks.

The key findings of the study suggest that Indian banks have recovered nicely from financial crisis and their risk profile has improved over a period of time. However, as a group, public sector banks are riskier than private sector banks as more public sector banks fall in high-risk cluster on an average than private sector banks. When it comes to variables, NPAs have not been an important consideration for risk profiling in the initial years of study, but their significance has increased over the period.

Most important variables are Deposits to Total Liabilities and Loans to Deposit Ratio for both public and private sector banks, whereas Net profit is more crucial for the profiling of public sector banks, mainly due to the profitability of SBI as compared to other banks. These findings are expected to be of use for investors and policymakers alike in terms of methodological contribution of risk cluster analysis in risk profiling.

The research is however limited to Indian banks only, that to a limited set of 20 banks. Due to the ongoing process of consolidation in Indian public sector banks, only these banks were taken which have not been merged into some other bank. Also, the study does not capture the impact of current pandemic on the risk profile of these banks, which can be a good field of study for future research. Future research can also be conducted on same variables in some more emerging economies which can validate the findings of the current study.

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**NEO COLONISATION IN DECOLONISED INDIA: THE TRIBAL REALITY****S. Bhattacharya<sup>1\*</sup>, S. Pal<sup>2</sup>, D. Kumar<sup>3</sup>, P. Sarkar<sup>4</sup> and S. K. Ghosh<sup>5</sup>**<sup>1,3</sup>Department of History, University of Technology, Jaipur, Rajasthan, India.<sup>2,4,5</sup>School of Education, NSOU, West Bengal, India.<sup>1</sup>sbhattacharya1977@gmail.com, <sup>2</sup>subhoriddhipal2010@gmail.com**ABSTRACT**

*India, the world's second-largest tribal inhabitation, is afflicted with the issue of tribal development. In the bureaucratic and exclusive developmental approach by Govt of India neither the tribal people are included nor do the actual benefits percolate to them. The emergence of 'NeoDikus' has started new modes of exploitation. Development induced displacement and socio-cultural destruction felt to them as expatriates on their own land leading to neo colonisation in decolonised India. With the Exposure to mainstream culture; Egalitarianism and collectivism are replaced by individualism and materialism specially among the better off tribal. Utterly frustrated about the notion of development, the country is witnessing several ethnic insurgencies and violent protest movements from various tribal communities. Presently tribal are struggling for ethnopolitical identity. Deplorable socioeconomic state and cultural annihilation of the tribal community raise the question is about the right direction of development. The meaning of development should be interpreted from a tribal point of view. Adoption of the concept of 'We' instead 'we and they' is the need of the hour. Discarding the concept of development from above; A Pro Tribal, inclusive and sustainable model of development can be a solution towards strengthening the socio-ecological niche of tribal communities.*

**Keywords:** Tribes, Development, Neo-colonialism, Culture, Socio-economy.

**Introduction**

The concept of tribe is slightly different in India from the other part of the world. Numerous theories are built about the origination of tribes in India. But none of the theories could postulate with accuracy. It is estimated that these people are the earliest inhabitant of the country. These pre-Aryan people were termed Dasyus (Dutta, 1909) by the racist leaders of Vedic antiquity. The caste structure developed in the later Vedic period consciously kept these pre-Aryan people outside of its structure. It was probably done to prove Aryan supremacy and to isolate them from the mainstream of the social process. Moreover, they were further stigmatised by terms such as Rakshasas, Vanara and Junglee (wild) in Vedic literature (Dutta, 1920; Dutta, 1903). Thus, the concept of 'We and They' was developed. As they were kept aloof from the Aryan social structure so they retain and further develop their own socio-cultural traits. In the Aryan Epics the Ramayana (Basu, 2012) and the Mahabharata (Bhattacharya, 2014) we get mentioning of interaction with the non-Aryan subjects. Specially in some parts of southern India and North East India, some of the non-Aryan communities established their political dominance.

The industrial revolution in Europe prompted the development of a new culture of political dominance, namely the colonisation of Asian and African countries. Britain became the world's largest coloniser, establishing colonies on every continent except the polar regions. India was one of Britain's largest and most prosperous colonies (Dutta, 1902). With the establishment of British rule in India, British officials conducted extensive surveys of the country to determine the most efficient use of the country's natural and human resources (Nauroji, 1901).

Indeed, the sociocultural distinctions and distinctness between pre-Aryan and caste structured communities had not gone unnoticed. All indigenous peoples were referred to as tribes in white settler colonies such as Australia, Canada, and America. However, in the case of India, colonisers may have taken advantage of the existing divisions in Indian society, which were largely regulated by the Brahmanical order. In India, only pre-Aryan outcastes were referred to as tribes.

Another factor that pulled the colonial administrator was the recorded culture of the Aryan people with Brahmanism at the centre (Srivatsan, 2005). The Eurocentric concept of tribe was tailored to accommodate the Indian society that existed at the time. Personal law was promulgated based on caste and tribe

distinctions, following colonial utilitarian logic. European utilitarianism was quite distinct from the colonial version. They had done so to obviate the possibility of the emergence of a nation (Srivatsan, 2019).

The colonial policy of isolationism of these noble savages made them socially, politically and culturally silenced. The Eurocentric approach of writing history never recognised oral sources as authentic because it lacks a scientific approach, another concept developed on European value. But this narrowed the scope of human history. The role of tribal people in making civilization was grossly ignored and not reflected in the European style of scientific history. The dilemma of the Eurocentric concept of civilisation and rationality directed the colonial historian in the wrong direction. Risley's theory of racial supremacy of European over Indians concerning nasal index is another example of describing British supremacy (Behera, 2020). Even the nationalist workers ignored their participation; nationalist historians ignored their contribution to the freedom struggle. In the British period, socio-economic development was spatially and temporally uneven. For example, the people of the Bengal presidency had the maximum advantage of exploiting colonial welfare and opportunities. But the tribes were in the most disadvantaged section. Their self-sustained economy was shattered by the colonial uniform economic policy which greatly reduced their access to forests, rights over land and exposed them to dual exploitation, one in the hands of colonial rulers and other in the hands of non-tribal Indians such as landlords, middlemen, money lenders etc (Donald, 1985). It was Verrier Elwin who desperately tried to draw the attention of the Nationalist leaders to intervene as in the case of untouchables. The Government of India act, 1935 introduced the concept of excluded and partially excluded areas that would be under direct administration of colonial government. This was done because maximum British administrators believed that this provision would protect the tribe from the oppression of the Hindu society. The colonizers at the same time put strong faith in the missionaries work as the ultimate resort specially spreading education among the non conventionally educated tribes. The colonial

philosophers often took refuse to Christianity as the saviour of tribal people all over the world. The white man's burden in India that is the tribal population was perceived to be the object of preservation by the colonial authorities against Brahmanical aggression.

Now, this policy of exclusion in socio-political administration scrambled the nationalist leaders. After decades-long silence over the social exclusion of the tribal community, the nationalist leaders started recognizing the tribal community of the country. They simply protested it as outrageous or even feared that these excluded might be a scientific zoo for anthropological experiments (Guha, 1996). That was the beginning of thinking seriously about the century's long most neglected, oppressed, exploited section of society. The basic question stirred the nationalist leaders about what to do with the tribal people? What will be the path of development?

Immediately after independence, the most challenging and experimental task before the Government of India was determining the mode of tribal development. The first Prime Minister of the country Pandit Jawaharlal Nehru, greatly influenced by the working philosophy of Varrier Elwin, expressed his that tribal population of the country should be left least administering by outsiders rather they should be helped to develop in respect of communication, health, education and better agriculture, keeping the view of their culture and age-old traditions. His 'Panchsheel' about tribal development owed its root in their customary rights over forest and land, preservation of culture and inclusion in developmental planning (Elwin, 1964). Nehru had the vision that the tribal community of the country was more democratic in terms of their socio-cultural norms and more civilised in some sense. At the same time, he rejected Elwin's theory of dominant caste society and blamed the colonisers to project the tribal people of the country on the wrong foot of history. Moreover, he was in the view that there was a strong interaction between the tribal and non-tribal communities in the pre-colonial period (Gavit & Chand, 1989). According to article 342, the president of the country is empowered to declare tribes or tribal communities as Scheduled Tribes (STs) of a

state or Union Territories while fulfilling certain criteria. Several constitutional and legal provisions were made to safeguard the interest of the STs (Basha, 2017) for their socio-economic development and cultural preservation while integrating with mainstream society. But the nomenclature is controversial because it merely included the British notified tribes without considering the denotified tribes who are still struggling to be included in the Scheduled Tribe list.

The first and second planning commissions were constituted with the aim of rapid agricultural expansion and large-scale industrialization. The government of India took the mode of the mercantile economy as the path of development and also perceived that this would reduce economic and social discrimination. Perhaps the policymakers of the country took refuse to colonial down filtration theory without taking into consideration the views and desire of the people of a targeted region for the developmental process. Thus, this was a model of 'development from above' without taking into consideration of tribal's world view, their hope and desire.

The construction of national identity was the notion of this development. As the tribal people were already perceived as underdeveloped from every societal aspect in developmental discourse so the process of mainstreaming was considered as the most viable resort for integration. This wrong notion of development became a panacea for tribal development. Development is a multi-dimensional concept. The term usually drives towards positive change. It is centred at social, political, economic, educational, health and cultural arenas. In India, earlier development plans were aimed at economic growth without inclusion. Except eighth five-year plan none of the five years plans allotted more than 3.7 percent of the total budget expenditure for the development of the tribes (Ministry of Tribal Affairs, 2007). The aspiration of the tribal communities of the country had no importance in the developmental policies. the adverse inclusion by the upper caste dominated political and bureaucratic prejudices paved the way for further deprivation and alienation. (Dev & Xaxa, 2012).

The tribal people, often stereotyped, stigmatized as primitives, lack intellect, present-day are regarded as wiser and more scientific in their way of life by the so-called civilized world. Their sustainable resource management, knowledge over the forest and their symbiotic relationship with nature unleash a fresh debate that who is more developed? Our very existence does not depend upon mere economic development. Development in every aspect of life sustainably and inclusively can only save the civilizations on this blue planet.

The most burning issue of Environment and Sustainable Development throws new light on tribal perspectives on natural resources specially land and forest. Land and forest are treated by them as identity. Nature, land and forest owe importance in everyday life, religion, culture, beliefs and traditions of tribal communities. The tribal fought several fierce battles against the British in their first hundred year's rule in the country for their rights over land and forest (Guha, 2012). Though the colonisers killed lakhs of tribes in the process but considering their indomitable nature of and to restore peace in tribal-dominated areas made some special provisions for them. For that purpose, two acts had been legislated one Santhal Pargana Tenancy Act 1876, Chota Nagpur Tenancy Act, 1908. The second one prohibited any kind of sale or lease of land under Mundari khunt-Kattidari tenancy. Even a court order should have to be executed with prior permission from the Deputy Commissioner of the region (Chota Nagpur Tenancy act, 1908). But multiple projects aimed at economic development across the states proved to be havoc on tribal life. This so-called developmental process seems to be internal colonisation. The construction of dams, highways, large industries, large scale mining activities invited large scale eviction, dispossession of tribes from their land. This 'res- nullius' mode of development by the government, unleashed protest movement and even fierce resistance from tribal communities who are wholly dependent on land. On 2 January 2006 the officials of Jaipur district in Orissa, accompanied by a heavily armed police force ruthlessly acquired the tribal agricultural land for the establishment of a private project without giving them proper compensation.10



person from local tribal villages died by police firing when they desperately tried to resist the eviction. What is development? Does the roadscars and vehicles only indicate development? Asking these eternal questions, a tribal leader from Orissa exposed the fallacy of the system. He further continued, “We are the people of the soil and our lives revolve around the soil. We cannot live without our land. We will die to save our land” (Mahana, 2019). This is not only the voice and view of a particular person but it echoes the clamour of tribal people of the whole country who in the name of development further marginalised. As per the government records up to 2008, the highest number of cases registered, on claim over the land among the nine states with scheduled areas, was in Jharkhand followed by Andhra Pradesh. The rejection of the claim was highest in Madhya Pradesh and Maharashtra (Channa, 2020). On 23 November 2016 when the government of Jharkhand amended the historic land laws of the state for the interest of industries and real estate business. The tribal people feared that it will cause widespread displacement in the name of development (Jitendra, 2016).

The Santhal, the Mundas and the HOs identify themselves as ‘Har’ means humans and term people from other tribes as ‘Mitan’. Thus, the concept of ‘Har-Mitan’ creates a sense of ethnic identity (Mahato, 2012). The tribal people fought against the colonisers as well as Dikus (non-tribal people) against their exploitation. Unfortunately, the colonial relics continue in new form even after independence. The provisions of the fifth schedule and sixth schedules were either made ineffective or simply violated by the state authorities. Proviso 3(a) of the sixth schedule empowers the government to acquire any land for public utility (Ministry of Tribal Affairs, 2014). Thus, the tribal people of the country witness emergence of ‘Neo Dikus’ (private businessmen and corporate sharks) who loot them, exploit them beyond any description. Acquisition and alienation from land are carried out by the government based on the concept of ‘eminent domain’ where landless people will not get any benefit from developmental projects (Usha, 2009). According to Walter Fernandes around

60 million tribal people were alienated from their land up to the year 2000 since independence (Ministry of Tribal Affairs, 2014). In the egalitarian value-based community land ownership strengthen their kinship relation, power and organisational behaviour. But displacement and deprivation shattered their socio-economic structure, cultural heritage, customs, and traditions. Denial, dispossession and deprivation of share in government patronised developmental projects seem to be ‘Neo colonialism’ among the tribal community. Their despair reflected through the ‘Jhumur’ songs like-

“BoroBorokalkarkhanalokholokhoquater  
Pardeshirachakri kore jamintakaharre”  
(Mahato, 2012).

It means big industries where thousands of outsiders are working and living in quarters on whom land? It signifies that the benefit of development never reaches the ill-fated tribes who were displaced by it. They have lost anything or everything in the name of development but has got not even a speck of development. Their dream breaking despair dripped with ‘Tusu’ song-

“sautaldibijlikarkhana  
Koto babuder ana gona  
Kolkatatebijlijabek  
Purulyartyaretyare  
Batijolbakkolkatai  
Arhamararoiboandhar

Ei to babuderbichar.” (Mahato, 2012).

It means the Santhaldihi power plant was established for supplying electricity to Kolkata but the people of Purulia remain in the abject darkness. The poet asked if this was the justice done by so-called civilized people.

The developmental approach invites a new debate that without economic progress the aim of social welfare cannot be achieved but at the same, if the fruits of so-called development will instrumental in destruction, deprivation and exploitation of subalterns then it will be ‘Terra Nullius’ mode of development, development sandwiched between inequality and injustice. The ill-fated tribal people were not only alienated from land rights, their centuries-old rights over forests were mercilessly stripped off by the colonial and post-colonial government. Forest is the most important component for the livelihood, religion, customs and beliefs of

tribal society. The colonial administrators perceived Indian forest as inexhaustible and thus exploited the forest and its ecosystem in the name of scientific forestry. Post-colonial India witnessed how the forest and its produce were commoditized and commercialized by national bourgeoisies (Bose et al., 2012).

Following independence, a national forest program was formulated in 1952, which was merely a reiteration of the 1927 Indian Forest Act. In the name of national interests, the 1952 policy simply asserted monopoly rights at the expense of the forest community. Additionally, the assigned objectives lacked clarity, leaving the inter-philosophy of forest utilization unchanged. Industrial wood and fuelwood production were given priority to cater for the need of paper and pulp industries at the early phase of independence. More and more natural forest cover is replaced by commercial plantations like teak, tropical pine and eucalyptus. By 1978 the production of paper industries reached one million tons (Guha, 2012). Thus paradigm shift towards production forestry and commercialization of forest proved to be a catastrophe in the socioeconomic structure of tribal society.

The tribes residing in the lap of nature more harmoniously. There is always a symbiotic relationship between forest and tribe. While they are dependent on the forest for their livelihood and religious customs at the same time, they keep an emphasis on the preservation of forests on equal footing. (Xaxa, 2008). Their ecological wisdom towards sustainably balancing their needs is very much important from the conservation point of view. But the impact of encroachment, eviction from the forested area and changing nature of forestry cause much trouble for the tribal population. Monoculture is reintroduced in the name of productive forestry has a detrimental effect on the tribal economy. The protest of the replacement of natural Sal Forest with teak plantation in Jharkhand and Bihar sparked off *Jungle Bachao Andolan* (save the forest) by the local tribal community fearing loss of their traditional job of Sal leaves and seeds collection (Anantharaman, 2016). In the name reserve forest, protected forest the access for fuelwood collection is also restricted but

several recent studies show that collection fuelwood in no way harms the forests (Shukla et al., 2018). Another matter of concern is Minor Forest Products (MFP). It has grown to be a multibillion-dollar industry for multinational corporations. The majority of MFP originates in central India, where they account for 65 percent of the total tribal population. MFP accounts for over 67 percent of forest exports, which is increasing daily. MFP is a significant source of income for tribal members and other forest dwellers, but the companies and middlemen reap the profits. MFP collectors earn subsistence wages, even though the true value of the products maybe 100 times that of the selling prices. Indeed, tribal exploitation is most prevalent in MFP-oriented commerce. During the time of independence revenue earned from MFP was 30.3 million and it reached up to 1299 million in 1976-77 (National Commission on Agriculture, 1976) according to World Bank estimation MFP support the poorest of the poor 54 million tribal population of the country. When they could manage to earn only meagre wages then the state, MNCs and middleman private traders earn huge profits. The spokesperson of Vasundhara NGO estimated that while the state Orissa made a hefty profit of 500 crores the one million tendu leaf collectors could fetch collectively 64 crores in 2010. Another story from Bastar district of Chhattisgarh the tendu leaf collectors had got only 13.5 crores the state managed to profit 25.7 crores (Down to Earth, 15 November 2010). Thus, the thin difference between a trader and the government creates a sense of expatriates on their own land.

Under severe criticism, the Government of India implemented the Forest Rights Act, 2006 but the fruits of it passed to the tribes and other forest-dwelling communities are sadly inadequate. Some of the conservationist's fear that it may endanger wildlife conservation. But these civilised intellects perhaps fail to assess the ecological wisdom of tribal communities living in or outside of the forest. In 2019 the Inter-governmental Panel on Climate Change (IPCC) in its special report on climate change and sustainable land management gave due recognition on rights of indigenous and communal land tenure for better forest

management, wildlife conservation and carbon storage (Kukreti, 22 July, 2019). Though the FRA was intended to safeguard the tribal rights over forests and their produce illegal nexus between forest officials and timber lobby frustratingly jeopardise the holistic effort. The Soliga tribe, who have a recorded history of living in Bili Ranganathan Temple (BRT) Tiger reserve since 1807, were simply ignored by forest officials about their presence in the official documents. But the FRA Act legitimizes their habitat and claim over forest despite criticism from the conservationists who argued for inviolate land as a prerequisite for tiger conservation. Proves all their fears wrong the BRT Tiger reserve ranked top within the country in respect to highest tiger density in 2013. It seriously throws light on our civilized prejudices, stereotyping, dilemmas and attitudes towards the people of nature which cause hindrance to the eternal truth that 'we may know the science but they know forests' (Madhusudan et al., July 2019). The developmental plans for tribal people without the inclusion of tribal communities in the planning process sadly fail to achieve the goal.

### **Objectives of the Study**

The present study throws light on how the wrong notion of development, sandwiched development and sabotaged development wreak havoc on the tribal communities of India. Even after 75<sup>th</sup> years of independence, dozens of development programme for them measurably fails to uplift their socio-economic condition. Their culture is fading away. They are displaced, dispossessed and further marginalized. The paper examined the impact of modern development on them and also suggested how A pro-tribal model of development could save them from their sociocultural extinction. Moreover, their traditional knowledge could be the search beacon in environmental conservation.

### **Methods**

The study was entirely qualitative in nature and drew data from secondary sources such as pertinent official data, articles, and newspaper reporting. The research was purely descriptive. Further detailed report on tribal welfare and development is collected from the reports of

Ministry of Tribal Affairs, GOI; Ministry of Education and from the reports of different organs of UNO.

## **Result and Discussion**

### **Economy and Development**

The basic economy of tribes is quite different from the economy of the so-called society. Their economy had shared the resemblance with the primitive organization related to the economy. Modern advanced society economy is based on 'production-consumption-distribution' category where the tribal economy had felled into the category of 'production-consumption' (Majumder & Madan, 1967). Along with that, they used to pursue their economy without currency before mingling with the outer world.

From the reign of Cornwallis in the 18<sup>th</sup> century, a new type of taxation policy was introduced named: 'the Permanent Settlement' (Ray, 1974) which had turned out as a curse to uproot tribes from their original habitat. Due to this policy, the free movement of tribes in the jungle was shortened and paying certain revenues non-tribal and non-forest communities began to settle down near the jungle and employed tribes into thralldom to cut down forests and engaged them into cultivation. It imposed a change into their lives. The monetary economy was introduced in their life as well as that had metamorphosed them from free migrant to paid servant but there was still a blow of independence in their lives. Elwin conceived it as the beginning of the worst phase from where their story of destitution has begun. He enumerated those colonial rulers, landlords as well as moneylenders who took out tribes from their original roots, from their indigenous production economy and implanted them into the mainstream of economy which made their lives a hell (Elwin, 1944).

After Independence, India had chosen the route of the mixed economy to reach and touch the zenith of success. Indian government emphasized the private sector as well as the public sector to fuel up the mechanism of economic development. Free India ruthlessly uprooted the tribes to recklessly use the natural resources. But all those processes had been

gotten justified only because these uprootings has provided resources to turn the industrial wheels on. Forests are not only declared reserved, due to mining a lot of tribes had lost their abode in a twinkle of an eye. The country has continued to make progress for the people by making her people abandoned in the name of development. 'Common resources' which once were the resources of tribes' life just had been taken away from them without a single thought. N. S. Jodha has penned that common property resources have lost their quality than previous as a result rich have decreased the level of dependence on those products. To survive, tribes then had compelled to depend on low payoff options which again had turned out a disaster for them (Jodha, 1995).

A large part of tribes for their sources of food had depended on shifting cultivation. Again, they used the forest as the cattle rearing ground. When the forest is declared as 'reserved', both two aspects of their lives suddenly has been closed before them. To rehabilitate those tribes, a new phase of land distribution programme in the 1970's has been initiated. The initiative of land distribution of Gram Samaj(GS) (Hazaray, 1970) has been to distribute the land to the landless along with the tribes. But again, those tribes did not know the law, in maximum cases, the wealthy outsiders and inhabitant landowners received the legal pattas of the land. Deprived tribes again were deprived by the civilized society. They have lived their lives by ploughing others land at minimum wages as seasonal labourers. Again, those tribes who have got monetary compensations, also have destroyed money as they did not know how to use it or where to invest it. As a result, they have remained wage labourers either in factories or in the field.

From the period of P.V. Naroshimarao government in 1991, the wave of globalization has reached our country. Privatization, liberalization, FDI: all new coinages have begun to transform the whole economic scenario in the country. It again has proved a curse for the tribes who have been cultivators. Groundnut has been cultivated in dry areas as cash crops which proved beneficial to shackle off the title of bonded labour in Chitoor district in AP. But this process has got a terrible setback when edible oils have been allowed to

import. The import duty on oil has been reduced to a large percentage and the price of imported oil has been much lesser. As a result, the price of groundnut has been fallen tremendously and many farmers again have been caged in debts and have lost their lands and continued to migrating towards urban: a new destination and an uncertain destiny again are tagged with tribes by these development policies. Throughout the whole country, numerous incidents are the burning examples of this victimization.

Globalization in the economy has brought the feature of liberalization: mitigation of restriction in economic as well as social policies. In the economy, it has derived in contraction in public spending and has altered the right of decision making and the vacuum has been fulfilled by the private sector whose only intention is to enlarge their profits. In India, wherein 1960's the percentage of public spending was 11.0, this amount was reduced abruptly in the 1990's with only 4.7% spending and 2019 only with 1.6% spending (The Economic Times, 2019). As a result of this, government measures to provide help in employment, social services like health services, housing facilities, education is curtailed to a large extent and the state has stepped back in taking decisions from the field of economic planning and has prioritised and powered the market to take economic decisions. Tribes become more vulnerable in the hand of society because of this abolition of social protection of government is going into the hand of the public. There has been a visible shift observed in the field of rural development by reducing expenditure on health and education (Dev & Mooij, 2002). It again has brought impecunious fate for tribes. The government has reduced subsidies, expenses on pensions by opening more roads to bring destitution to the fortune of tribes. The industrial economy has employed this opportunity to generate a competitive lower-cost convenience for their industries by lessening the social standards in bonuses, insurance against injury, co-determination rights, pension schemes and many more. Not only that, there is very little security in job profiles which has made those unskilled tribal

labours more exposed to face ‘social dumping’ (Thame& Denny, 2018).

Before 1997, poverty has been defined by measuring the scale of consumption and other related determining components. The new

definition of poverty defined based on human development standpoint is “a denial of choices and opportunities for living a tolerable life” (UNDP, 1997).

**Table 1: per capita consumer expenditure (Rs) by household type and social groups in India 2011-12**

All India average monthly per capita consumer expenditure (Rs) by household type and social groups in India 2011-12	Rural	Urban
Tribes	1122	2193
Non-tribes	1719	3242

Source: NSS 68<sup>th</sup> Round, 2015.

After so many ‘spoon-feeding policies’, tribes still are lagged from the civilized society in economic aspects and reduction in subsidies

has made their lives horrible. Their income is so minimum to live a sustainable life. In name of development, we throw them into the ditch.

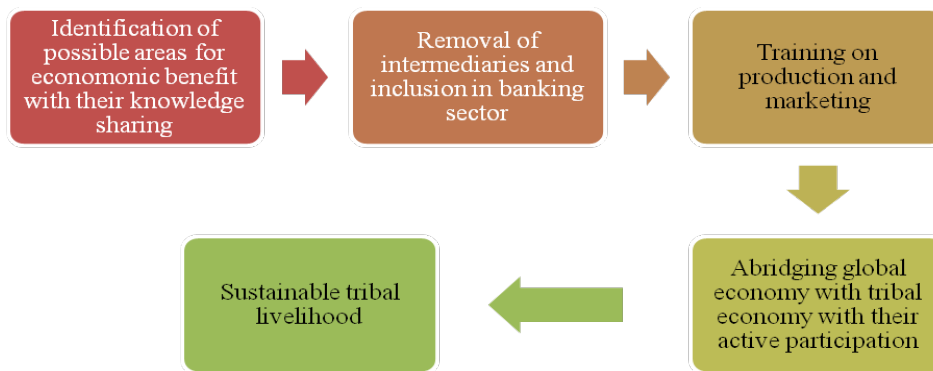


Figure 1 Inclusive and sustainable economic development model for the tribes.

**Development and Cultural Change in Tribes**

Culture is the unique traits of a particular society where most of its members to a large extent share common feelings, beliefs, faiths, rituals, food habits along with the words which bind them together and akin. Any culture of any community grows and develops based on the availability of its resources and based on its geographical locations. Tribal cultures have begun to bloom in the area far away from the so-called crowd at their ease and their own space. The rat race, the turmoil of wealth are not the elements of their culture, their culture mainly is characterized by need-based, not handled by the materialistic notion. What they cultivate, they know that a portion of it should be shared among the animals who are a part of the eco-system. But in the so-called civilized society, we protect it from grain eater animals and insects by spreading insecticides. This world view of them has made the superstructure of their culture. Their culture

gets substance from nature, in return they preserve nature.

After introducing the ‘Permanent Settlement Policy’, the so-called civilized world has entered into its periphery of isolation. This introduction has brought two things with it: one has been the introduction of coin and another has been the language of the outer world. Both two has helped to start the process of assimilation from isolation. They have now opened to a language that is different from theirs and to survive in this new scenario, they have begun to adopt the language and has introduced it in their day to day life. They are now open to a wider aspect of society and has introduced a new doctrine: the caste system of Hindu (Ghurey, 1959). The inauguration of currency has brought them into the market economy. These two learnt behaviour have begun to leave their marks on their culture as culture is the very product of cognitive behavior.

The change of culture lies in the seed of directives and ideas that stimulates the

behaviour. To live with the changing scenario, they have begun to adopt their directives and norms to follow their behaviour patterns. When they have been uprooted from their abodes: forests and hills and has left among another society, They have left among to the system as they have started to perceive themselves as safe and secure among it (Bose, 1941). Acceleration and Sanskritization slowly begin into their pattern into their life.

Amalgamation with the Hindu society creates a culture of cultural relativism in which tribal culture is taken as a degraded and inferior one which plays a destructive role to kill the culture of tribes: the indigenous traits of tribal society. Colonial India has also used India as a ground to spread Christianity in the exchange of bread and butter. Due to their miserable condition, to get rid of the intolerable pain of starvation, they have found it easy way to survive by embracing Christianity. Soon in gross, a majority of tribes have grabbed Christianity which has comprised one-tenth of the Christian population of the then society and the trends have been mostly visualized in north-east Himalayan pockets.<sup>15</sup> Christianity has emerged itself as a prominent force in the life of tribes, it has started to infuse their pattern on their cultures and has produced some cocktail one. Constant motivation from church and missionaries have washed out maximum tribal aspects and aspiration from their lives. Christianity has brought the first mould of modernization and westernization (Choubey, 1999). Two years back, I travelled through the seven sisters. Present generation youths of that area, consciously abandon their indigenous knowledge and cultures and bend towards western culture as they have perceived that their culture is of no use and it makes them lagged. Cultural relativism is a poisonous bane that plays a key role to destruct the tribal culture.

During the Colonial era, British Government let the tribes allow to sustain their lives and lifestyles apart from the civilized society, to some extent in isolation. But in the post-colonial era, Nehru has introduced the process of integration of tribes with the mainstream of society. The brainchild of Nehru: 'Five Year Planning' has put butter in the process but all-embracing attempts in this procedure have turned out a fatal one, a discouraging one,

which is not at all thought, perceived and expected. In the forest, they have collected their resources from shifting cultivation, but being uprooted from the forest, they are left with permanent cultivation which has altered their thinking process and has left a permanent mark on their culture. Maximum of them have been engaged as wage earners either in the field or in the factory, continuous assimilation with others cultures destroys the simplicity of them and juxtaposition with other has helped some foreign element to enter into their cultures which alternates the original one. The uprooting of tribes also put an end to their wandering nature, their hunting and all other qualities that have been flourished under the influence of nature. Hindrance in socio-cultural components has created a lack of motivation and aspirations on their part and has lubricated the path of acculturation.

With the wave of urbanization and industrialization tribes has faced revolutionary shifts in their surroundings. The momentum of mining, establishing of new industries in tribal belts, deforestation of forests without mercy has greatly affected the tribal pockets of India. Being root out again and again by society has left them more vulnerable. To survive, they have begun to mutate them and a new genre has enlightened in their life and has begun to evaluate their lives: 'cultural mutation' (Rao, 1966). The cultural crisis that they have felt is filled up with the amalgamation and mutation with the culture of so-called society and adopt a heterogeneous one in the terminology of religion, language as well as the world view and moral ethics. It alters the definition of face-face relation, the etymology of kinship and the authority of their life and weakens the thread of taboos and traditions regarding marriage and sex. The moral laxity which has been once forbidden to enter their periphery now has reshaped their creeds and cultures.

The tribal young generations don't enthusiastic about their culture as they find no cognitive assimilation of those as their present need. Therefore, they refuse to learn and carry. Even in their schools, a variety of cultures is celebrated or announced holidays on marked red days in the calendar. But they never find the same with them. In this scenario, they

unconsciously adopt new cultural traits and bring back them into their threshold not only putting them in their bag but also seeding it in the cognitive mind. It drastically remoulds their culture and their life. This diffusion of culture constantly adds up some new components fading away from the inheritance one. Acculturation and globalization encourage the money centred economy and fade away the knots of the kinship pattern of tribal life and altered the coding of their culture. When I have confronted some tribal students, they aren't able to speak their language, even they have no idea about their songs.

In a nutshell, we can easily conclude that tribes have already lost their indigenous knowledge and culture in a large quantity. The future harbingers feel less interest in their culture. These two components are quite enough to abolish the culture from the world scenario.

### **Education and Development of Tribe**

Education spreads its roots by three systems of education: formal, informal and non-formal education. Each has its periphery and its importance in the lives of individuals. When we enumerate literate and illiterate, stress is only put on the degree which can be obtained through either formal or informal education. UNESCO has defined literate as being the person who can read, write and be competent (UNESCO). Based on this we simply neglect and disown the indigenous knowledge they have possessed as they have a low literacy rate on the conventional literacy weight machine of ours. Here lies the prime question: are they illiterate and what is education? In ancient times, there were no written scripts, students learnt slokas from Gurus and recited it. When Guru felt that students had achieved the insight to make and spend their lives in a meaningful way, their education has ended. Like them, tribes also have no written scripts but has their own language. They have their own established education system and world views which make them capable to live life more. If their society permits and recognized it as worthy then who are we discard their traditional age-old education. It is a better way to say that they are non-conventionally educated rather than ruthlessly stigmatized as illiterate. Literacy rate and literate are two need-based terms generated

due to the emergence of the industry. There is a constant need for skilled labours which is manufactured by a formal conventional education system. If tribe society doesn't feel the need to develop themselves as human resources, don't feel the urge to dump in the conventional education system: is it the right way to label them as illiterate.

The main aim of education is to make humans more humane, not to prepare humans to utilize in the factory as human resources. The halo effect of our present education system even fails to make humans a little bit tolerable to accept others indigenous knowledge and education system. If education only means and implies institutional education, then what is the necessity to recognize non-formal education and bring it forefront as a part of education. As I conceive them, they are non-formally well educated. If the curriculum that we are taught in school is set on the priority-based of industry, if the outcome of education is materialistic one: then we are making stereotyping education system, a selfish complicated machine which drains out all human instinct which is not the traits of education at all. Colonial India had stressed more to generate institutional literates so that they could run the colonial reign smoothly without spending too much penny. British Government had introduced some asses to carry the load of the government through implementing their education policies, their intention of education is not a man making one. After the colonial era, we are so obsessed with the package system of their education, we reintroduce it and run the ass-making education system without celebrating the indigenous one and stereotypes the tribal education and ignores its man-making pedagogy and taboos them as illiterate one.

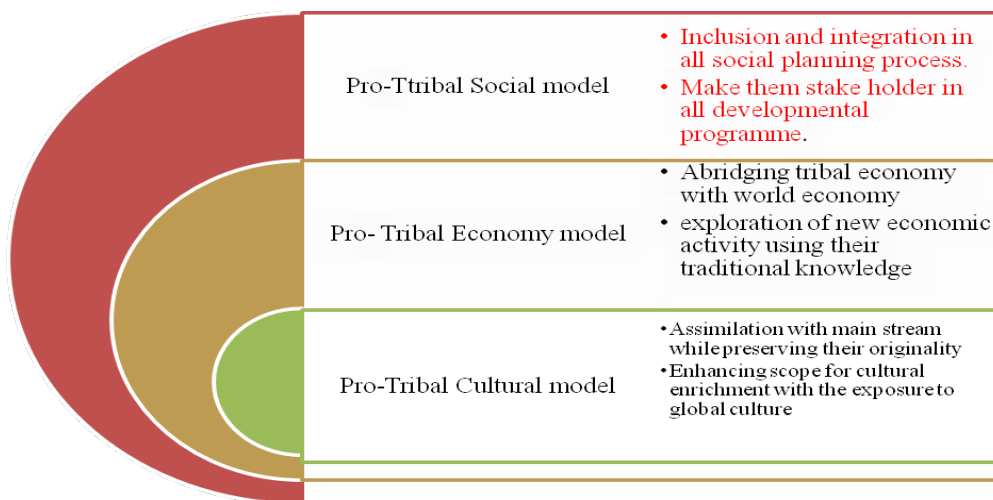
Indigenous pedagogy of learning is much more superior than European pedagogy of learning. John Dewey (Sikander, 2016) is the mastermind of 'learning by doing' philosophy, Montessori (yıldırımdoğan, 2015). Proposed that education has to be learnt through independence, observation where children are free to choose and develop as per their needs and requirement along with interest. All these flavours, components are present in tribal pedagogy, so if we appreciate Montessori and

Dewey, how can we not give proper value and respect to tribal pedagogy. They do the same thing without a good package and without promotion. Tribal education directly stresses and emphasizes those aspects only. In some places tribal had a dormitory education system which is denoted by the name ‘Ghotul’ but due to several being uprooted it has lost its existence but who is responsible for this – obviously Government and Government policies.

Rabindranath was not educated by the formal education system but he is a great educationalist. He has raised his voice for

establishing and promoting learning within close contact with nature. Gandhiji has encouraged ‘NaiTalim’ (craft, art, health and education) which is a perfect mixture of basic education. Idealism also speaks of truth, goodness and beauty as the essence of education. The tribal education system and pedagogy have all components if someone educated in this system is declared as illiterate: now the time has come to declare actually who is illiterate- the civilized one who are just literate human resources or the educated one in the true sense of education that is tribes.

**Conclusions**



**Figure 2: Proposed Pro Tribal Development Model.**

We wear a civilized egoistic glass. We scan everyone under this glass and who does not wear the same glass-like us, we brutally condemn them, we curse them and make them feel inferior and boastfully convey that we are so humanistic in our approach that we give them some scopes in the name of ‘reservation policy’. Before ‘spoon feeding’ the tribes in the name of reservation policy, we have to respect their indigenous way of living, their way of acquiring knowledge, their visions towards their life. The poem ‘Fable’ by Ralph Emerson rightly figured out that every creature is equally important to the world. No one is superior, none is inferior. Everyone is individual and made for certain purposes: we should respect diversity. Our heinous attitudes towards them, our self-imposed inferior tag on their back brutally kill their all aspirations and motivations. A livingly dead man can’t do anything. If we plant a hilly tress in the desert and castigate the tree for not growing well: is this a wise decision. In the

tagline of development, we lay hold of all the substances from where tribes rejuvenate and revive. We pluck out the roots of the tribes and simply leave them on the concrete road to survive. A new learner along with the instruction badly need compassion, empathy in their course of adopting a new environment and scenario. We just let them take entry just up to the threshold and forget about letting them in into our houses like us. We introduce inclusive education for them, but in the name of that, we dump them in the integration process. We priorities education at the beginning stage has to be delivered in mother tongue but in their case, education starts with an unknown language. The gap of education built from the beginning is never shortened rather it increases abruptly. Simple thing is that we make a zoo of tribes but forget to put an environment where they used to grow up which we usually do in the case of the animal zoo. Assurance a mouthful of food is not enough to survive; aesthetic, comfort,



self-reliance are also needed to survive like a human of brain and heart. There is also a huge lack between planning and execution as the executor sometimes is biased with the outcomes of the execution and he is self-propelled that they never do good if they are provided with the opportunity and sometimes the individual does not have any knowledge regarding tribes and their communities. So, half heated efforts bring no outcomes.

This is the age of specialization. The policy should be blue planned according to the strong points of tribes rather than make them

assimilate into a common periphery. In what they are strong, we put emphasis on that, polish that and help them to promote. The nature which nurtures them, lets bring back to them and give them space to flourish at their speed. We try to help them to regain their motivation, self-reliance back to their life otherwise cultural relativism and acculturation slowly kill the indigenous quality of tribe and turn into an etherized person. Development should be planned according to the traits of the targeted groups rather than make a dumping zone for the tribes.

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## A PERSPECTIVE OF CLOUD BASED E-LEARNING

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### ABSTRACT

The present era is a transforming era in the context of Information Communication technology. The effect of ICT are also depicted on the education sector as in the present context a big section of higher education were transformed on the online mode. Lot of massive open online course are available with cost optimizing price. But the main challenge here is to assessment of actual learning from the online platform. Therefore there is need to know the perspective the Cloud based e-learning with reference of related factors like user friendliness, costing and availability of resource to meet the level of higher education of the nation. The present study is an attempt to assess the said three major factors with the opinion of the respondents who are actively involved in the field. The study also tries to examine the similarity index among the factors taken for the study. The study is a direct attempt to find out the perspective of cloud based e-learning with information communication technology enable services and supports.

**Keywords:** ICT, Transforming, Cloud based e-learning, Education, Information Technology.

### Introduction

The aim of the modern online education is to carry out the far-away populace together to providing a platform to widen Knowledge domain. Also people can share their views and thoughts as well as current technology. With the advent of information communication technology, in the present time online education plays a fundamental role in the higher education sector. This technology keeping people together free of the geological boundaries for the higher education. But as we know that every coin has two sides, in the same manner online education also has some hopeful and doubtful features too.

Nowadays, it is of vital importance for a person to stay connected with the internet and its various media tools. We can say that this is need of the time to do so, for efficacious growth and development.

Cloud based e-learning are the internet based communication and knowledge platform which provides the enhanced facilities to the one to make sure quality, latest and high class of data. The varieties of forms of cloud based e-learning have been developed by the help of communication media. The role of Information and Communication Technology (ICTs) have moved toward the back bone of the cloud based e-learning for the user of higher education.

Now cloud based e-learning have capability as the contemporary instructive conveyance worldwide that it has basically turned out to be comprehensible to convey or get formal training without the use of such propelled advances in the procedures.

The comprehensive term - ICT-which covers an extensive variety of innovations for gathering, putting away, recovering, preparing, examining and transmitting or introducing data is, as a general rule, for all intents and purposes irreplaceable in the conveyance of contemporary training.

Consequently, governments and its organizations, the corporate division, instructive outfits and people progressively keep on investment enormous entireties of capital, time and different assets in this great speed of development to stay up with the latest as to the present requests and patterns.

### Cloud based E-Learning Scenario

Nowadays, the utilization of chalk and duster in our workshop rooms what's more, address theatres are totally terminated on some grounds. Instead of that, we currently have intuitive whiteboards controlled by PCs and projectors, learning administration frameworks and so forth.

Rating	5	4	3	2	1
Degree of Satisfaction	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

The electronic learning mediums alluded to as cloud based e-learning is progressively turning into the set up practice with a wide exhibit of positive results. In this situation of advanced education in the modern city's cloud based e-learning as a present setting for workforce training, what cloud based e-learning is, the verifiable foundation of e-taking in, its advantages, the main impetuses behind e-taking in, the types of cloud based e-learning , attributes of Cloud based e-learning , how it is conveyed and composed, innovation drifts, the sorts of advances being utilized, new hierarchical courses of action in cloud based e-learning , quality announcement and developing approach issues. But the main challenge here is to assessment of actual learning from the online platform. Therefore there is need to know the perspective the Cloud based e-learning with reference of related factors like user friendliness, costing and availability of resource to meet the level of higher education of the nation. These three major factors with the opinion of the respondents who are actively involved in the field are very much important. The study is an attempt in which we are trying to find out the actual scenario and similarities in the given factors.

**Objective and Hypothesis**

The objective of the study is to find out the feasibility of the cloud based e-learning with three factors namely user friendliness, costing and availability of resource to meet the level of higher education of the nation. So we can say that objective of the study is trying to assess the usability of cloud based e-learning as compare to the traditional education.

To assess the objective of the of the study three statement are taken in the consideration. These statement were treated as the statements which satisfy the statement of hypothesis if the study.

**Hypothesis**

“The cloud based e-learning technology is a significant technology which support user better than traditional learning technologies”.

**Methodology**

To assess the significance of the assumed hypothesis, there are three statements were taken in the consideration. These statements were:

- E-learning technologies are user friendly as compare to traditional learning technologies in higher / professional education system.
- The costing of Cloud based e-learning and its examination system is having low cost then the traditional education system.
- There is ease in availability of resource and contents for Cloud based e-learning with special reference of higher education.

The opinion of the respondents were collected for each of the statement. The respondents mean here from students, user and operators of cloud based e-learning courses in the higher education institutes.

For this study response of 150 respondents were taken on the five point Likert scale. The composition of the Likert scale is as follows:

Table 1: % point Likert Scale

The final assessment were taken by applying one way ANOVA (analysis of variance) test on the dataset of the questionnaire. Analysis of Variance (ANOVA) is a hypothesis-testing technique used to test the equality of two or more population (or treatment) means by examining the variances of samples that are taken.

**Analysis of the data**

To test the hypothesis opinion of the 150 respondents were collected with three said statement. The descriptive statistics on the three statements were:

**Table-2: Descriptive Analysis**

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Statement-1	150	486	3.24	1.270872
Statement-2	150	506	3.373333	1.148277
Statement-3	150	523	3.486667	0.667606

The result of test of analysis of variance (ANOVA) is received as given below. The result shows the similarity among the statements.

**Table-3: ANOVA Analysis**

ANOVA					
Source of Variation	SS	df	MS	F	F crit
Between Groups	4.573333	2	2.286667	2.23	3.015
Within Groups	459.9267	447	1.028919		
Total	464.5	449			

As per the description given in the Analysis of Variance sheet it is very much clear that the F value of the analysis is 2.23 which is less than the F critical / tabulated value. So it can be put in writing that  $F_{(observed)} \leq F_{(Tabulated / Critical)}$ . Therefore  $F_{(observed)} < F_{(Tabulated / Critical)} = F(2.23) < F(3.01)$ . So hypothesis is accepted here as F observed value is less to F tabulated value.

### Result

As per the result obtained from the one way ANOVA test / value of F test, it is found that the value of test satisfies the hypothesis. So on the basis of test we can say that the cloud based e-learning technology is a significant technology which support user better than traditional learning technologies.

The cloud based e-learning technology is also user friendly technology and cost optimize

technology. Also it is noted that resources for the learning satisfy the user.

### Conclusion

As per the objective and hypothesis framed for the study, the study is an attempt to assess the significance of cloud based e-learning as compare to the traditional learning. In the era of information communication technology it is observed that online education is provides a satisfaction in reference of cloud based e-learning. Even the various aspects related to learning in the higher education were also satisfied with cloud based e-learning. As it is found that cloud based e-learning is one of the user friendly learning activities which also provides interactive online resource on the chipper cost. So we can say that ICT supports e-learning and the next stage of e-learning which is cloud based e-learning is also beneficial for higher education institutes.

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**LINED INTERJECTION APPROACH FOR REDUCING AMBIGUITIES IN DATASET****T. Trivedi<sup>1</sup> and M. S. Deora<sup>2</sup>**<sup>1,2</sup>B N University, Udaipur<sup>1</sup>tanvitri@gmail.com, <sup>2</sup>mahideora@gmail.com**ABSTRACT**

*In the digital age data become an important aspects of today's life and backbone of the information technology age. The role of information is very crucial for taking decision. Maximum time the consolidated result of any analysis is more important to take decision. Data outlook and fulfilment is critical to any result and decision formations. Data arrangement for data mining is a key phase of data analysis. In the same way data preparation for data mining is a key stage of data analysis. Anomalous or irregular value in database is solitary of the biggest problems faced in data analysis and in data mining applications. The problems get increases when values are irregular and anomalous at the early or end of the attribute. In the present study, an anomalous and irregular values i.e. outliers and inliers are introduced and in the same way a set of approaches are introduced which tries to discover the pattern to produce values against the anomalous and irregular values from a real world imbalanced database with ambiguities. The present paper is based on the proposed lined interjection approach for reducing ambiguities in dataset.*

**Keywords:** Ambiguities, dataset, Anomalous values, Missing values, Attribute

**Introduction**

It is noted that data is one of the important and most costly part of the present life. In the digital age data become backbone of the information technology age. In the data mining, role of data and information is very crucial for taking decision. It is also observed that the consolidated result of the analysis is more important to take decision. Similarly data outlook and completion is critical to any result and decision formations. In this case data preparation for data mining is a key part of the data analysis.

The major problem which is faced here is associated with the presence of the anomalous or irregular values along with missing values. Anomalous or irregular value in database is solitary of the biggest problems faced in data analysis and in data mining applications. Such kind of the situation generated ambiguities in the database / dataset. The ambiguities in the dataset is a major challenge as the ambiguities in the dataset lead to error in the result. So there is a strong need to reduce or remove the ambiguities from the datasets.

In the present paper, an anomalous and irregular values i.e. outliers and inliers are identified along with missing values and a techniques also introduced to remove ambiguities. Such approach are hosted due to several logics, i.e. manual data entry methods, equipment failures and improper evaluations. Therefore it is valuable to explore irregular /

anomalous data from most of the data sources used.

**Methodology**

Identifying the problem and producing the suitable result to achieve the objective is the key of any study. Therefore, the problem and solution in the paper can be depicted in the two phase. Where in the first phase detection of anomalous / missing values is committed and the second phase is dedicated to prediction of the values at the place of missing / anomalous values. Both the phase are jointly able to achieve the goal of the study.

In the elaborative ways we can separate whole task in the several stages. Where in the first stage we have to read the dataset in which missing / anomalous data are available. After reading or importing data, algorithm identifies the anomalous values as per the other values of the dataset. So we can say that this is the phase to recognize the unpredictable values/inliers and exception values Study on whole data set. The major task which is taken in the consideration here are:

- Reading and Importing the identifying dataset
- Deliberation of inliers in the present dataset.
- Deliberation of outliers in the present dataset.
- Elimination of inliers and outliers
- Generation of missing values



- Assess the significance

**Algorithm**

The projected approach is one of straight forward approach to recover the missing values with very close attribute vicinities. This approach developed the view of predicted data from the consecutive attribute, the order of the attributes are almost not affected except the linearity trends of the data available in the attribute. If the linearity trends of both of the data attribute is similar than we can consider any of the attribute to help the missing data attribute.

In this approach we are considering two attribute simultaneously so here, we are captivating two variable/ attribute symbolized as U and V. The variable U is the variable with no missing values cases and the variable (attribute) V is with missing values case.

The variable V (which is basically an attribute and values are here in as stored in the column) is mixture of available, anomalous and missing values so we can say that:

$$V = V_{alb} + V_{aml} + V_{mis}$$

Where  $V_{abl} = (v_1, v_2, v_3, \dots, v_k)$ ,  $V_{aml} = (v_{k+1}, v_{k+2}, v_{k+3}, \dots, v_m)$  and  $V_{mis} = (v_{m+1}, v_{m+2}, v_{m+3}, \dots, v_n)$ . The value of  $V_{abl}$  is the set of values which are available in the variable while  $V_{aml}$  is the set of anomalous values and  $V_{mis}$  is places or the subscripts positions where values are not exists or values are null.

Similarly the values of the variable U is denoted as:  $U = (u_1, u_2, u_3, \dots, u_n)$ ,

Attribute / Variable/ Dataset:

$$U = (u_1, u_2, u_3, \dots, u_n)$$

$$V = (v_1, v_2, v_3, \dots, v_n)$$

Where  $V = V_{alb} + V_{aml} + V_{mis}$

$$V_{abl} = (v_1, v_2, v_3, \dots, v_k),$$

$$V_{aml} = (v_{k+1}, v_{k+2}, v_{k+3}, \dots, v_m)$$

$$V_{mis} = (v_{m+1}, v_{m+2}, v_{m+3}, \dots, v_n).$$

// Conversion of Anomalous values in Null values.....

Import:  $V = (v_1, v_2, v_3, \dots, v_n)$

$$U = (u_1, u_2, u_3, \dots, u_n)$$

$$\text{array}(V) == \text{array}(U)$$

for (i=1 to n),

If (value (v<sub>i</sub>) == NULL) then

$$v_a = \text{value}(v_{i-1})$$

$$v_b = \text{value}(v_{i+1})$$

$$u_a = \text{value}(u_{i-1})$$

$$u_b = \text{value}(u_{i+1})$$

$$u_i = \text{value}(u_i)$$

Here,  $v_a, v_b, u_a, u_i, u_b \neq \text{"NULL"}$

$$\text{trans} = 0$$

$$v_{prd} = 0$$

$$\text{trans} = v_a + (\text{abs}(v_b - v_a) + \text{abs}(u_b - u_a)) / \text{abs}(u_b - u_i) \quad // \text{ calculation of predictable value}$$

$$v_{prd} = \text{trans} \quad // \text{ the predicted value}$$

value (v<sub>i</sub>) = v<sub>prd</sub>// transferring of the predicated value

$$i = i + 1$$

// i counter increment by one

repeat until (i < n)

end loop,

stop.

**Operation Procedure**

The dataset with diverse variables were occupied for the study. In the strategic way after conversion of anomalous values in the missing values, the same are executed, the ratio of the deliberated missing values are 15%.

The approximation in the projected algorithm is calculated in the manner by which algorithm procedure spontaneously identifies the anomalous values and alter them into the missing or null case and the null or missing value case resolve by the handling of missing values through the projected algorithmic approach.

The projected algorithm alters the anomalous values of the dataset into the null values that is finally assumed as the missing values, after that these cases are resolved through the statistical inference.

From the datasets, it has been divided into three main classes' first, standard datasets, second data with missing attribute values and lastly dataset with predicted or recovered values.

The outcome and data consolidation received from the dataset with 15% missing values. To

obtain the single representative value at the place of whole attribute, some statistical consolidation taken in the deliberation, these are arithmetic mean, standard deviation, and coefficient of variation. To test the significant of the result analysis of variance ANOVA is utilized. The dataset consist of detail about Global Carbon Dioxide Emission from fossil burning by Fuel Type (Million Tonnes) from the year 1964 to 2013. Thus it is set of 50 records in the every column. The study includes three variables / attributes namely year, coal, and natural gas on which study is conceded.

**Data Analysis**

**Analysis (Arithmetic Mean: Coal):** here the arithmetic mean obtained by the normal dataset of variable Coal is 2351. Subsequently by considering the 15% missing values in the same attribute, the mean values goes to 2097. By utilizing lined interjection approach to approximate the missing value, the mean value comes on 2341. It is observed that after approximation the consequences are similar as the mean of normal attribute.

**Analysis (Arithmetic Mean: Natural-Gas):** The mean acknowledged from normal dataset about variable Natural-Gas is 994. Further by containing 15% of missing or null values in the attribute, the mean goes to 878. While the lined interjection approach utilized to approximate the missing values then after the mean values received as 990.

**S.D (Standard Deviation: Coal):** The values of standard deviation for the normal dataset is received as 764. Similarly the values of standard deviation for the 15 % missing values of dataset is received 785 which is slightly higher than the values of normal dataset. After applying lined interjection approach to recover

missing value the approximated values standard deviation is received as 766.

**S.D (Standard Deviation: Natural Gas):** The values of standard deviation for the normal dataset for the variable natural-gas is acknowledged as 429. Whereas the standard deviation values with 15% missing values is acknowledged as 437 which is slightly high from the standard deviation values of normal dataset. Subsequently by applying lined interjection approach on missing value place the recovered values standard deviation is observed as 428. Thus it is found that values of normal dataset, missing dataset and values of approximated / recovered dataset is similar.

**Analysis (Co-efficient of Variation):** According to observation the values for Co-efficient of Variation is more or less are similar at normal extent. Variables are independently depicts same nature. The resemblance in the CV values for the entire datasets displays that there is homogeneousness except some extent in the variable values before and after the approximation. So we can say that the outcome supports the proposed algorithm for the study.

**ANOVA for Variable Coal**

As per the hypothesis considered for the analysis of variance, is acknowledged that we have to test the assumptions / hypothesis as:

$H_0: \mu_1 = \mu_2 = \mu_3$

The alternate hypothesis for the same is:

$H_1$ : the alternative hypothesis state that at least one of the  $\mu$  equivalences not kept which means one set mean value are not equal. Therefore to assess the above considered hypothesis, the test of ANOVA is applied on the dataset of coal.

Source of Variation	SS	df	MS	F
Between Groups	44189.49	2	22094.74	0.037167
Within Groups	83821077	141	594475.7	
Total	83865267	143		

**Table 1: Analysis of Variance for Coal**

Critical / Tabulated Value:  $F(2, 141; 0.5\%) = 3.062$

**Discussion of Result**

According to the result received from the table 5.10 (a), it is found that F (calculated)  $0.037 < 3.062$  F (critical). Hence it shows that null hypothesis ( $H_0$ ) is accepted at the 0.5% level of the significance. Thus we can say that there is no significant difference between various set of variable Coal with reference of mean values.

**ANOVA for Variable Natural Gas**

As per the hypothesis considered for the analysis of variance is acknowledged that we

Source of Variation	SS	df	MS	F
Between Groups	1211.40	2	605.7038	0.00325
Within Groups	26234199	141	186058.2	
Total	26235411	143		

**Table 2: Analysis of Variance for Natural-Gas**

Critical / Tabulated Value:  $F(2, 141.5\%) = 3.060$

**Discussion of Result**

As per the result obtained by the table 5.10 (c), it is observed that  $F(\text{calculated}) 0.00325 < 3.0598$  F (Tabulated). Therefore it can be committed that null hypothesis ( $H_0$ ) is accepted at the 0.5% level of the significance. It shows that there is no significant difference amid the various set of particularly variable Natural Gas in concerning to the mean values.

**Conclusion**

From the result observation of test measurement of central tendency, it is found that the algorithm developed for approximation of missing values plays vital role to recover the

have to test the assumptions / hypothesis as:

$$H_0: \mu_1 = \mu_2 = \mu_3$$

The alternate hypothesis for the same is:

$H_1$ : the alternative hypothesis state that at least one of the  $\mu$  equivalences not kept which means one set mean value are not equal. Therefore to assess the above considered hypothesis, the test of ANOVA is applied on the dataset of natural-gas.

missing values. Similarly the result of SD is also gives a positive sign in the form of consolidated result. The values of CV is quite constant. So we can say that the outcome supports the proposed algorithm for the study. In the all case of ANOVA it is noticed that calculated values of F is less than the critical value and null hypothesis  $H_0$  is accepted at all level of significance. Thus it is observed that that, there is no significant difference among various groups. According to the ANOVA result the recommendation for the algorithm are very strong and algorithm are very much suitable for small dataset till 500 records of time series.

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**RESEARCH TRENDS, CHALLENGES, AND THE FUTURE OF AI IN DATA SCIENCE****S. Gour<sup>1</sup>, V. Kumawat<sup>2</sup> and B. Umamaheswari<sup>3</sup>**<sup>1,2,3</sup>Jaipur Engineering College and Research Centre, Jaipur<sup>1</sup>sanjay.since@gmail.com, <sup>2</sup>Vijetakumawat.cse@jecrc.ac.in, <sup>3</sup>baluma78@gmail.com**ABSTRACT**

*Pandemic is really putting every field to check for human alternate as social distancing becomes mandatory. This adds fuel to the rise in demand for digital workforce even after pandemic when everything becomes normal. This is being achieved easily with the help of AI. The world has started witnessing Data as real wealth anyone can have. Now we can relate how data is viewed by Data science and AI. Data Science will use AI for data analysis. In this paper let us discuss some of the Research Trends, Challenges and the Future of AI in Data Science.*

**Keywords:** AI, Data Science, Research Trends, Challenges, Application.

**Introduction**

Artificial Intelligence becomes more competing and efficient but it can't replace human intelligence. Humans can observe the things around them and able to easily compare them with the previous event and able to act in the way needed by rectifying the faults. However, AIs don't exactly match that capability just yet. AI is just enormous data bank to achieve their goals. This means that AIs require a huge pool of data to do something as simple as editing text. AI is nothing but the process in which we make machines capable of thinking and understanding like humans. For example, an AI-powered car is making decisions in a way; a human would make while driving that car. Other examples of AI are facial recognition, translating, chatbots, etc. Data science is a bigger ecosystem and machine learning is a part of entire data science as field. Data science has machine learning, data analysis and other data cleaning as different pieces so machine learning is the one such field of data science.

AI uses a subfield of Machine Learning called Deep Learning. Deep Learning is nothing but is basically a fancy term for Neural Network which is making machines thinks like human brain. AI uses a part of ML subpart of this is called Deep Learning and use ML in AI but not fully. So, AI comprises of many field NLP, Machine Learning, computer vision, Robotics etc. ML is that area that is used in both in Ds when you solve business problem when it is used in AI, when trying to creates products that mimic human being so it is totally depends on the application whether it is business app or DS

and for making machines behave like human being becomes AI.

Data Science is a very vast field; it is being used in many industries. But in its core, Data science is the study of existing data and then providing insights about it and making further predictions. Data Science is the combination of several fields of knowledge like data, domain knowledge, computing and so on. But not all data scientist will have knowledge of these areas. Also they may have expertise in other areas too. Data Science uses many algorithms [1] for better predictions in all contexts such as business and society. For example, Scientists are feeding existing earthquake data to data science algorithms [2] to find insights and then predict how many earthquakes might happen in the future.

AI and Data Science are connecting every component of life starting from finance to ecommerce to medical and so on. In theory, both Data Science and AI might not look connected, but they have one thing in common. How can you make a machine learn human behaviour like driving in AI? How will data science algorithms make a prediction based on only data?

Both AI and DS are playing major roles in the industry from healthcare to finance and manufacturing. The Data Scientists collect and clean the data as well as structure and organize the data for analysis. Various statistical reasoning techniques are being applied to this data to extract useful patterns. AI scientists then learn from the data and apply machine learning and especially deep learning techniques to make predictions about the future as well as to make the best possible decisions

that also include detecting early stage cancers and preventing catastrophic events. While there has been debate as to whether ML belongs to DS or AI, it is now more or less accepted that ML is sort of at the intersection of AI and DS. This is where Machine learning comes in. Machine Learning is a method in which we empower machines to learn without being programmed explicitly. Machine Learning algorithm is being applied in different industries to meet the demand of data science. Machine Learning is likely the connection concerning data science and AI since machine learning is the process of learning from data over time. However, it's not the only thing connecting those two together. But machine learning is the branch of AI that works best with data science. AI has several applications like robotics, expert system, NLP, neural network etc. But it is the Machine Learning that gained popularity among others because of its utilization in Data Science. So, we can say machine learning is the connecting point between Data Science and AI.

So, an AI-powered car uses machine learning to learn driving like a human. Similarly, Data Scientist uses Machine Learning [3] to make their algorithm learn about data and how they

affect real-life to make an educated prediction. The more data it has, the better its prediction. So, in a way Machine Learning connects AI & Data Science. Thus, Data Science is more concerned on data organization and AI is concerned about planning and searching [4] while Machine learning will take care of classification, neural network and clustering.

### Research Trends of AI in recent years

The year 2019 marked an adoption of AI, Machine learning and RPA in all segments, starting from Government policies to individual startups. Till 2018 personalization and customer acquirement are the main consideration for research field. Deep learning, RPA, NLP and Neural Networking have become influential in most of the sectors. According to the analyticsindiamag.com the following trends are identified to materialize in 2020. It includes Hyper Automation, Humanized AI gadgets, Improvement in Natural Language Processing & everyday AI, Explainable AI, Augmented Analytics and AI, Modernizations in Data Storage Techniques, Data Privacy, more Awareness on ethical use of AI, Quantum Computing and saving the data lakes.

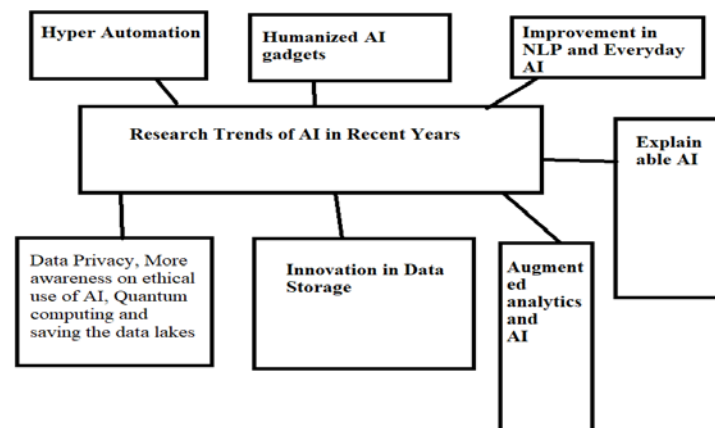


Fig 1: Research Trends of AI in recent years

### Hyper Automation

The automation will be dominant in many industries. It enables optimization by adding AI in automation using analytics and data science. RPA growth rose not only by magnitude but also printed its footstep in almost many sectors. Its entry has changed all walks of life. It enables us to make better decision by proper

analysis. It involves Machine learning techniques for automation. It requires minimum human involvement in the beginning and no involvement at all at the later stages. But it may face equal amount of threats also.

### Humanized AI gadgets

Already AI has started dominating our homes through voice-based gadgets. AI robot

companion, smart AI alarm, smart 3D headphones, smart watches and other smart devices at home have already rooted with our lifestyles. With the entry of jio fiber more and more Netflix, Amazon shopping, google assistance to reach the destination, social media is the best example of AI based technologies. Now the gadgets are not mere machines or electronic device where as they are human in digital form.

### **Improvement in Natural Language Processing & everyday AI**

Till NLP audio data can't be processed easily. NLP [6] enhances text analysis and optimize data. Google translate helps in language translation. Grammarly and spell check have improved the grammatical accuracy of the content. IVR (Interactive Voice Response) is being used in Tele calling to reply customer queries. Personal Assistance from Google, Apple etc.

### **Explainable AI**

When the Machine learning came into existence it looked like Black box testing [5] but the predictions it gave was promising. But nowadays people want transparency and also reasoning for such predictions which require an updating in such machine learning models. Also if an Amazon prediction giving undesirable results may not affect people but a medical diagnosis can prove fatal.

### **Augmented Analytics and AI**

Data science require more time for data collection and preparation. Replacing this with AI not only saves time but can improve predictions. Augmented Analytics reveals hidden patterns making room for decision makers across Business. Data will become part of everyone in day today business giving better insights. Data literacy will be increased among the employees not only related to data scientist.

### **Innovations in Data Storage Technologies**

The data explosion every year demands innovative storage to facilitate enterprise to unlock data power efficiently. Also, it proved to be cost effective. It enabled Machine Learning to come into action. Other trending factors are Data Privacy, more awareness on

ethical use of AI, Quantum computing and saving the data lakes.

According to Forbes AI playing a major role in understanding the behaviour change of consumers in business. The online business is now trending among the consumers because of pandemic situation. Even the business that was using old traditional way of transaction is now started using AI technology for upgrading their business. Even the medium level organizations are applying the business strategy and implementing them by prediction with high accuracy. AI tools are helping business to understand people behaviour towards adapting to current scenario. This particular year AI has seen huge implementation phase in almost all walks of life. Some of them include Government, Commerce, Defence, Finance and Entertainment sector. In defence AI tools are involved in making decision at critical situation.

### **Applications of Artificial Intelligence**

Even United Nations has regarded AI as serving for good purposes. But at the same time, it is having some applications in which results are biased. So, companies has started governing data delivered by AI and Data Science. In 2000 among many applications of AI, neural network drawn interest and many learning layers are drawn into it. That sustained in the industry for some period of time. With the introduction of cloud to handle and store data in 2011 ML became more popular. Data-warehousing and Datamining were combined to begin new era as Data Science.

AI is continuously responsible for collecting data from user for analysis and learning. This data is used by data science for data analysis. AI is continuously improving with more and more iterations including parameters such as accuracy and precision. It also helps to analyse large data sets. AI can identify pattern and more insight than human perception. Its scope is rising rapidly. Its scope of predicting accurate results is improving. So, results will be altered by having better scope of action.

AI has already started analysing the data with the help of learning by going through the output of already analysed data. By this way it can give more accurate results within a short span of time. Along with the enormous

quantity of data available the result from previous analysis is enabling AI to give predictions accurately even early. So, weather predictions among others are an example of AI [8]. In addition, machine learning will influence business analytics [8] by recognizing impending difficulties or concerns which is far beyond human reach. So, it is becoming mandatory for companies to mount artificial intelligence in data analytics to meet the competition among others.

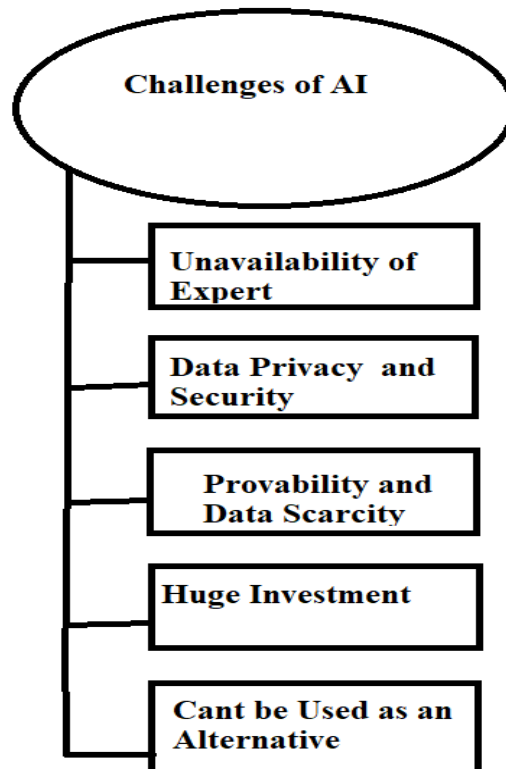
Today AI is being used by layman in various forms in day today life. One such example is Personal Assistant like Alexa or Siri. Here Voice based instructions are converted into text form then with the help of NLP the text meaning is interpreted to open the accurate application. It includes text parsing and identifying its semantic meaning. This is the same for all the applications. The AI-powered mobile apps can deliver elementary healthcare provision, typically as chatbots. It enables us to define symptoms, or shoot the doubts as queries, and then receive vital data regarding one’s medical condition derived from an extensive network including symptoms and causes. Apps helps us to take medicine on time, and assign an appointment with a doctor, if required. This approach provides a healthy

lifestyle by allowing patients to make healthy decisions and saves their waiting time. Also enabling doctors to focus on more critical cases.

AI is continuously dominating in the areas like Healthcare, RPA, and Transport. The quality of products is continuously improving and automated. Whereas Data Science is dominating in areas such as Marketing, Advertizing, Bank Sector and So on. Company taking decision based on Data Science has started to flourish in many fields. AI can be explored further but Data Science already rooted with analysis of data and revelation.AI is much more comparable with human in many ways. It consists of various components which are responsible for implementing some task that generally performed by humans. Normally AI can observe its environment and respond to changes occurring by storing information. They are also capable of learning from previous experience. This generation is witnessing the transition from manual work to automated ones.

**Challenges of AI**

The challenges of AI can be explained by the following diagram



**Fig 2Challenges of AI**



### Unavailability of expert in the field

In the certain fields and domains sometimes, their respective experts may not be available. AI is the latest technology, so there is a shortage of people who deal with it. Due to which AI based organizations would not be interested in investing money on AI based projects. Since AI need to handle large volume of data people ignore due to lack of knowledge about the technology. Due to lack of skill it is difficult to gain maximum benefit from the technology. An organization needs to train its employees to work with this technology to avail its benefits.

### Data privacy and security

To be effective, AI needs access to a lot of information which means it could be taking or sharing your employee or customer data without your knowledge. No one is stepping up to regulate what they can't see or use. This is especially crucial as AI becomes smarter and more self-reliant. AI has the capability of decision making and its applications are dependent on big volumes of data. An expert system depends on data which is frequently sensitive and personal in nature.

### Provability

AI is just like Blackbox in whatever the user has asked, for a particular idea that has been shared, it gives the solution without any proof. It could not give the explanation how it is solving. There is no proven explanation for the AI decision making theory. People could not understand the reasoning behind its decision making.

### Data Scarcity

Sometimes, an expert system may have a very shallow knowledge and data base. So, it may not have a crystal-clear idea related to the subject domain in those cases. To solve the problem, it needs proper data. So, data from kinds of format should be integrated and

processed for providing the solution. Also, it requires constant source of right data for conclusion. Otherwise, the information provided by the expert system may not be trust worthy.

### Huge investment

These technologies are very costly. A project made with AI is expensive. It requires large amounts of power and technology [7]. The company owners cannot invest money. The hardware installation with latest tools and equipments for AI labs along with GPU, FPGA, and ASIC are costly. AI processors are the specialized chips which are incorporate AI technology and Machine learning.

### User acceptance

This is a biggest problem with the expert systems of AI. To accept working on AI projects, users must expertise in the field of AI and have an in-depth knowledge about the it.

AI can't be used as an alternative

Like other technologies AI can't be used as an alternative [7] for each and every task that humans perform. But it can be used to improve human performance and produce better results. It enables normal people to perform more useful tasks with accuracy and efficiency.

### Conclusion

Pandemic is really putting every field to check for human alternate as social distancing becomes mandatory. This adds fuel to the rise in demand for digital workforce even after pandemic when lockdown is over. This will be achieved easily with the help of AI. The world has started witnessing Data as real wealth anyone can have. Now we can relate how data is viewed by Data science and AI. Data Science will use AI for data analysis. Thus, we discussed some of the Research Trends, Challenges and the Future of AI in Data Science.

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## ECONOMICS OF SMELL, TOUCH AND SIGHT: BEHAVIORAL ECONOMIC NUDGES IN MARKETING DECISION MAKING EVIDENCES FROM STREETS OF KOLKATA, INDIA

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### ABSTRACT

*The global marketing arena is fast changing amidst rising tensions and economic shifts brought about by various economic functionalities. Marketing gurus are changing their strategic impulses to better cater to customer choices and loyalty. As the global marketplace transforms itself to a highly heterogenic module marrying various theories and models require to well define branding holistically, the need to understand the customer from core has been rightly emphasized wherein multidisciplinary studies needed to be integrated to formularies the notion of placing product in a well disciplined order before the global consumer base so that despite the fierce fight in selling propositions a loyalty brand evolves more cognitively understanding how, when and why the brand is appealing to a consumer. This paper builds on various platforms during a crisis like Covid -19 pandemic, natural exploratory cases from myriad lanes of book shops in historical set up to understand and measure brand location, repository, faith and alliance in a never experimented zone like books and how book selling and buying can be implemented ethically to even luxury brands to increase their net worth and revenue. Specific interviews and discussions were conducted with ethnographic importance and semi structured interviews to better understand the behavioural nudges underlying bibliosmia crowd in Kolkata, India.*

**Keywords:** Behavioural economics, Neuromarketing, Bibliosmia, Olfactory branding, Emotional branding.

### Introduction

The global world in itself is a jungle crowded with ideas and thoughts which are shaping the globalization animal in everyday product innovation and innovation funnels (1). Various global corporations are fast changing their advertising bandwagon and brand story linking human actions and behaviour as cognitive branding has changed how economics flow in business world amidst rising tensions in a crowded marketplace with numerous choices to consumers (2). The idea behind involving experiential marketing into product attractiveness is quite new as brand allocators globally are fighting to sustain their brands amidst changing economic conditions (3). It is also unique to think that branding strategy is unique to unique economic geography wherein the consumer base inequality plays pivotal role in decision making. Humans are not always rational and they behave quite selfishly in a scarcely allocated world where desires are unlimited (4). Every firm irrespective of size demands considerable pie into such wants with their philosophy of allocation to their brand preferences (5). In such scenario, there lies considerable thoughts on how ethically managers can allocate brands to consumers and create a emotionally appealing communication.

It is perhaps a more trendy definition to highlight neuromarketing as an artificial ground where brain mapping and other medical devices are studied to measure marketing stimuli (6). Philippe Morel is better associated with this particular term historically though. Gabriel Tarde is highly involved with the psychological studies related to economics and the behavioural psychology involved in economic decision making in alternative judgmental nudges (Sendhil Mullainathan) (7). Herbert A. Simon is credited with development of bounded rationality which was better formulated into nudges by Prof. Thaler (8). Kahneman as well as Tversky has reflected on prospect theory which also states on loss aversion principles where losses are more avoided over relative gains (9). Satisfying as well as directed cognition are somewhat basics of behavioural economics which can be very much related to optimal satisfaction gain through book buying behaviors (10). People allocate various resources during crisis times to various segments; understanding such mental accounting gathers information about how much and when the buying rationality will be peak and what if such decisions are not met fully (11). Though brand managers often use herding as a principle in extending their brands it is a misnomer in few cases of brand building

in emerging economies (12). Monte Carlo fallacy has been sometimes studied in case of historical brand management where future implications are more reflected in buying decision making. Parental teaching and control over ages sometimes create unknowing brand behaviors across various ages. Such cultural imprints are very deeply associated with buying behaviors and can be better understood by silhouette branding (13). The cognitive biases and feedback loops are important behavioural finance yardsticks to understand the tendency of human beings to react to decisions and environments (14). Olfactory cues are very pertinent plethora where brand strategists create particular flora and fauna to induce buying behaviors. Such cues have been widely noted in packaging as well as bottling industry where particular olfaction has created notable changing platforms (15). Even olfaction has been instrumental in creating time span and space in customer loyalty in big brands like Star bucks who try to induce brand extension through its particular store aesthetics with music and contour (16). Even with big cosmetic brands which fall into luxury branding the notion of sensory linkages are quite old wherein scent induced marketing behaviors have shown positive results in buying decision making. Neuromarketing has evolved over time and is a multidisciplinary platform with economics, marketing, psychology, cell biology and arts getting interlinked to produce integrated effects in brand communication (17). Though the bluebook of marketing has included emotional practices which caters to society development to stay ahead natural tendencies which require behavioural heuristics is quite gaining momentum. As the global economic diasporas changes its innovative green shoots, the Porter's 5 P requires additional dimensions to sustain amidst rising technological advancement which requires behavioural study to understand and interpret human actions in various complicated ambiances (18). It is true that human actions are very diverse with various economic geography but few niche branding zones create a linear curve within various variables which can be replicated towards other struggling brands and even start ups to create economically efficient venues

where advertising budgets can be reduced thereafter (19). Rieunier has propounded in favour of sensory brand management which can substitute traditional marketing plethora. Aradhna Krishna (2014) stated that multipletheora communication is fast changing the perceptions of consumer voices and brand allocations (20). The evolution of Apple with its dream stores creating the very basic foundations of sensory marketing applied to its niche products transformed how brand communicated with consumers (21).

### **Aim of the Study**

The basic foundation for conducting this research lies in bridging the gap created for understanding branding cognitively in case of how books are sold and bought in various circumstances by global book lovers which can be an yardstick to judge and measure implications for even luxury brands globally who are fighting every day and night to catch the gaze of consumer base in a increasingly polarized economic jungle.

### **Materials and Methods**

This research method is basically a mixed method of ethnographic regional exploration with the rationality of creating semi structured interviews and personal discussions set at the backdrop of informal ambiances to create stability in judgments of human beings. As understanding human nature is very difficult and more complicated is the functioning of the brain under various circumstances and aesthetic compulsions it was necessary to create a sample population as large as 350 spread across random clusters irrespective of inequality, class and other variables. The peculiarity of choosing College Street area in Kolkata has various advantages like:

Historically a region haunted from ages by authors and literature aficionados.

Historically and culturally rich having great educational institutes and outlets of national and international heritage and architectural importance.

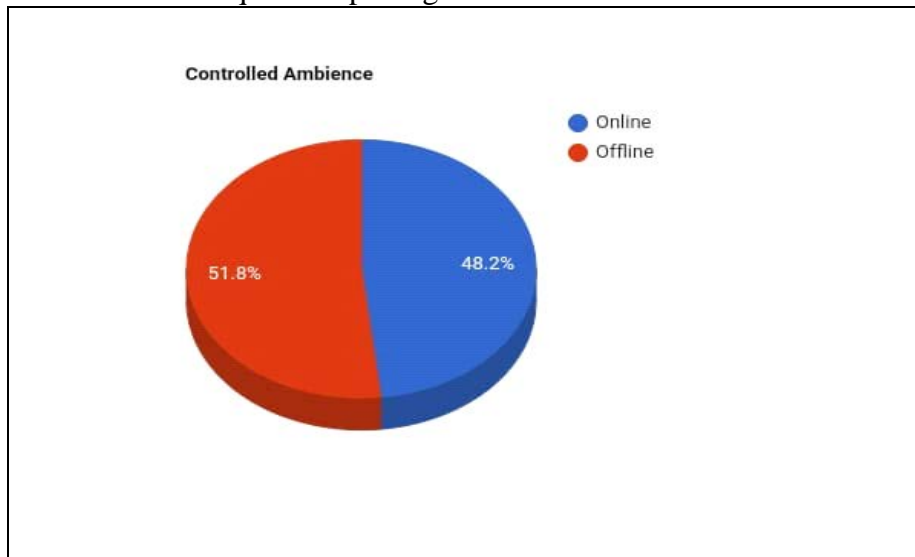
Most well-known national and international book publishing houses have their office here from ages.

- Hunting ground for rare book collections by booklovers from centuries.

- Globally largest second hand book seller regional capacity.
- Mixed consumer bases of book buyers in national arena.

Before creating a database of population, the research conducted self reporting style emotional intelligence tests over a selected group of around 100 booksellers to judge their various emotional stability while buying books to find parity in economic decision making. According to Goleman, Emotional quotient can be best mapped through various testing parameters to understand parity in emotional bindings. The test result was quite surprising

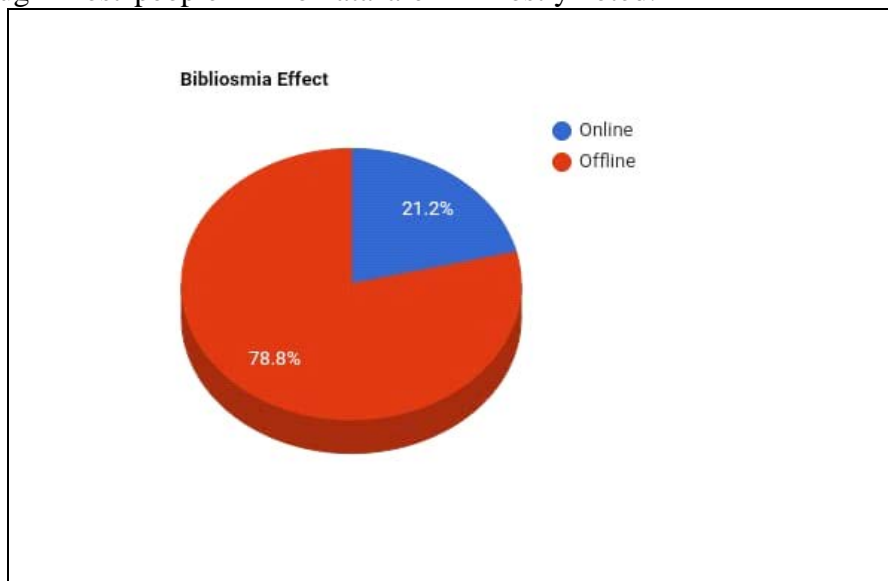
having 58% positivity responses to book affinity or bibliophile attitude. This was certain to prove that decision making has tended towards rationality while behavioural nudges were quite unique and circumscribed by sales heuristically attitudes. Moreover 30% saw a neutral attitude towards second hand buying attitude rather decomposing the affinity-based marketing which was quite true. The research took as active control measure the emotional intelligence of buyers who were mostly thought to be literate and belonging to middle income group strata.



**Figure1 Author generated Controlled experimentation**

The above figure clearly postulates controlled experiment which favours offline buying in case of books and its various marketing channels. Though most people in Kolkata are

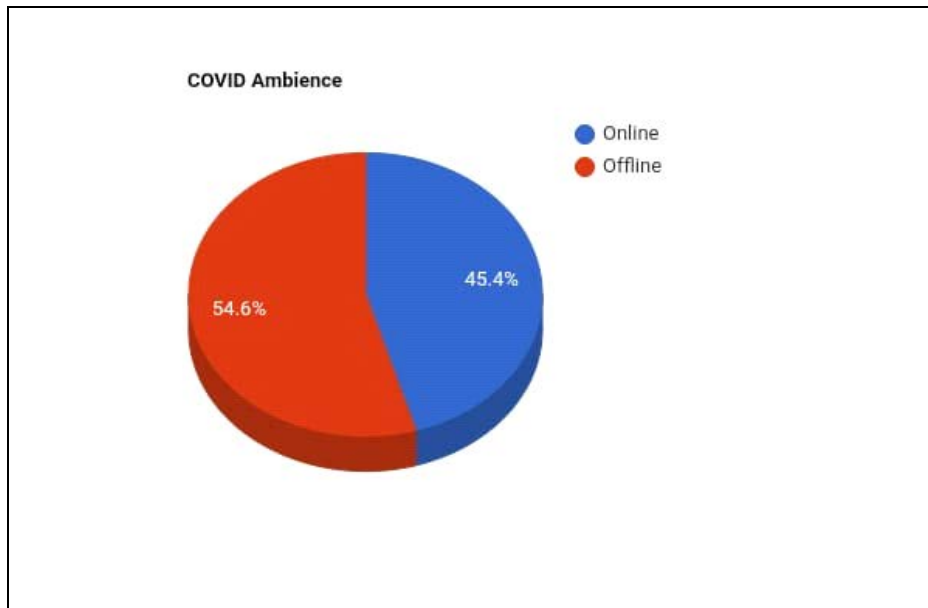
internet savvy and are quite new and attracted to online marketing, still when it comes to buying books in heritage area offline trends are mostly noted.



**Figure2: Author Generated Bibliosmia trends**

As scientific literature globally has this new entry to science “bIbliosmia” but this trend and smell attitude towards changing patterns in consumer affairs has been clearly noted in experimentation. This particular olfactory trend

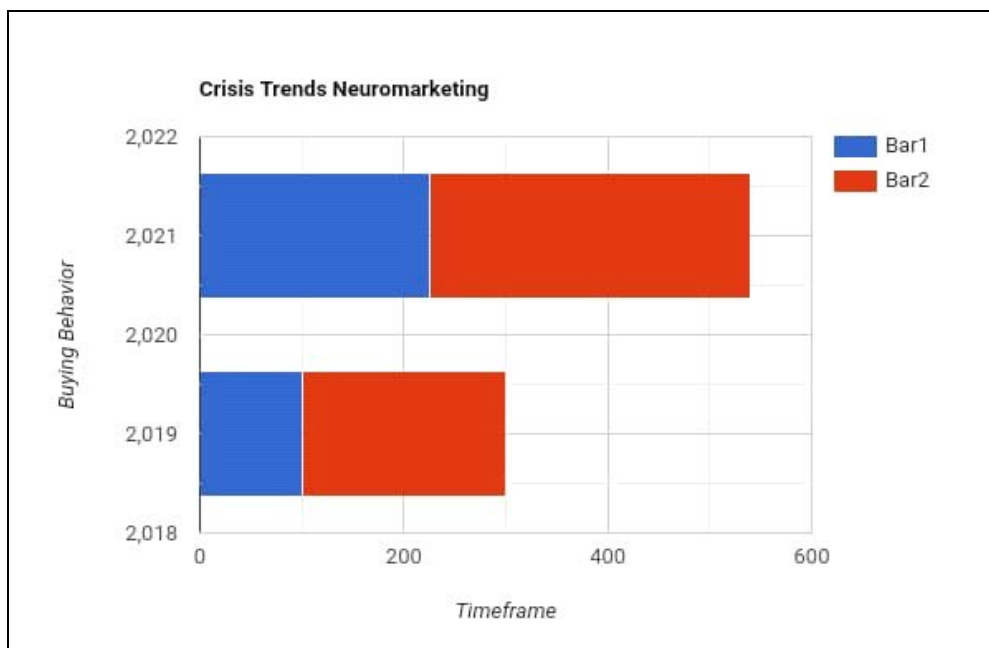
in brand management is quite unique and hidden to book buyers in Kolkata region who responded positively towards smells of books, particularly old books.



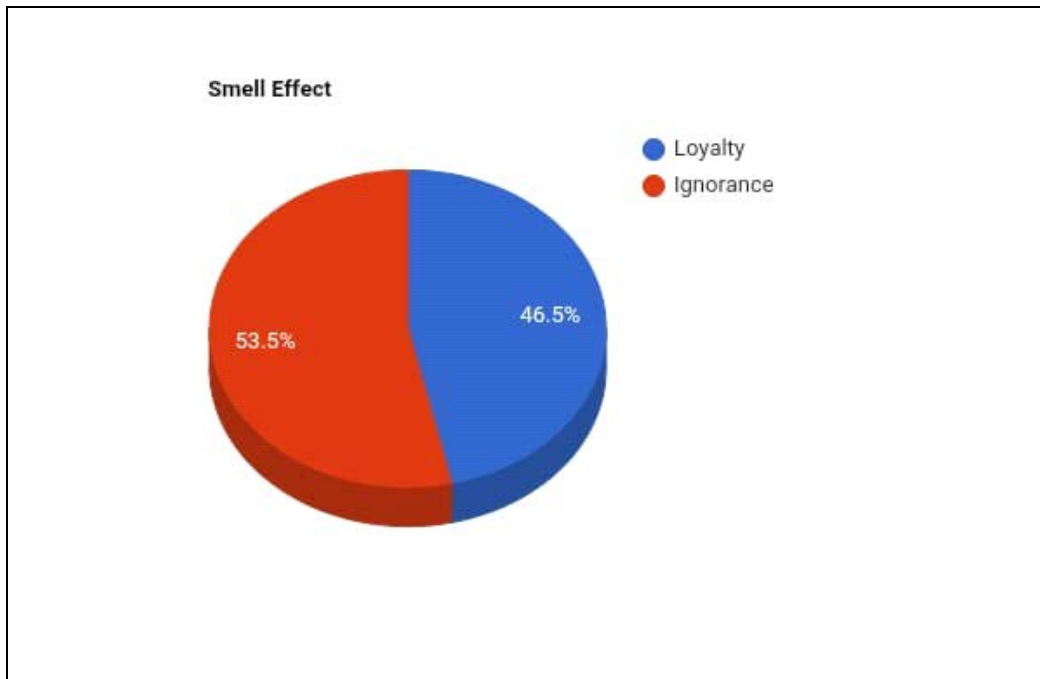
**Figure3: Experiment under crisis points like Covid-19**

The above experiment was run under Covid situation where global trends were towards online shopping under restrictive situations but people try to shed their inclinations towards second hand book buying over trendy and hyped online shopping even in case of pandemic. They even preferred normal book delivery at homes by book sellers in College

street area over popular portals like Amazon, Flipkart, etc. The behavioural nudges in this case was quite strong in creating marketing trends. The proximity of the product to the respondent was seen to be mature and stronger when complemented with smell and other experiential trends.



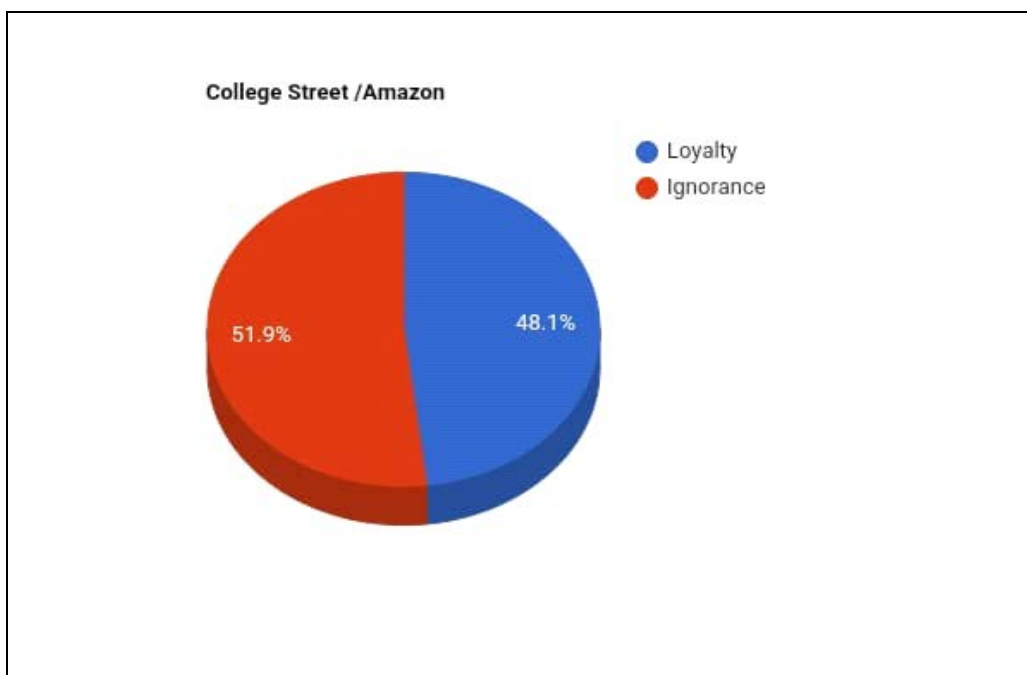
**Figure4: Neuromarketing Trends and effects on economic behaviors.**



**Figure 5 Olfactory branding**

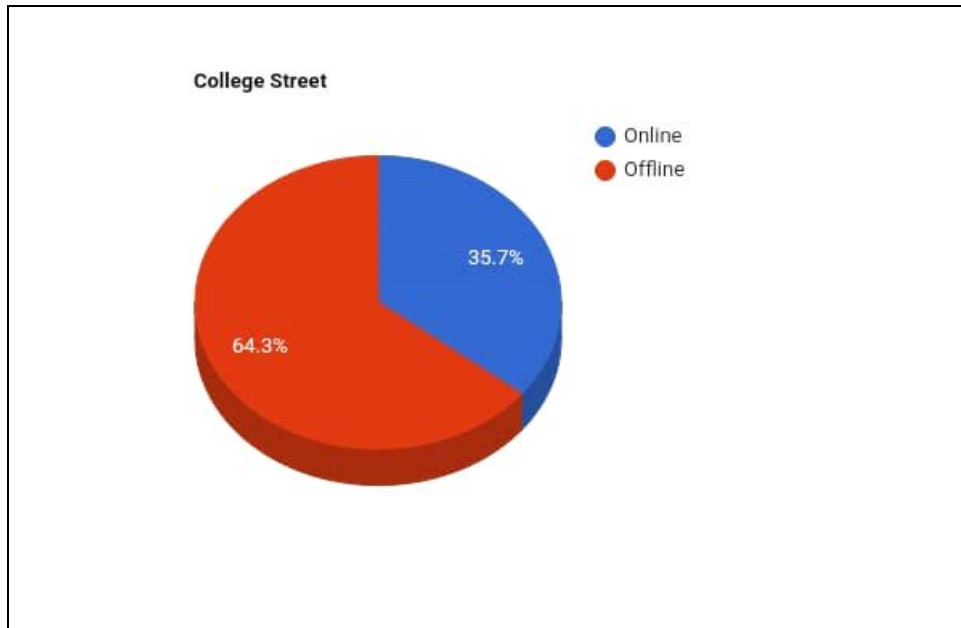
Olfaction has been a potent tool in this experimentation wherein bibliophiles choose proximity over distance when buying and changing their decision making. No particular

change in rational thought was seen while consumers replicated their decision making in extreme situations.

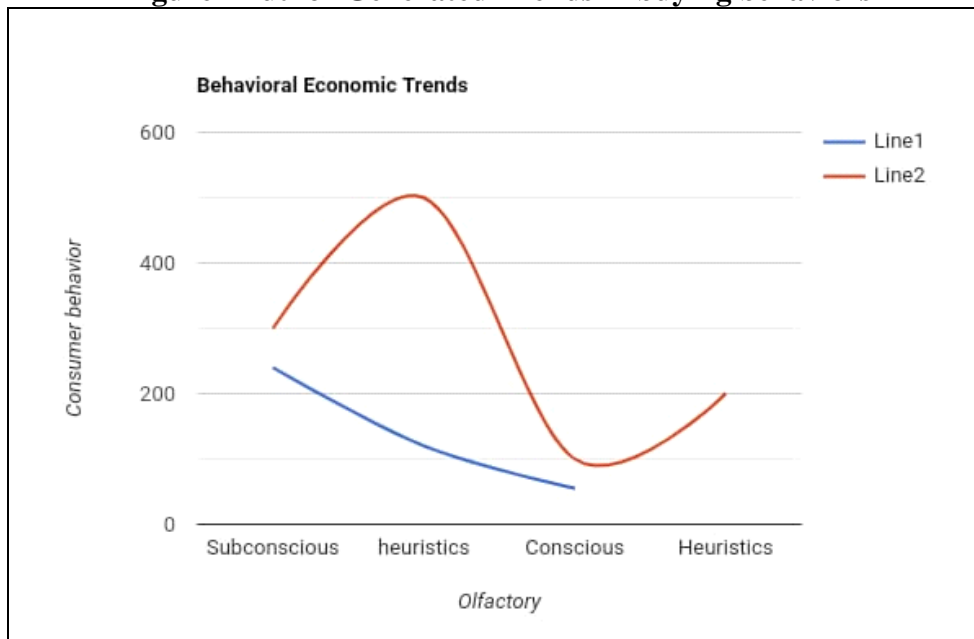


**Figure 6 Amazon negativity trends (Author Generated)**

The filed experiments greatly and surprisingly challenged the global marketplace too while branding books. It is established fact that globally Amazon has revolutionized book loving arena and introduced various subcategories too into their brand building like Kindle and other e-book platforms which has been a steady game changer in reading habits. But when it comes to olfaction and sensory branding in the experiment, it was found that direct buying behaviour was positively rated over Amazon and even E-books.



**Figure7 Author Generated Trends in buying behaviors**



**Figure 8 Author Generated Behavioural economic fluctuations over various heuristics.**

**Key Takeaways**

Heuristically economic activity has been strengthened in decision making of bibliophiles.

Brand of books were highly reflective when sensory marketing principles were hidden challenges to sellers.

Behavioural economic principles showed greater relevance while buying and deciding over books as branding sectors.

Brand loyalty was better positioned when in crisis situations where financial accounting and herd behaviors were not replicated.

Brand positioning showed stronger tendencies irrespective of high EQ in College street area. Such branding natural tendencies are historically significant and can be replicated for newer brands.

Economic nudges were stronger felt with books in College Street area.

Both under controlled as well as disruptive situation newer loyalty were not formed.

**Analysis**

Researchers globally have always questioned about the rational thinking of homoeconomicus and how judgmental are its decision making



guided by impulses. In such scenario, a vast spectrum of studies was conducted at leading research institutions like Harvard and MIT to understand the nexus between behavioural psychology and rational decision making (22). In light of such literature, specific idea related to how cognitively strong brands create differences were measured qualitatively and based on such implicative studies judgments were created to better reduce revenue generation and create a natural ambiance understanding human behavior towards economic decision making which can also be implemented across various business management domains and multilateral firms (23). Whereas there of course lies a big question about symmetry in human actions across various economic geography and wealth of the nations which guide consumer choices, but the very intricate core of human brain regarding few natural choices cannot be denied completely and can retrospect the need for strategy allocations (24). The emotional intelligence of various respondents showed a surprising positive trend towards buying even under distressful situations. This particular economic behavior was important to understand the fluctuations and probable complication in aesthetics of brain while creating rational decision making. Though global firms battle over sensory marketing, many legislatures and consumers are threatened by influential marketing practices brought about by disruptive innovation in neuromarketing practices. This particular research builds on promised lands for both sellers and consumers by studying various economic and neuroscience related aesthetics, understanding why and how people behave rationally due to certain product and how we can better replicate such differentiation in creating strong brand equity. Global crisis indeed has changed innovation and brought in technological disruption but in few cases like this, there was positive trends towards application and decision-making favouring historical buying trends and behaviors. Such retrospect can be better amalgamated with positive digital know how which can create stronger brands during crisis (25).

### **Deduction**

Though the very word bibliosmia is quite new and creates a different flavour to how books are perceived by the consumer base but somehow it is worth mentioning that booklovers are universal and has distinct choices and trends in creating for themselves a different world of branding and selling plethora. As many may argue and move away from the buzzword of neuromarketing as it involves various intricacies of medical devices imaging and mapping brain activities which may not sound so natural but human actions are complicated and each and every actions of rational decision making are too much complex for normal scientists to interpret and deduce strategic plans. In such complicated situation of strategic compulsions, it is necessary to learn holistically from our natural surroundings rather than artificially create steps to consumer action orientation which may further weaken the brand proposition. Books are very important globally and has been neglected from studies by researchers dealing with branding which requires present day orientation on how retrospectively brand management can learn from simple book selling and buying on the streets by understanding human rationale to get inclined to specific product choices which may not sound very catchy, pricy or the elite magnetism but creates a nevertheless important big resilience and sustainable brand loyalty amidst even crisis situations. As big brands like Coca-Cola, Google, 3M, Singapore Airlines spent huge money on cognitive branding and bringing that human attachment to individual brand allocations, this research focus bringing forth very basic study related to human behavioural nudges which are quite unique and creates everlasting flora and fauna in creating a vibrant market can be quite deductive in laying strategic grounds where all companies can replicate brand preferences. Various other brands also have replicated sensory marketing to better relate to consumers. Few researches have understood the natural ambiance created by human beings which are more long-lasting and create future imprints in brand building promises.

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gritties of books as products and brands to look out for.

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**SYNTHESIS AND CHARACTERIZATION OF GaAs THIN FILM ON ITO SUBSTRATE FOR PHOTOVOLTAIC APPLICATIONS.****S.D. Nimbalkar<sup>1</sup>, P. P. Bhosale<sup>2</sup>, M.D. Shirsat<sup>3</sup> and Madhav.N. Rode<sup>4</sup>**<sup>1,2,3,4</sup>Optoelectronics and Advanced Sensors Research Laboratory, RUSA,

Department of Physics, Dr. B.A.M.U, Aurangabad, 431004 (M.S.), India.

<sup>1</sup>siddhunimbalkar1@gmail.com**ABSTRACT**

During the last decade scientists and researcher are trying to increase the photo conversion efficiency of solar cell by developing new material and structure. The rapid development and progress of science and technology in the field of energy and material has been illuminated the significance of organic materials. In the present work we try to make comparison between two cells prepared from commercially available & Electrodeposited GaAs substrate & the benefits of organic and inorganic semiconductor by uniting them together, thin films of organic materials PEDOT: PSS is formed on N-type GaAs inorganic substrate by drop casting method. The structure and morphology of the prepared films were studied from XRD, AFM pattern, Raman spectra. And optical characteristics of the prepared films were studied from UV spectrometer and voltage current characteristics of the composite films shows the suitability of materials for photovoltaic application.

**Keywords:** Solar cell, conductive polymer, GaAs, Electrodeposition.

**Introduction**

In hybrid solar cell we can take the advantage of both organic and inorganic materials by combining them together. organic materials have number of good properties easy to process, good absorption coefficient (for thin films) relatively low cost. On other hand inorganic material has high electron mobility, good environmental stability and high dielectric constant. therefore, the idea of hybrid photovoltaic cell using the combination of organic and inorganic materials open the new era of research in the field of solar cell. (1-3) researcher developed a linear combination of various inorganic materials Si, (4-8). ZnO (9-11) and TiO<sub>2</sub> (12-14), GaAs. InGaAs combined with organic materials PEDOT: PSS, PANI, P3HT, PCBM etc.

In earlier days; the most common solar cells were designed using single p-n junction silicon crystal. But the cost of the single silicon crystalline substrate was high and hence new absorbing materials and cheap technologies were under sought. The main advantage of the thin film technology is the material can be spread on to the large area of wafer or substrate by any suitable method in order to produce high volume.

GaAs is one of the most influential III-V semiconducting materials, which possesses high mobility and direct band gap of 1.43eV. this property of GaAs material makes them suitable for an optoelectronics and

photovoltaic application. different growth techniques are used for the synthesis of GaAs thin films, these methods are spray parolysis(1), liquid phase epitaxial(2), molecular beam epitaxial(4), electrode position, metal organic chemical vapor deposition(5), chemical vapor deposition(3). these all techniques are expensive and complicated .among all various techniques, electro deposition techniques offer several advantages (6,10), means it is simple ,powerful and inexpensive. In this technique films thickness, structure and composition can be controlled by voltage or current, here the optimization of parameter for the deposition of single metal is easy but for binary compound is difficult (11) .we studied the characteristics of photo electrochemical solar cell designed using GaAs thin film acts as photo electrode and graphite as counter electrode in 2M polysulphide. D.K. Ferry reported the successful deposition of GaAs from a electrolyte whose ph was 0.7(3), Maralinga reported the deposition of GaAs from a electrolyte of GaCl<sub>3</sub> and As<sub>2</sub>O<sub>3</sub> for various ph and temperature (13). K.R.Murali, have synthesized GaAs by varying duty cycle from aqueous solution of GaCl<sub>3</sub> and As<sub>2</sub>O<sub>3</sub>. (14) Andreoly have reported the synthesis of GaAs thin films by depositing Ga on Ti substrate and As layer was electrodeposited on Ga layer (8). M.Chamekh Have reported that the co deposition of GaAs metal at 279k and pH was 1 from gallium metal and As<sub>2</sub>O<sub>3</sub> dissolved in dilute HCL (15). In the literature.V.M.Zozlov,

S.Chandra (10, 11) has been reported that large effort had been made by researcher for the deposition of GaAs thin films from acidic and alkaline solution with limited fruitful output. In this paper we present the co-deposition of gallium and arsenic metal at room temperature from a electrolyte contain gallium metal and  $As_2O_3$  dissolved in concentrated HCL and the pH was maintain at 1.2

Before 30 year ago it was considered that polymers were used as an insulator but by simple modifications in the conjugated polymer their electrical conductivity has been raised(12) the first remarkable feat in the field of conducting polymers has been taken around 1978, explained by Shirakawa(14) he showed that the oxidation and reduction reaction in the conjugated polymer and enhance their conductivity and turn as p doping and n doping respectively( 20) Conducting polymer have found large applications in the manifold fields of Electronics, Optics, Energy devices and Medicine .study on polymer solar cell reveals a positive effect on the efficiency and hence, the structure of inorganic –organic hetrojunction solar cell have been allured much more attention.

Generally, hetrojunction solar cells are fabricated from Donar and Acceptor layers. Donar materials absorb light and generates excitons and Acceptor layer transports electrons( 8,11 )efficiency of solar cell depends upon several factors. In the present work PEDOT: PSS layer was formed on GaAs substrate by Drop casting method. And deionized water was used as solvent,in the PEDOT:PSS conducting polymer PEDOT is a polycation and PSS is a polyanion(15,19).

### Experimental details

ITO coated glass substrate were initially cleaned ultrasonically in order to remove surface contamination, dust particle and then rinsed thoroughly with double distilled water, and dried at  $400\text{ }^\circ\text{C}$  for 5 min.

Gallium metal (99.99% pure purchased from Sigma Aldrich) and  $As_2O_3$ (99.99% pure purchased from Sigma Aldrich) were separately dissolved in concentrated 10ml HCL,1M Gallium metal was separately dissolved in concentrated HCL and 0.1M  $As_2O_3$  was dissolved in another 10 ml HCL.

After adding two solutions in appropriate ratio, the resulting solution was stirred for 3 hours, the solution was diluted by adding double distilled water and the pH value of the electrolyte was set to 1.2 by adding concentrated KOH solution in such a way that the final volume of the electrolyte should be 40ml. Thin films of GaAs material have been electrodeposited from an electrolyte containing Ga metal and  $As_2O_3$  dissolved in concentrated HCL.

ITO coated glass substrate were commercially available and it is purchased from sigma Aldrich and the size of the substrate was  $2.5\text{ cm} \times 2.5\text{ cm}$  which has a resistance of  $10\ \Omega/\text{cm}$ . Electrolytic cell consisted of two electrodes in contact with electrolyte, ITO coated glass substrate used as working, platinum plate acts as counter electrode and Ag/AgCl<sub>3</sub> was used as reference electrode. During the electrolysis process Ga, and As, ion attracted toward cathode and gets deposited on ITO substrate. The Stoichiometric ratio of Ga and As ions depends on the pH of the electrolyte, temperature, concentration, current or voltage parameter and electro deposition time. There is no clear cut method discussed in the previous literature for the fixing of deposition parameters for binary metal. And hence failure rate in co deposition of metal was high. In the present work, we performed our experiment by applying a potential between 0.6 to 1.1volt.during the experiment we prepared number of samples for various deposition times while other growth parameters kept constant. Then prepared samples were removed and rinsed thoroughly with double distilled water and annealed in air for 10 min.

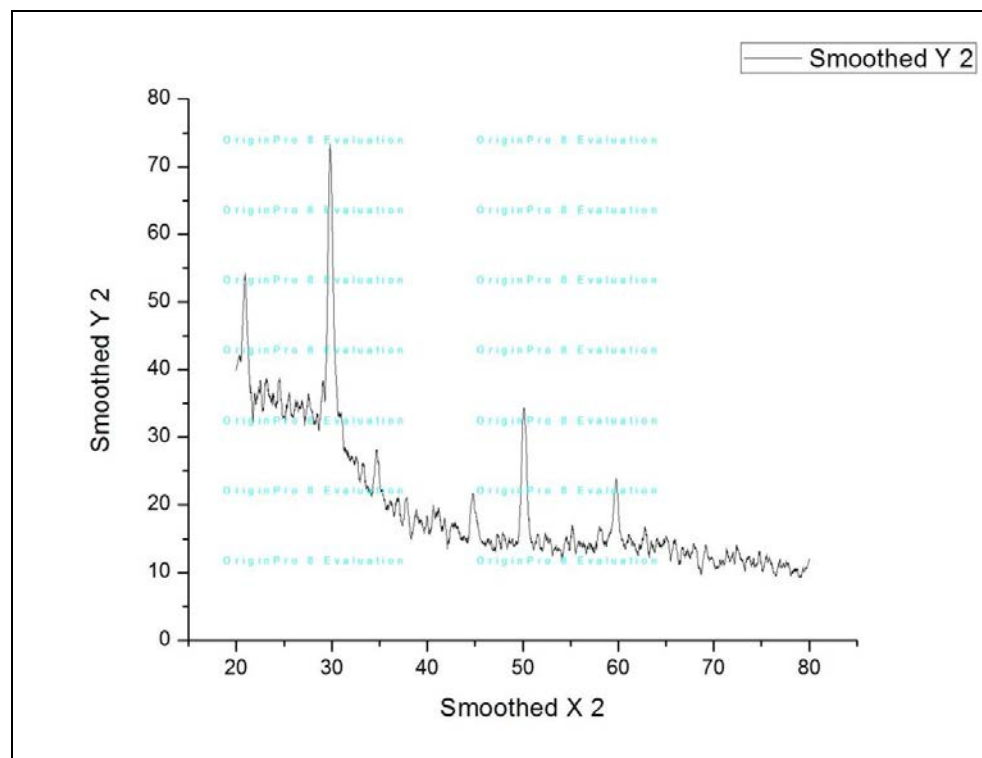
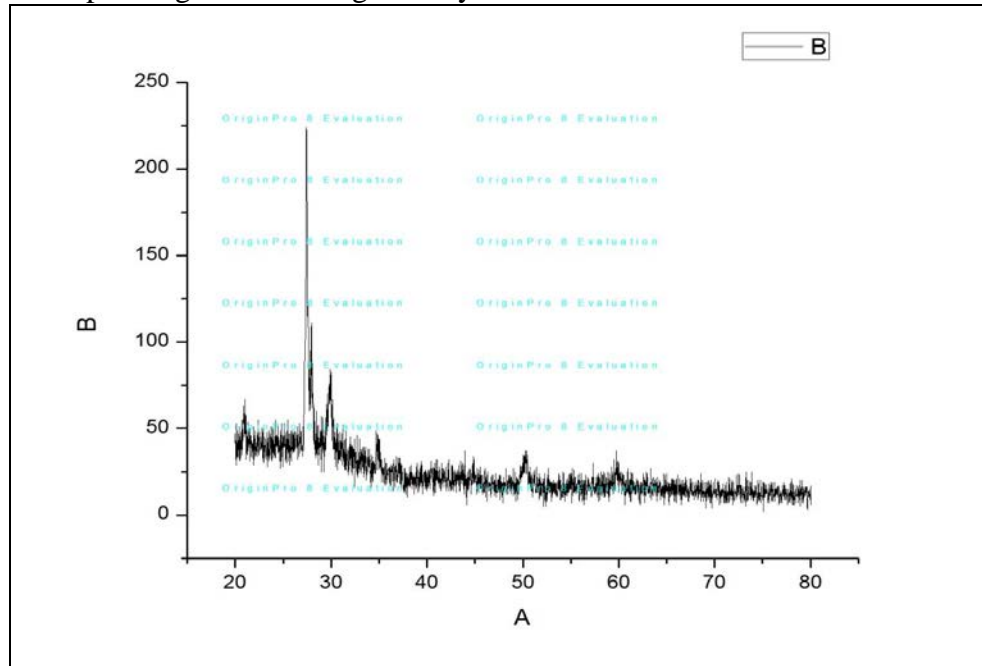
Here, we prepared two samples of photovoltaic cell ,the first sample by using GaAs thin film deposited by electro deposition techniques and second was prepared by GaAs substrate (100) purchased from U.S.A the substrates were cleaned in ultrasonic bath, isopropyl alcohol and deionizer water for 5 min. and in dil. HCL solution for 2 min. in order to remove the surface contamination and annealed at  $100^\circ$  Si doped n –type GaAs substrate (100) with  $4 \times 10^{18}$  doping concentration and thickness of 350 micrometer purchased from precision Micro Optics USA are used for device fabrication. Thermally evaporated aluminum

was used as cathode, ITO used as Anode, PEDOT: PSS (Clevious PH1000) dissolved in deionized water, and (P3HT) poly-3 hexythiophene was used as hole transport layer.

### Characterization

GaAs thin films deposited on ITO coated glass substrate were characterized by Keithley XRD diffractometer Operating in  $\theta$ - $2\theta$  geometry

XRD pattern used to identify crystalline phases ,XRD pattern shows that films are polycrystalline in nature and peaks intensity corresponding to single phase GaAs .UV absorption spectral characteristics of the prepared samples were performed at room temperature.



### Result and discussion

The sharp diffraction peak in the XRD pattern reveals that the films are crystalline in nature.

Figure show that if the deposition time of the prepared film is less than 10 minute then it exhibit cubic and orthorhombic structures(16,17) .where as the film deposited at deposition time greater than 10 min shows predominantly of orthorhombic structure (19,20) by applying Debye-Scherer formula (18), to XRD pattern we can calculated the average grain size of the prepared films.

$$D = k\lambda / B\cos\theta \text{ ----- (1)}$$

Where- k is the shape factor,  $\lambda$  is the X-ray wavelength and  $\theta$  is the diffraction angle.

The three-dimensional surface scan of the prepared GaAs thin film is analyzed by AFM technique. This study reveals that as the deposition time was increased then the average particle sizes of the surface were found to increase.

The absorption coefficient of the films is given by  $\alpha E = C(E - E_g)^n$ .

Where, C is constant E is the photon energy and  $E_g$  is the band gap energy n is the constant which value is depend upon the types of transition and which may be assigned the value 2, 1/3, 1/2 for allowed indirect transition, forbidden direct transition ,allowed direct transition respectively.

GaAs is a direct semiconductor materials and hence for this materials  $n=1/2$ .the absorption

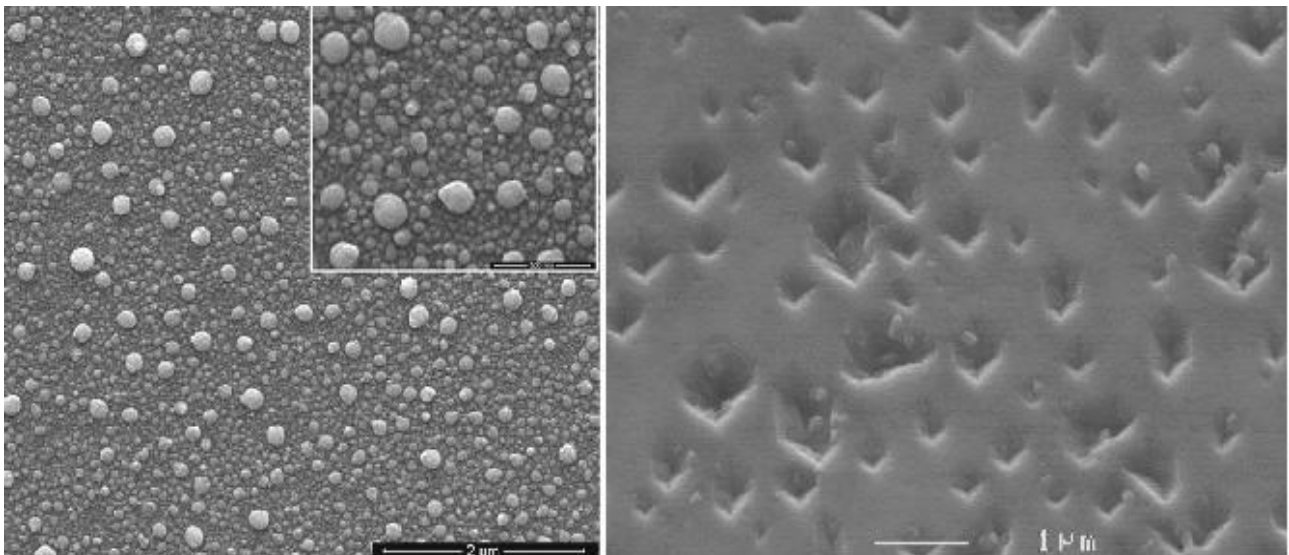
coefficient  $\alpha$  can also be calculated from the following equations which shows the relationship between the sample thickness "d" "and transmittance" T" this equations is valid for high absorption when the reflectivity dispersion and interference effect are negligible (20)

$$\alpha = 2.303 \text{ Log } (1/T)/d$$

Where T is transmittance and d is thickness

Linear nature of the graph between  $\alpha$  and E indicate that this is direct band gap semiconductor and the straight line intercept at x axis gives the value of band gap energy. Band gap is in good agreement with the values reported for GaAs thin films prepared by Galvanostatic technique (19, 20).

Under 110 mw/cm<sup>2</sup> illumination power, voltage current characteristics of prepared hybrid solar cell are measured in this case open circuit voltage, current density, fill factor and efficiency are  $V_{oc}=0.610$  v,  $J=7.10$  mA/cm<sup>2</sup> ,FF=0.71 , $\eta=4.72$  % but the performance of the another solar cell which was designed by electrodeposited GaAs layer on ITO substrate was poor .in this case open circuit voltage, current density, fill factor and efficiency are  $V_{oc}=0.57$  v , $J=8.10$  mA/cm<sup>2</sup> ,FF=0.61,  $\eta=2.72\%$



**Figure SEM image of GaAs**

Conclusion: now a day conjugated polymer is blended with inorganic materials in order to enhance the efficiency of the device. GaAs material is useful for optoelectronic devices and sensors. Heterojunction structure accompanied with conductive polymer which has tremendous applications in the field chemical, electrical and medical. But still there are some challenges in the field of development and implementation; co deposition of conducting polymer and metal is very complicated.

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