MIXED HYBRID MULTI-CLASS CLASSIFICATION MOVIE RECOMMENDER SYSTEM USING LOGISTIC REGRESSION

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ABSTRACT

With the advent of Big data and cloud computing there is a huge amount of data available on any product the customer wants. In order to reduce the time and effort required by the customer in choosing his preferred product, the industrial giants use recommender systems, which recommend products. Although many algorithms have been implemented for these recommender systems, still it remains a good area of research. This paper presents a movie recommender system which uses two different content based filtering algorithms. The first algorithm uses a logistic regression function and to adjust the gradient descent of the logistic function, truncated newton method has been used. The second algorithm makes content based recommendations to the user based on repeated words from the previously watched movie titles. The movies recommended by both the algorithms are presented to the user to make it easy for him to choose from a wide variety of movies, that is suitable according to his preference. The performance of both the algorithms are good in terms of its accuracy of prediction.

Keywords: *content based filtering, logistic regression, multi-class classification, mixed hybrid content based filtering*

1. Introduction

One of the most important application of machine learning is recommender systems. Today there are a number of such systems. Examples of systems include Amazon that recommends books, CDs etc.[2]. Recommender systems recommend products based on users taste or preference. So, there may be some products that the customer have used but many others which they have not used. These recommender systems finds what would be the rating of the customer for the products they have not used based on the choice of products they have used and recommends these new products to them.

Recommender systems have become an important research area since it gives customers personalised recommendations from the continuously growing online information on products. They have been used in many areas such as e-health, e-commerce, entertainment etc.[3,4,8]. But there is an ongoing research seen in this field since the recommendation methods adopted needs to be further improved [1,3,4,6,8] and the same can be extended to various fields of real-time applications such as recommendation on investment based financial services, personalised tours, job search [4] etc.

Recommender systems have been widely implemented using machine learning algorithms. Many researchers are working in various sub-fields of machine learning. This is because, the effects of the machine learning systems on society has been extensive. These systems learn the structures hidden in huge amounts of data and make accurate predictions using the efficient machine learning algorithms [5].

The huge amounts of data available are in the raw unstructured form and needs to be pre-processed [5], extracted, cleaned, changed, combined etc. before any analysis or predictions could be made. After the data are pre-processed then a machine learning algorithm that suits the current problem is chosen and an appropriate model is created and trained with the available test data [7]. This model is evaluated for its performance. Once its performance is accurate it could then be used in future for making the required predictions.

Machine learning algorithms are of three types. They are supervised, un-supervised and re-inforcement learning algorithms [7]. In supervised learning both inputs and outputs are known and training is done based on known data. These algorithms are again classified into two types. They are regression and

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classification algorithms. In case of un-supervised learning algorithms unlabelled data is used to train the model. These algorithms are again classified into two types. They are association rule learning and clustering algorithms. In case of re-inforcement learning, the algorithm learns by using a trial and error strategy.

Recommender systems come under the supervised learning. More specifically it is a classification problem. Classification problems help in putting items into their categories. Say example if there is a book. It first considers the features of the book to say if the item is book or not. In case of multi-class classification if there is an item its features are considered to decide if the particular item is a book or a song or a movie etc. A brief explanation on recommender systems are presented in the next section.

The rest of the paper is organised as follows. Section 2 gives details on recommender systems. Section 3 explains the mixed hybrid recommender model adopted in this paper. Section 4 presents the algorithms used in implementing the model. Section 5 presents the implementation results. Section 6 gives the conclusion and future enhancements.

2. Recommender Systems

Recommender Systems provide customised product recommendations from the overloaded online product information available and thereby improves the relationship with the user [3,4,8]. Good customer relationship is very important in today's competitive environment and hence, it is important to ensure that the results of these systems are of high quality. Therefore, recommender systems is an important research area. There are a number of types of recommender systems [1,3]. One type of recommender system is content based recommender system.

A content based recommender system, recommend products to customers based on the customers past preferences on similar items [1,11]. Therefore, the information on the customers preference needs to be retrieved and filtered for this prediction to be made. These systems can be improved by getting more accurate customers preferential information either through questionnaire or by learning

their surfing and other transactional behaviours. In such systems every item is represented by a feature vector which describes the features or characteristics of that particular item. Therefore, these systems use user's profile and item profile, to analyse the preferences of the user to make the recommendation.

Advantage: This method is said to be very simple and recommendation is user specific that it does not require other user's data. Also the recommendations are relevant, transparent and new items with similar features can be recommended immediately[6].

Disadvantage: *1. Over-specialisation* – This method does not recommend any items that the user has not seen before. In some cases such as recommendation on news it is not advisable to recommend a similar news or the same event. Therefore, some content based system not only filters different items which are far away from the user's taste but also too similar items. Therefore, recommending diverse products [1, 11] based on their preference or presenting the user with a good set of alternatives is equally important. For example it is not good to recommend all Kamal Hasan movies if a user just liked one of them.

2. New user problem – To make effective recommendations the system needs an enriched user's profile, which may not be the case for a new user.

3. Data sparsity – When a user rates movies to what extent it can be trusted is an issue. It is also a problem if user's rank only specific movies or ranks movies wrong.

There are also other recommender systems such as collaborative recommender, demographic recommender, utility based recommender etc. To solve the above problems hybrid recommender systems are also good solutions. A Hybrid recommender system combines two recommender systems that suit a particular industry in such a way it increases the strength of the system and eliminates any weakness of the individual ones [3]. These systems combine different recommender systems according to their requirements, to improve the performance of the recommendation made [9]. There are different types of hybrid recommender systems. A mixed hybrid recommender system presents

recommendations from various recommender systems to the user at the same time.

To solve some of the disadvantages of content based recommender systems we have implemented a mixed hybrid recommender system in this paper. The next section presents the mixed hybrid recommender model adopted in this paper.

3. Mixed Hybrid Recommender Model

This paper presents a mixed hybrid recommender model for movie recommendation. It combines the output of two different content based recommender systems to make its recommendations. The first recommender system uses a logistic regression function to do the content based filtering on genres of movies. The second recommender system filters movies based on repeated words in movie titles. For example if the user has watched "Harry Potter and the Chamber of secrets", then the user is also recommended with "Harry Potter and the Philosopher's stone", or if the user has watched "Spider Man", then the user is also recommended with "Bat Man".

3.1 Logistic Regression Model: This is a simple machine learning model which classifies an item. For example if an item is good or bad, preferred or not preferred etc. It is a binary classification model which calculates the probability that an item is preferred or not [6]. If the feature of the item is above a particular threshold according to user's preference, then it is classified as preferred and If the feature of the item is less than the particular threshold according to user's preference, then it is classified as not preferred. However, the same logistic regression model could be extended for a multi-class classification as well [6]. In this case, the threshold values of all features of all classes considered are evaluated and compared, according to user's preference, to classify if the particular item is suitable or not suitable etc.

For example the movie avatar can be classified under all of the following genres: action, adventure, fantasy and science fiction. Therefore, the threshold values of all genres considered are calculated and checked to recommend the given movie to the customer based on his past genre preference. The movie

recommender system considered in this paper comes under multi-class classification since it makes its recommendation based on genres, combination of genres and title of movies.

3.2 Dataset: The data about the various movies were downloaded from the IMDb movie dataset.

3.3 Model adopted and its functioning: There are two models adopted in this paper. The details of the models are as follows:

3.3.1 CBLR (Content Based Logistic Regression) Model: Using the genres of the movies and the combination of the genres watched by the user in the past, the logistic regression model was trained to evaluate the user's likeliness towards the different genres and combination of genres to make future predictions. Common genres such as Adventure, Action, Animation, Comedy, Fantasy, Horror, Mystery, Romance, Sci-fi and Thriller were considered in this model.

3.3.2 CBRWF (Content Based Repeated Words Filtering) Model: Using the tiles of the movie watched by the user, the titles with similar words were filtered, and these movies were recommended to the user.

3.4.2 Mixed Hybrid Model: The Mixed Hybrid model presented in this paper implemented both the above mentioned CBLR and CBRWF models, and made recommendations on movies based on both the model results.

3.4 Algorithm used:

3.4.1 CBLR (Content Based Logistic Regression) algorithm: A content based filtering algorithm which uses a logistic regression function to learn the likeliness of different genres of a user from the movies watched by him in the past and to recommend future movies based on the likeliness threshold of the user towards the different genres as mentioned in the CBLR model, has been implemented. To adjust the gradient descent of the logistic regression function, truncated newtons method has been adopted.

3.4.2 CBRWF (Content Based Repeated Words Filtering) algorithm: A content based filtering algorithm which filters the movies based on the repeated words in the movie titles has been implemented in the CBRWF model.

3.5 Type of Model:
CBLR model, uses a model based system to train and test the CBLR algorithm.
CBRWF model uses a memory based system in CBRWF algorithm.

3.6 Technique: The technique employed by CBLR algorithm is logistic regression with truncated newtons method for gradient descent. The technique employed by CBRWF algorithm is memory based filtering technique. Since a mixed hybrid model is implemented the techniques of both CBLR and CBRWF models are combined to achieve the result.

3.7 Predictions: Given a movie dataset and the movies watched by user in the past, the extent of likeliness of the movies based on its genre combination and title, are predicted, using the parameters calculated by both the algorithms. The movies predicted as preferred, are sorted in descending order. The top highly rated twenty movies presented by CBLR algorithm are combined with the results of CBRWF algorithm and recommended to the user.

3.8 Advantage of the model adopted: The mixed hybrid model has solved the data sparsity problem. To avoid data sparsity problems we have not considered the user's rating but had kept track of the movies watched by them in the past, the titles and the genre combination of these watched movies to evaluate the likeliness of various genres and titles for every user. The model adopted has also reduced over specialisation problem since recommendations are made based on many classes such as genres, genre combinations and title of movies.

4. Algorithm used in Implementation

4.1 Input: Let us consider a system recommending movies. Let there be n different movies. Let there be a set of m users. The movies watched by the users in the past are considered as input.

4.2 Output: Based on the input, new movies are recommended by the recommender system to the users.

4.3 Algorithms Used: Two algorithms were used to make the recommendation.

4.3.1 CBLR Algorithm: A content based filtering algorithm which recommends movies based on the genres of the movies preferred by the user in the past were implemented. The content based filtering is done using logistic regression function and the gradient descent is adjusted using the truncated Newton's method. Truncated Newton's method has been used because it gives a guarantee for solution as well as it is better in finding global optimal solutions [10].

Step1: A set of movies MW_i where i=1 to n, watched by the user U, in the past and a set of movies from which the prediction is to be made, MP_j where j=1 to m are taken as input.

Step 2: The genres of the movies in both MW_i and MP_j, are identified and the genre data is preprocessed.

Step 3: The likeliness of the user towards each of these genres are predicted using the logistic regression function for the MW_i dataset.

Step 4: The gradient descent is adjusted using the truncated Newton's method in the above logistic regression cost function.

Step 5: The movies from which the prediction is to be made MP_j where j=1 to m, are preprocessed by cleaning, null values removal, converting the categorical data to numeric etc. for the analysis and prediction to be done.

Step 6: Now the optimal theta for the User U, for the movies MP_j where j=1 to m, are calculated based on the likeness prediction made towards each genre for a particular user.

Step 7: The resultant score obtained for the movies MP_j is sorted in descending order.

Step 8: The first twenty movies are recommended to the user.

Step 9: The above Steps 1 to 8 were repeated for m users.

4.3.2 CBRWF Algorithm: A content based filtering algorithm which recommends the movies based on the repeated words in the title of the movies were implemented.

Step1: A set of movies MW_i where i=1 to n, watched by the user U, in the past and a set of movies from which the prediction is to be made, MP_j where j=1 to m are taken as input.

Step 2: The words in the title of movies such as 'Pirates', 'Harry', 'Potter', watched by the user in the past in the set MW_i where i=1 to n are extracted leaving out common words such as 'The', 'the', 'of', 'Of', 'at', 'At', 'a', 'and', 'And', 'A', 'in', 'In', 'on', 'On' etc.

Step 3: Movies with the same words in the title of movies MP_j where j=1 to m, were filtered and recommended.

Step 4: The above Steps 1 to 3 were repeated for m users.

5. Results and Discussion

The following genres were considered: Action, Adventure, Fantasy, Sci-fi, Thriller, Comedy, Romance, Horror and Animation. The sample likeliness scores for five users for the above genres are presented in the table 1.

The user1 and user2 made random preference on movies watched in the past, from which the likeliness scores were calculated. User3 specifically preferred fantasy and romance. User4 specifically preferred thriller and action. User5 specifically preferred adventure and science fiction. The likeliness score for the various genres were calculated from the movies watched by them in the past. The movies preferred by the user1 and the results of CBLR algorithm and CBRWF algorithm are presented in detail below. Table 2 presents the movies preferred by user1 in the past, Table 3 presents the movies predicted as suitable to watch by user1 and the corresponding predicted scores for the movies using CBLR algorithm. Table 4 presents the movies predicted as suitable to watch by user1 using CBRWF algorithm.

Similarly for user 4 who mostly prefers thriller and action specifically, the results are

presented. Table 5 presents the movies preferred by user4 in the past, Table 6 presents the movies predicted as suitable to watch by user4 and the corresponding predicted scores for the movies using CBLR algorithm. Table 7 presents the movies predicted as suitable to watch by user4 using CBRWF algorithm.

The accuracy of the predictions made were calculated. The formulae used in calculating the accuracy [3] of the algorithms were

Accuracy= Number of successful recommendations/Total number of recommendations

The accuracy of both the algorithm predictions were calculated and presented in table 8. Similarly, the likeliness score and recommendations were found for 100 and 200 users. The prediction accuracy score for these 100 and 200 users were also calculated. Table 9 gives the prediction accuracy score for 100 and 200 users. The Fig. 1 and Fig. 2 presents the prediction accuracy score for 100 users for CBLR and CBRWF algorithms. The Fig. 3 and Fig. 4 presents the prediction accuracy score for 200 users for CBLR and CBRWF algorithms. An average of 75 to 100 percent accuracy were exhibited by both the algorithms.

Table 1. Likeliness score for the genres for different users

Users	Action	Adventure	Fantasy	Sci-fi	Thriller	Comedy	Romance	Horror	Animation
User 1	14.045339	11.057809	4.560929	0.631325	5.609852	-0.998562	-0.768502	-0.378297	3.646536
User 2	15.597688	13.173539	3.193927	1.286578	5.303354	-0.998562	-0.768502	-0.378297	5.311971
User 3	1.42E+00	2.22E-03	7.99E+00	1.95E+00	8.65E-01	-6.46E+00	4.07E+00	-3.78E-01	5.17E-01
User 4	4.417057	1.002681	3.348522	-0.976247	10.187228	2.072179	-0.768502	0.418049	-0.252867
User 5	2.576867	6.970481	0.353445	5.506839	0.050186	0.017816	-0.768502	-0.289340	1.094384

Table 2. Movies watched by User 1 in the past.

Movie_Number	Genres	Movie_title
200	Action|Crime|Thriller	Fast Five
211	Adventure|Drama|Fantasy	Life of Pi
113	Action|Drama	Hancock
233	Adventure|Drama|Sci-Fi|Thriller	Gravity
112	Adventure|Family|Fantasy|Mystery	Harry Potter and the Goblet of Fire
443	Adventure|Animation|Family|Western	Spirit: Stallion of the Cimarron
12	Action|Adventure|Fantasy	Pirates of the Caribbean: Dead Man's Chest
65	Action|Crime|Drama|Thriller	The Dark Knight
33	Action|Adventure|Fantasy|Sci-Fi|Thriller	X-Men: The Last Stand
120	Action|Adventure|Fantasy|Sci-Fi|Thriller	X-Men Origins: Wolverine
303	Action|Adventure|Fantasy|Thriller	The Mummy Returns
316	Action|Adventure|Fantasy|Thriller	Lara Croft: Tomb Raider

Table 3. Predicted Movies and their scores for user 1 using CBLR Algorithm

Movie_Number	Genres	Movie_title	Score
199	Action|Adventure|Fantasy|Sci-Fi|Thriller	X-Men 2	35.90525292
33	Action|Adventure|Fantasy|Sci-Fi|Thriller	X-Men: The Last Stand	35.90525292
885	Action|Adventure|Family|Fantasy|Sci-Fi|Thriller	Race to Witch Mountain	35.90525292
720	Action|Adventure|Fantasy|Sci-Fi|Thriller	Reign of Fire	35.90525292
46	Action|Adventure|Fantasy|Sci-Fi|Thriller	X-Men: Days of Future Past	35.90525292
120	Action|Adventure|Fantasy|Sci-Fi|Thriller	X-Men Origins: Wolverine	35.52695551
632	Action|Adventure|Fantasy|Horror|Sci-Fi|Thriller	Blade: Trinity	35.27392777
316	Action|Adventure|Fantasy|Thriller	Lara Croft: Tomb Raider	35.27392777
303	Action|Adventure|Fantasy|Thriller	The Mummy Returns	35.27392777
452	Action|Adventure|Family|Fantasy|Thriller	Mighty Joe Young	35.27392777
690	Action|Adventure|Fantasy|Thriller	The Scorpion King	35.27000000
71	Action|Adventure|Fantasy|Horror|Thriller	The Mummy: Tomb of the Dragon Emperor	34.89563035
457	Action|Adventure|Comedy|Fantasy|Thriller	The Brothers Grimm	34.27536534
342	Action|Adventure|Animation|Family|Fantasy|Sci-Fi	Atlantis: The Lost Empire	33.94193721
293	Action|Adventure|Animation|Family|Fantasy	Legend of the Guardians: The Owls of Ga'Hoole	33.31061205
146	Action|Adventure|Animation|Fantasy	Beowulf	33.31061205
160	Action|Adventure|Animation|Fantasy|Romance|Sci-Fi	Final Fantasy: The Spirits Within	33.17343482
129	Action|Adventure|Animation|Comedy|Family|Fantasy|Sci-Fi	G-Force	32.94337478
181	Action|Adventure|Animation|Comedy|Family|Fantasy	Puss in Boots	32.31204962
718	Action|Adventure|Animation|Comedy|Family|Fantasy	The Lego Movie	32.31204962

Table 4. Predicted Movies for user 1 using CBRWF Algorithm

Movie_Number	Genres	Movie_title
8	Adventure|Family|Fantasy|Mystery	Harry Potter and the Half-Blood Prince
111	Adventure|Family|Fantasy|Mystery	Harry Potter and the Order of the Phoenix
185	Adventure|Family|Fantasy|Mystery	Harry Potter and the Prisoner of Azkaban
188	Action|Fantasy	Harry Potter and the Deathly Hallows: Part II
191	Adventure|Family|Fantasy	Harry Potter and the Sorcerer's Stone
195	Fantasy	Harry Potter and the Deathly Hallows: Part I
268	Adventure|Family|Fantasy|Mystery	Harry Potter and the Chamber of Secrets
1	Action|Adventure|Fantasy	Pirates of the Caribbean: At World's End
17	Action|Adventure|Fantasy	Pirates of the Caribbean: On Stranger Tides
194	Action|Adventure|Fantasy	Pirates of the Caribbean: The Curse of the Black Pearl
3	Action|Thriller	The Dark Knight Rises
604	Comedy	Last Man Standing
352	Action|Adventure|Fantasy	Lara Croft Tomb Raider: The Cradle of Life

Table 5. Movies watched by User 4 in the past.

Movie_Number	Genres	Movie_title
3	Action|Thriller	The Dark Knight Rises
27	Action|Adventure|Sci-Fi|Thriller	Battleship
28	Action|Adventure|Sci-Fi|Thriller	Jurassic World
33	Action|Adventure|Fantasy|Sci-Fi|Thriller	X-Men: The Last Stand
45	Action|Adventure|Horror|Sci-Fi|Thriller	World War Z
46	Action|Adventure|Fantasy|Sci-Fi|Thriller	X-Men: Days of Future Past
58	Action|Comedy|Crime|Thriller	Rush Hour 3
65	Action|Crime|Drama|Thriller	The Dark Knight
71	Action|Adventure|Fantasy|Horror|Thriller	The Mummy: Tomb of the Dragon Emperor
75	Action|Adventure|Sci-Fi|Thriller	Water world
76	Action|Adventure|Sci-Fi|Thriller	G.I. Joe: The Rise of Cobra
96	Action|Adventure|Sci-Fi|Thriller	Inception
99	Action|Crime|Thriller	The Fast and the Furious

Table 6. Predicted Movies and their scores for user 4 using CBLR Algorithm

Movie_Number	Genres	Movie_title	Score
457	Action|Adventure|Comedy|Fantasy|Thriller	The Brothers Grimm	21.02766748
71	Action|Adventure|Fantasy|Horror|Thriller	The Mummy: Tomb of the Dragon Emperor	19.37353773
303	Action|Adventure|Fantasy|Thriller	The Mummy Returns	18.95548849
316	Action|Adventure|Fantasy|Thriller	Lara Croft: Tomb Raider	18.95548849
690	Action|Adventure|Fantasy|Thriller	The Scorpion King	18.95548849
452	Action|Adventure|Family|Fantasy|Thriller	Mighty Joe Young	18.95548849
632	Action|Adventure|Fantasy|Horror|Sci-Fi|Thriller	Blade: Trinity	18.39729033
33	Action|Adventure|Fantasy|Sci-Fi|Thriller	X-Men: The Last Stand	17.97924109
885	Action|Adventure|Family|Fantasy|Sci-Fi|Thriller	Race to Witch Mountain	17.97924109
199	Action|Adventure|Fantasy|Sci-Fi|Thriller	X-Men 2	17.97924109
720	Action|Adventure|Fantasy|Sci-Fi|Thriller	Reign of Fire	17.97924109
46	Action|Adventure|Fantasy|Sci-Fi|Thriller	X-Men: Days of Future Past	17.97924109
120	Action|Adventure|Fantasy|Sci-Fi|Thriller	X-Men Origins: Wolverine	17.97924109
646	Action|Crime|Fantasy|Thriller	Elektra	17.95280707
769	Action|Fantasy|Thriller	Ghost Rider: Spirit of Vengeance	17.95280707
492	Action|Crime|Fantasy|Thriller	Wanted	17.95280707
212	Action|Fantasy|Thriller	Ghost Rider	17.95280707
387	Action|Adventure|Comedy|Thriller	The Rundown	17.67914542
575	Action|Adventure|Comedy|Thriller	Bad Company	17.67914542
353	Action|Adventure|Comedy|Crime|Mystery|Thriller	Now You See Me 2	17.67914542

Table 7. Predicted Movies for user 4 using CBRWF Algorithm

Movie_Number	Genres	Movie_title
488	Action|Adventure|Sci-Fi	The Lost World: Jurassic Park
604	Comedy	Last Man Standing
179	Adventure|Sci-Fi|Thriller	War of the Worlds
329	Action|Comedy|Crime|Thriller	Rush Hour 2
895	Action|Drama|Thriller|War	13 Hours
158	Action|Adventure|Sci-Fi|Thriller	G.I. Joe: Retaliation
367	Action|Crime|Thriller	The Fast and the Furious
390	Action|Crime|Thriller	The Fast and the Furious: Tokyo Drift
481	Action|Crime|Thriller	2 Fast 2 Furious

Table 8. Accuracy of prediction

Users	Successful Recommendations CBLR algorithm	Total number of recommendations CBLR algorithm	Accuracy percentage for CBLR algorithm	Successful Recommendations for CBRWF algorithm	Total number of recommendations for CBRWF algorithm	Accuracy percentage for CBRWF algorithm
User 1	15	20	75	12	13	92
User 2	18	20	90	9	10	90
User 3	17	20	85	4	4	100
User 4	16	20	80	8	9	89
User 5	18	20	90	11	13	85

Table 9. Accuracy of prediction for 100 and 200 users

Accuracy percentage	Accuracy percentage for CBLR algorithm for 100 users	Accuracy percentage for CBRWF algorithm for 100 users	Accuracy percentage for CBLR algorithm for 200 users	Accuracy percentage for CBRWF algorithm for 200 users
<75	3	4	5	7
75 and 85	33	34	71	76
85 and 95	35	43	66	83
95 and 99	26	17	48	29
EQUAL TO100	3	2	10	5

Fig. 1 Prediction accuracy score for 100 users using CBLR algorithm
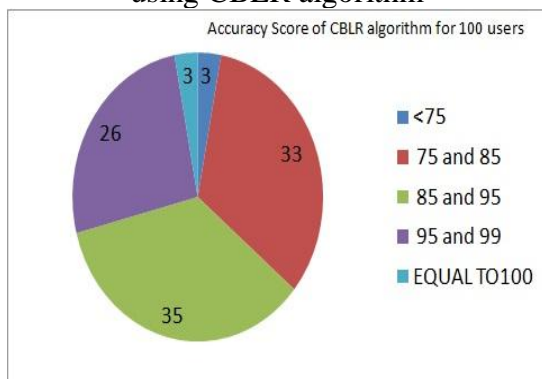
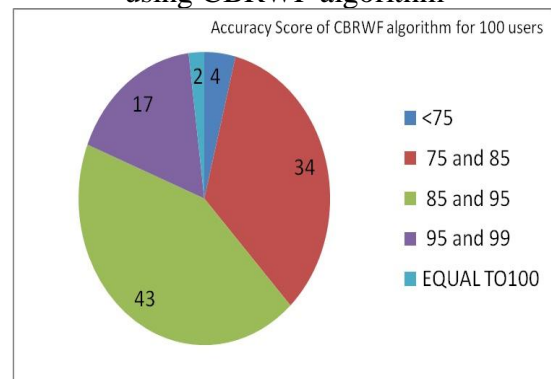Fig. 2 Prediction accuracy score for 100 users using CBRWF algorithm

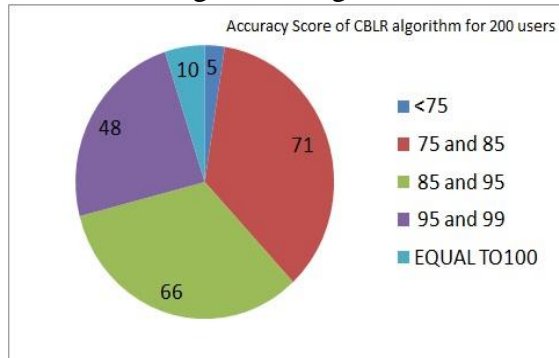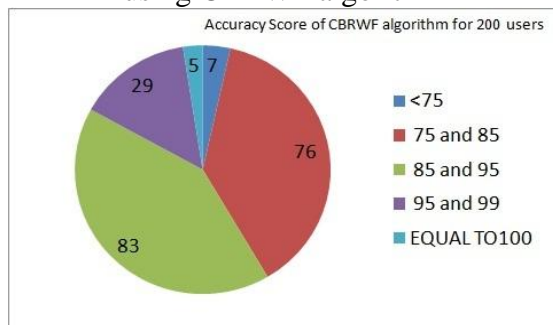Fig. 3 Prediction accuracy score for 200 users using CBLR algorithm

Accuracy Score of CBLR algorithm for 200 users

- <75
- 75 and 85
- 85 and 95
- 95 and 99
- EQUAL TO100

Fig. 4 Prediction accuracy score for 200 users using CBRWF algorithm

Accuracy Score of CBRWF algorithm for 200 users

- <75
- 75 and 85
- 85 and 95
- 95 and 99
- EQUAL TO100

6. Conclusion

A mixed hybrid recommender model has been implemented to improve the performance in terms of presenting a diverse set of suitable movies to the user. Two different content based filtering algorithms have been used. Firstly, the CBLR algorithm was implemented. This is a logistic regression algorithm with truncated Newton's method for gradient descent adjustment. This truncated Newton's method have been used to get solution convergence as well as global optimal solutions. Secondly, the CBRWF algorithm was implemented. This is a content based filtering algorithm which recommends movies based on repeated words in the previously watched movie titles. The accuracy of prediction for both the algorithms is more than 75 percent. The data sparsity problem has been solved in case of both the algorithm implementations. The over specialisation problem is reduced as the mixed hybrid model presents movies preferred by user based on genres as well as titles of movies. However, the new user problem found in any content based filtering algorithms are seen and needs to be addressed in future implementations.

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IN VITRO EVALUATION OF GROWTH STIMULATION EFFECT OF PREBIOTIC ON *Pediococcus pentosaceus* ISOLATED FROM SAUERKRAUT

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ABSTRACT

The purpose of this study was to find suitable prebiotics for synergistic combinations with the probiotic Pediococcus pentosaceus isolated from sauerkraut have the similar characteristics as like of probiotic. Garlic and pumpkin are good sources as prebiotics. The growth stimulatory effect of prebiotic on Pediococcus pentosaceus was studied by measuring optical density (OD) levels over a 48-hour period. The findings of this study were demonstrated that probiotic strains could utilise a variety of carbohydrates from the pumpkin and garlic extract shows stimulatory effect. Growth of Pediococcus pentosaceus was observed in MRS media supplemented with Garlic extract, pumpkin extract and Inulin as standard, with maximal growth observed in MRS medium supplemented with a combination of Garlic and pumpkin extract as compared to inulin. According to the findings of this study, several prebiotics (garlic and pumpkin extract) can boost the advancement of these representative probiotic strains in vitro. Sauerkraut juice, garlic and pumpkin extract as a synbiotics may be the potential formulation as a prophylaxis for dysbiosis induced chronic diseases such as obesity, Diabetes, Depression, cardiovascular diseases and Inflammatory Bowel Disease etc.

Keywords: Sauerkraut, Pediococcus pentosaceus, probiotic, Prebiotic.

Introduction

A chronic disease is one that lasts over a lengthy period of time. Chronic illness may impede the independence and health of persons with disabilities by causing extra activity constraints. The global burden of chronic illnesses is steadily rising.

A great number of demises among a populace of about fifty-seven million at the commencement of the new millennium can be attributed to incessant ailments[1]. These incessant ailments stem from food intake and nourishment issues and ultimately lead to public hardship. Such repercussions include heavy expenditure to the government and life that needs to be adjusted to disabilities. Gain in weight; inadequate insulin production; strain in heart functioning; malignant cells; bone impairments and tooth decays are evidences of such impairments.Chronic illnesses are expected to account for over three-quarters of all fatalities globally by 2020, with developing nations accounting for a good number of IHD, stroke and diabetes deaths [2]. The incidence of diabetes is forecasted to become two-fold with a staggering two hundred plus million patients in about four years' time [3]. Globally, developing nations will bear 60% of the burden of chronic illnesses. The world is witnessing a rise in such ailments; however, Asian countries like China and India seem to be the world leaders in such ailments [4]. The prime ailment that outshines other issues is gain in bogy weight [5]. Such a scenario is not just startling but also a major hurdle for the health care system.

A variety of reasons may be attributed for the recurrence of incessant ailments. However, dysbiosis has now gained spotlight for highlighting the issue pertaining to metabolic capabilities of microbiota [6,7]. Dysbiosis may impede health functioning in different angles. It can trigger cholera or grave inflammation [8,9]. Also, bacteria that shield health issues may be hampered or completely alleviated. This indicates a situation wherein there is loss of function [10, 11]. Gain in body weight and liver issues stem from such functional losses. Researchers think that a poor diet, in particular, contributes to the fast advancement of many disorders.Thus, dysbiosis is characterised by lower amounts of helpful bacteria [12].

Microorganisms, termed as probiotic, that exist in appropriate quantities may reap benefits to the health as averred by the United Nation's Food and Agricultural Organisation as well as the World Health Organization. Lactic acid Bacteria, or commonly known as LAB, comprise various classes including Lactobacillus, Pediococcus, and Enterococcus. They are believed to supply lactic acid that stems from fermentation [13].

Although evidence supports probiotic use for obesity management, few research has looked at the function probiotics play in other metabolic illnesses [14].Probiotics repair and maintain beneficial microorganisms in the human body. Probiotics are popular in fermented creamery products, baby formula besides nutritional supplements [15].

Preservation of cabbage, dating back to the 4th century BC as a food source, has been possible thanks to Sauerkraut. It is high in probiotics and tyramines, as well as vitamins and minerals, and has little calories. Sauerkraut is a classic vegetable product that often stems from fermentation and is also dependent on LAB (natural ingredient in white cabbage) [16,17].

Sauerkraut may be thought of as a probiotic bacterium carrier. Probiotics are responsible for prove advantageous to the host when supplied in sufficient quantities [18]. LAB extracted from sauerkraut has been reported in many investigations to be a possible probiotic [19].

Prebiotics (polysaccharides) can resist acidic and enzymatic breakdown in the intestinal tract and are utilised for proliferation and activities that enhance the host's wellness by probiotics and gut bacteria in the larger intestine.This boosts resistance and mineral assimilation, reduces cholesterol, and protects against colon carcinoma and related gastrointestinal illnesses.Myriad plants house natural elements like oligofructose, lactulose, and inulin that result from enzymes that procreate carbohydrates and starch [20].

Prebiotics comprise substrates or unprocessed foodstuff [21] that are processed favourably by various bacteria in the intestinal tract, such as Lactobacillus and Bifidobacterium, and possess a wellness effect [22]. Prebiotics function by encouraging the growth and functioning of bacteria that benefit the host's wellness, especially non-pathogenic microorganisms. According to Gilchrist et al. [23], practically every oligosaccharide can be counted as prebiotic except in the case of meals that have enormous amount of carbohydrates.

A substance must meet at least three requirements in order to qualify as prebiotic: (i) there should not be any absorption at the entrance to the intestinal passage and ultimate exit from the body as part of the faeces [25];(ii) Microflora that are advantageous must be able to collect anferment in the colon that in turn aid the functioning of the bacteria toward metabolism [26]; (iii) Microflora in the colon must be metamorphose into elements that eventually stimulate Lactobacillus [27].

The purpose of this research is to extract probiotics from sauerkraut, analyse their properties, and investigate the influence of prebiotics on the development of isolated probiotics. Prebiotics promote the development of probiotics as well as gut flora, and this combination has the potential to be employed in the prevention and treatment of dysbiosis-induced chronic illnesses.

Materials and Methods

Collection and authentication of cabbage

Cabbage (Brassicaceae group), a contender for the globe's significant vegetables, is popularly termed Brassica oleracea L. var. capitata, entails Kale, broccoli besides cauliflower. The size, shape, and colour of the leaves, as well as the texture of the head, vary greatly amongst farmed species of cabbage [28]. Cabbage appears in various forms according to the farms from where it emanates and this evidenced in myriad types of heads, shape, growth and hue of the leaves [28]. The cabbage utilised for the research was sourced from a market close by and was validated by a botanist at Dayanand Science College Latur in Maharashtra, India.

Preparation of Sauerkraut: Cabbage was washed with sterile water and ruined upper green leaves were removed. The cabbage heads were trimmed and sliced into 1-2mm thick shreds. The shredded cabbage was mixed with 3% (w/w) food grade salt (NaCl) and kept 1L sterilized in a bottler that did not allow any air and the same was fermented for a little over a week at 25 °C.

Growth media: Media for the growth stimulation was used as Lactobacillus MRS Broth, Granulated-GM369-500G (HIMEDIA) and for isolation and subculture Lactobacillus MRS Agar M641 (HIMEIDA) was used.

Growth substrates: Pumpkin is a significant horticultural crop in the Cucurbitaceae family. Pumpkin possesses vitamins and antioxidants and is grown in huge quantities globally.

Pumpkin is a low-calorie food that possesses flavonoid polyphenolic antioxidants and also is rich in Vitamin A [29, 30]. Pumpkin is a traditional food in many nations, and it is thought to offer several health advantages, including anticancer, antioxidant, antihyperlipidemic, and antibacterial properties [31-32]. Pumpkin has a high concentration of putative prebiotic components [33]. Garlic has long been thought to offer several health advantages, including the avoidance of gastrointestinal illnesses. A significant constituentGarlic Fructan (GF), was studied; Prebiotic efficacy on human gut microflora was considered. [34] As a result, pumpkin seed extract and garlic extract were chosen as growth stimulators in this investigation.

Bacterial isolation and purification: On the eighth day of fermentation, 1g of fermented Sauerkraut paste was mixed homogeneously with 10 ml of sterile distilled water in test tubes, and serial dilutions were prepared up to 10-6. 100 l of the above-mentioned dilution was obtained and distributed on 1.7 percent (W/V) MRS agar plates [34]. The Petri plate was then anaerobic cultivated at 37 C for 36-48 hours. Bacterial colonies with a clean zone on the plates were individually selected. The bacteria colonies were streaked on plates and anaerobic cultivated at 37 degrees Celsius for 24 to 36 hours. To get a pure culture, the bacterial colonies were streaked two or three times.

Phenotypic and genotypic characterization of the isolates: The pure culture in the form of slant and Petridis (fig. 1) submitted to National centre for microbial Resources (NCMR) Pune, Maharashtra, India for 16S rRNA Gene Sequencing & Phylogenetic characterization.

Figure 01: Slant and agar plate of pure isolate from sauerkraut

Bacteria, Prebiotic Garlic extract and Pumpkin seed extract: In the pure culture, bacterial test strains (Pediococcus pentosaceus) were acquired from sauerkraut. Cultures of Pediococcus pentosaceus were maintained in suitable basal medium (MRS Broth, Granulated-GM369-500G, Himedia) was used at pH 6.5. Pediococcus pentosaceus were cultured in an anaerobic condition using anaerobic chamber. Pediococcus pentosaceus strain was initiatedat 37°C for a day in a basal medium and was subsequently injected to garlic and pumpkin seed extracts. These suspensions were employed as bacterial stock cultures for proliferation intensity assessments. Garlic extract and pumpkin seed extract was received from Herba Nutra, Greater Noida, India with certificate analysis as a gift sample.

Bacterial growth intensity in presence of Prebiotic: Ten ml lactobacilli (tubes) were produced for the assessment of bacterial growth intensity in the presence of prebiotic substrates such as garlic and pumpkin extract. Bacteria culture, a day-old, was amalgamated to these tubes that fostered an increment in volume of about 105 percent. It was noted from earlier investigations that strains being subjected to examination witnessed developmental results after two days and subsequently attained a stationary level.This incubation period was determined as a result of this experience throughout the studies. The next measurement pertained to the optical density; Spectrophotometer was utilised (1 cm cuvettes) entailing automation powered by 2202 PC-based UV-Vis (Double Beam). It was set to 600 nm. Tubes were swayed for 10 seconds to jolt the sediments and then one ml was assigned to an optical cuvette. Each optical density measurement was subjected to means and the same was calibrated with the cultures controlled by inulin.A selection of Pediococcus pentosaceus was studied (Table no. 1) with myriad prebiotic sources to audit the growth behaviour besides analysing the outcomes of

the serial tests. Optical density at 600nm was measured at 0hr, 24hr, 36hr, and 48hr following inoculation. OxyraseR enzyme (1 ml) was combined with substrate (50 ml) to ensure anaerobic ambience. It was subsequently dispensed into the microtubes to eliminate dissolved oxygen. After bacterial inoculation, all microvials were coated with two droplets of sterile paraffine oil. The microtiter plates were kept at 37°C at all times. Microbiology is characterised by optical densityresearch of microbial proliferation. These are based on propositions that optical density is comparable with the sample intensification numbers.

Table no: 01 synbiotic (Inulin), synbiotic 1(Garlic extract), Synbiotic 2(Pumpkin seed extract)

Tube no	Test sample
1	Broth media
2	Broth + Probiotic
3	Broth + Synbiotic (Inulin 2%) Standard
4	Broth + Synbiotic (Inulin 4%) Standard
5	Broth + Synbiotic 1 (2%)
6	Broth + Synbiotic 1 (4%)
7	Broth + Synbiotic 2 (2%)
8	Broth + Synbiotic 2 (4%)
9	Broth + Synbiotic 1 (2%) + Synbiotic 2 (2%)
10	Broth + Synbiotic 1 (4%) + Synbiotic 2 (4%)

Results

Microbial identification based on 16S rRNA: Bacterial strains recovered from sauerkraut are coccus-shaped germs that are Gram-positive, non-motile, and do not produce spores. They are classified as "lactic acid bacteria."

The bacterial sample(s) identification based on 16S rRNA, the identification report was generated using EzBioCloud Database at NCMR Pune as shown in the **Table no 02.**

**Table no: 02 Identification report based on 16S rRNA**

PRN	Strain No.	Taxonomic Designation	Accession No.	%Similarity
AUG_21_275	W/P/003	*Pediococcus pentosaceus* DSM20336(T)	JQBF01000022	99.93

Sequence Text (in FASTA format font: courier new 10):

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TGCTCAGGATGAACGCTGGCGGCGTGCCTAATACATGCAAGTCGAACGAACTTCCGTTAATTGATTATGAC
GTACTTGTACTGATTGAGATTTTAACACGAAGTGAGTGGCGAACGGGTGAGTAACACGTGGGTAACCTGCC
CAGAAGTAGGGGATAACACCTGGAAACAGATGCTAATACCGTATAACAGAGAAAACCGCATGGTTTTCTTT
TAAAAGATGGCTCTGCTATCACTTCTGGATGGACCCGCGGCGTATTAGCTAGTTGGTGAGGTAAAGGCTCA
CCAAGGCAGTGATACGTAGCCGACCTGAGAGGGTAATCGGCCACATTGGGACTGAGACACGGCCCAGACTC
CTACGGGAGGCAGCAGTAGGGAATCTTCCACAATGGACGCAAGTCTGATGGAGCAACGCCGCGTGAGTGAA
GAAGGGTTTCGGCTCGTAAAGCTCTGTTGTTAAAGAAGAACGTGGGTAAGAGTAACTGTTTACCCAGTGAC
GGTATTTAACCAGAAAGCCACGGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGTGGCAAGCGTTAT
CCGGATTTATTGGGCGTAAAGCGAGCGCAGGCGGTCTTTTAAGTCTAATGTGAAAGCCTTCGGCTCAACCG
AAGAAGTGCATTGGAAACTGGGAGACTTGAGTGCAGAAGAGGACAGTGGAACTCCATGTGTAGCGGTGAAA
TGCGTAGATATATGGAAGAACACCAGTGGCGAAGGCGGCTGTCTGGTCTGCAACTGACGCTGAGGCTCGAA
AGCATGGGTAGCGAACAGGATTAGATACCCTGGTAGTCCATGCCGTAAACGATGATTACTAAGTGTTGGAG
GGTTTCCGCCCTTCAGTGCTGCAGCTAACGCATTAAGTAATCCGCCTGGGGAGTACGACCGCAAGGTTGAA
ACTCAAAAGAATTGACGGGGGCCCGCACAAGCGGTGGAGCATGTGGTTTAATTCGAAGCTACGCGAAGAAC
CTTACCAGGTCTTGACATCTTCTGACAGTCTAAGAGATTAGAGGTTCCCTTCGGGGACAGAATGACAGGTG
GTGCATGGTTGTCGTCAGCTCGTGTCGTGAGATGTTGGGTTAAGTCCCGCAACGAGCGCAACCCTTATTAC
TAGTTGCCAGCATTAAGTTGGGCACTCTAGTGAGACTGCCGGTGACAAACCGGAGGAAGGTGGGGACGACG
TCAAATCATCATGCCCCTTATGACCTGGGCTACACACGTGCTACAATGGATGGTACAACGAGTCGCGAGAC
CGCGAGGTTAAGCTAATCTCTTAAAACCATTCTCAGTTCGGACTGTAGGCTGCAACTCGCCTACACGAAGT
CGGAATCGCTAGTAATCGCGGATCAGCATGCCGCGGTGAATACGTTCCCGGGCCTTGCACAC
```

The core of the investigation can be attributed to the sequence of a unitary gene entailing an aggregate length of 1411 bp (16S rRNA) and its mearest strains. Pediococcus pentosaceus is the sequence's closest phylogenetic cousin. The phylogenetic tree, analytical data, and general findings are all provided here.

Fig: 02 Phylogenetic tree of bacteria isolated from sauerkraut.
(Evolutionary relationships of taxa)
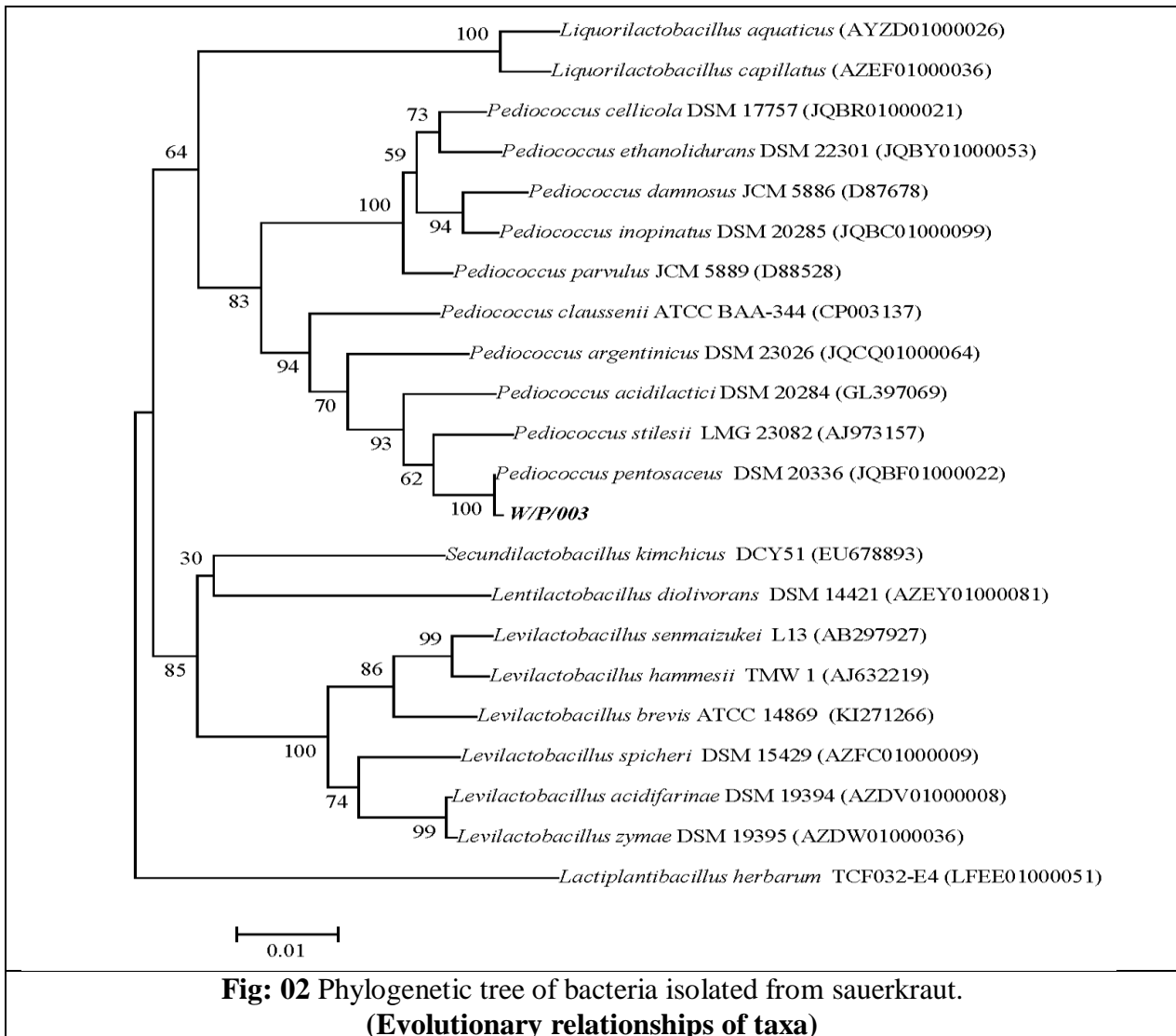
The progression chronicle was inferred by employing the Neighbor-Joining technique [36]. The ideal tree exhibited possesses a branch length total of 0.32680031. The bootstrap test (1000 repetitions) isalso proportionally exhibited [37].The exhibit is a scaled version wherein the length of the branches entails units that are similar evolutionary distances as backed by the Kimura 2-parameter technique [38].Rate .

variance among locations was indicated by utilising gamma distribution with unitary shape parameter. The study included 22 nucleotide sequences. Jobs exhibiting lower than ninety-five percent site coverage was alleviated. Hence, majority of unclear or absent data and gaps in alignment were secluded. Terminal dataset had 1338 locations in total. MEGA6 [39] was used to perform evolutionary analysis

Measurement of bacterial growth intensity in presence of Prebiotic[40]

Tab: 03 Absorbance at 600nm by using PC Based Double Beam UV-VIS. Spectrophotometer of test sample in presence of standard and test growth stimulators (prebiotic) at different time intervals.

S. No	Growth Stimulators	Absorbance at 600 nm			
		0 hrs	24 hrs	36 hrs	48 hrs
1	Normal (Negative Control)	0	0.1	0.12	0.11
2	Control	0.12	0.18	0.24	0.28
3	Std Synbiotic 2% w/v	0.40	0.47	0.52	0.58
4	Std Synbiotic 4% w/v	0.39	0.54	0.62	0.65
5	Synbiotic-1 (2% w/v)	0.20	0.25	0.3	0.34
6	Synbiotic-1 (4% w/v)	0.37	0.41	0.42	0.45
7	Synbiotic-2 (2% w/v)	0.28	0.35	0.37	0.38
8	Synbiotic 2 (4% w/v)	0.38	0.4	0.48	0.51
9	Synbiotic 1 (2% w/v) + Synbiotic 2 (2% w/v)	0.48	0.52	0.53	0.57
10	Synbiotic 1 (4% w/v) + Synbiotic 2 (4% w/v)	0.52	0.61	0.64	0.68

The optical density at 600 nm, or short OD600, is the most often used method for assessing microbial growth in solution. The technique uses absorbance detection mode to determine which fraction of light goes through a material, especially a suspension of microorganisms.

In this study probiotic strain of Pediococcus pentosaceus inoculated in the basal media containing the prebiotic (growth stimulators) in two different concentration and in combination for two access the maximum growth stimulation property of Garlic and Pumpkin extract. As per the observation in the Table-3 it clearly indicates that 4% combination of Synbiotic 1 and Synbiotic 2 shows significant growth as compare to alone or standard prebiotic. It concludes that Garlic and Pumpkin extract shows synergistic effect as a growth stimulator shown in the **Fig-3.**
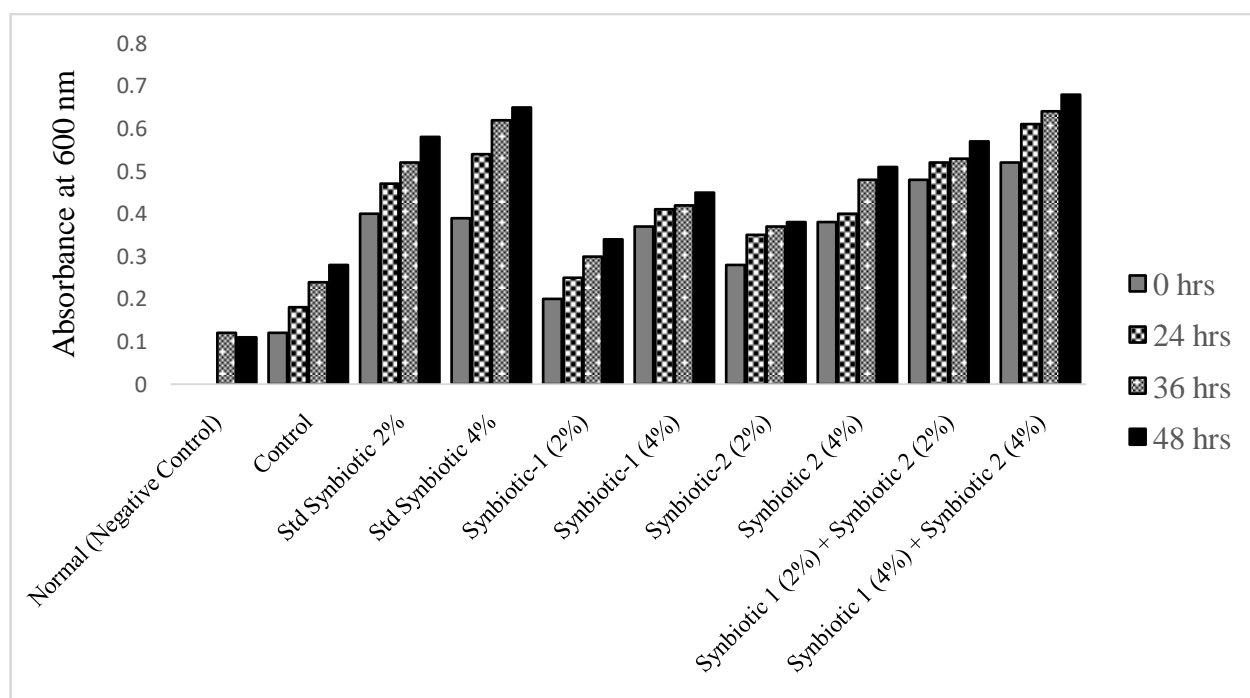

Figure 03: Graphical representation of growth stimulatory effect of standard and test prebiotic on Pediococcus pentosaceus with different time intervals.

Discussion

In the present study the bacterial strain which is isolated from sauerkraut was testedfor 16 S rRNA Sequencing, Phylogenetic analysis and growth stimulatory effect in presence of prebiotic. The bacterial sample(s) identification based on 16S rRNA, the identification report was generated using EzBioCloud Database confirm the taxonomic designation *Pediococcus pentosaceus* **DSM20336 (T)** with Accession No. JQBF01000022 and 99.93 % similarity. The study is based on a single gene sequence with a total length of 1411 bp of the 16S rRNA gene of the sample and its nearest type strains in the repository. Pediococcus pentosaceus is the sequence's closest phylogenetic cousin.

A phylogenetic study using the 16S rRNA gene put strain (C AUG 21-275) in a clade with the species Pediococcus pentosaceus and exhibited pairwise similarities ranging from 100 to 99 percent. Based on the findings of the phylogenetic tree constructed using a 1368 bp sequence of the 16S rRNA gene and pairwise similarity results obtained from the GenBank database, it is possible that this is a different genus of Pediococcus. However, according to the literature, a taxonomic category contains species/subspecies that cannot be distinguished only by the 16S rRNA gene sequence. MLST or a polyphasic method is indicated for further identification.

Pediococcus pentosaceus, a promising strain of lactic acid bacteria (LAB) discovered from sauerkraut, is increasingly gaining attention, resulting in an increase in experimental study. P. pentosaceus is a gram-positive, nonmotile, homofermentative LAB with facultative anaerobic and carbohydrate degradation properties [41]. Because there is a greater need for practical uses of microorganisms, the functional and harmless P. pentosaceus might be a valuable LAB strain for both the food sector and biological applications. There is growing experimental evidence that P. pentosaceus may be useful as a biopreservative for foods, plants, or animals, or as a potential probiotic candidate [42].

We have also determined the growth stimulation of Pediococcus pentosaceus in presence of garlic and pumpkin extract, shows significant growth stimulation with synergistic combination of garlic (4%) and pumpkin (4%) extract as compared to alone and standard prebiotic inulin(4%) this signifies the garlic and pumpkin are potent prebiotic.

Dysbiosis is characterised as the loss or increase of microorganisms that promote health or sickness, accordingly. While a variety of genetic and environmental factors play a role in the development of chronic disease, one emerging theory contends that dysbiosis, or a disparity in the formation and metabolic capabilities of our microbiota, enhances the risk of creating chronic diseases such as weight gain, diabetes, depressed mood, IBD, respiratory problems, and so on. [43,44].Dysbiosis of the gut microbiota is closely related to the appearance of many chronic diseases related to inflammation. Traditionally prescribed prebiotics and probiotics have generally not shown a significant impact in improving these conditions. Therefore, the development of next-generation probiotics and probiotics targeting specific diseases is urgently needed.

Conclusion

Dysbiosis is the cause of the various chronic diseases, if we add sauerkraut as probiotic and garlic and pumpkin as a prebiotic in our diet could be act as agut flora targeting prophylaxis for chronic diseases. For to clinically use, these data are not sufficient need to be preclinical and clinical study for to clinical use.

Acknowledgments

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CUSTOMER SATISFACTION OF ALMORA URBAN CO-OPERATIVE BANK

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ABSTRACT

Almora Urban Co-operative Bank is the biggest urban co-operative bank in north India. It's a state co-operative society and works after taking the banking license from the RBI. 100% ownership is in private hands and works as a private bank. This paper aims to identify the customer satisfaction of Almora urban co-operative bank. For this 100 samples have been collected through the scheduled interview including 34 questions. Data have been analyzed through the M.S. Excel, Smart PLS and the hypothesis has been tested by one way ANOVAs test. As the result, customers are satisfied with more than one-third of the full satisfaction levels. This study enhances the knowledge of the working of co-operative banks working and is helpful for every stakeholder of this bank. This study is also helpful for the RBI and other banking regulating organizations to assess the quality of banking services.

Keywords: Urban Co-operative Bank, Customer Satisfaction, Bank Service Quality.

Introduction

All co-operative banks are providing general banking services to the general people. Two types of co-operative banks are working in India. Rural co-operative banks work mostly in rural areas and urban co-operative banks are working in urban areas. Rural co-operative banks are further sub-divided into state co-operative banks and district co-operative banks. All co-operative banks are registered under the state co-operative societies act.

Almora urban co-operative bank is the biggest urban co-operative bank of north India with 51 branches in Uttarakhand. Almora urban co-operative bank is the biggest urban co-operative in North India. Almora urban co-operative bank is a state-level urban co-operative bank that was registered on 14/08/1991 as a co-operative society. The Head office is situated in Almora since the registration and at the present bank have a total of 50 branches in Uttarakhand which are providing general banking services to the people. All branches are fully CBS, RTGS, NEFT, and SMS facility enabled branches. Almora urban co-operative bank provides insurance services with the tie-up of Exide Life Insurance Company and Future Generali India Life Insurance Company Limited. 26 ATMs of the bank are working all over Uttarakhand and it is the direct member of the National Payment Corporation of India (NPCI). By which Almora Urban Co-operative Bank ATM holder customers can use the approx 2,42,183 ATMs

and 27,40,671 "Point of Sale" in India. The Bank is providing e-commerce facilities to its customers by which customers can make online shopping, mobile recharge, DTH recharge, etc.

Almora urban co-operative bank is a commercial bank and provides general banking services to the public as other private and public sector banks but it's working with some working limitations due to small size state-level banks.

"The term urban co-operative banks (UCBs), though not formally defined, refers to primary cooperative banks located in urban and semi-urban areas. These banks, till 1996, were allowed to lend money only for non-agricultural purposes. This distinction does not hold today. These banks were traditionally centred around communities, localities workplace groups. They essentially lent to small borrowers and businesses. Today, their scope of operations has widened considerably. The origins of the urban cooperative banking movement in India can be traced to the close of the nineteenth century when inspired by the success of the experiments related to the cooperative movement in Britain and the cooperative credit movement in Germany such societies were set up in India. Cooperative societies are based on the principles of cooperation, - mutual help, democratic decision making, and open membership. Cooperatives represented a new and alternative approach to organization as against proprietary firms, partnership firms, and joint-stock companies

which represent the dominant form of commercial organization." (Function of urban co-operative banks by RBI)

Review of Literature

Bose G. Subashchandira, Nagarajan P., (2018). The need of the time is that government should see the co-operative banking model as an appropriate structure for achieving the goals of financial inclusion. This system would be economical and offer results quickly if it is monitored properly and the function of SCBs will be very inspiring for the same. To conclude it all, the banking sector in India is progressing with the increased growth in customer base, due to the newly enhanced and innovative facilities offered by banks. The economic growth of the country is an indicator for the growth of the banking sector. This study highlighted the overall working performance of state co-operative banks in India from 2005-06 to 2014-15.

Nivedita, (2018). Cooperative was started in India in 1904. We have seen many successful cooperative organizations in India like Amul. And not only these but these days we can see that cooperatives are successful in banking also. The Himachal Pradesh State Cooperative Bank is a live example of this fact.

Merry Elizabeth John, Joby Joseph Thoomkuzhy, (2018). On the basis of the analysis of the study it can be concluded that the people under the low-income category are the main service takers of the cooperative banks. Even though they are comfortable with the service rates, they are dissatisfied with the bank in updating them with the information of new services.

Ravindran, R., (2011). The main objective of this research is to analyze on financial management, customers' perceptions and employees' perception to find solution to overcome all the drawbacks and maintain positive aspects of TDCC Bank. Co-operation is a wonderful principle, to make success in Co-operative Bank, co-operation from govt, employees, customers and general public is needed. Co-operative bank's success depends on successful financial management, human resources management and customer relation management. TDCC Bank should not cancel the loan amount for agriculture loans. Bank can

reduce interest rate on loan for the borrowers who have problems on repayment. Cancellation of loan affects profitability and liquidity of the bank. Even survival of bank will be questionable.

Objectives

The main objective of this study is to describe the urban co-operative banks and highlight the customer satisfaction of Almora Urban Co-operative Bank.

Hypothesis Formulation

In the primary survey, we saw bank employees doing different behavior with different customers and different customers may need different types of organizational infrastructure, employees work, and financial related needs.
H01: There is a moderate relationship between the customer satisfaction of Infrastructure and Instruments, Staff Competency and financial activities.

Research Methodology

This study is based on the primary and secondary types of data. To collect the primary data, one questionnaire has been designed and 100 samples have been collected through the questionnaire and secondary data have been collected the many journals, thesis, websites, annual reports, and etc. A questionnaire has consisted of 10 demographic related and 26 customer satisfaction related questions. A five-point Likert scale has been used in the questionnaire.

Data Analysis
Table 1. Demographic Details of Respondents

Particular	Percentage of Total Respondents
Account Type	
Saving Account	53%
Current Account	7%
Saving + F.D.	7%
Saving + Current	6%
Saving + R.D.	10%
Saving + F.D. + R.D.	17%
Total	**100%**
Loan Type	
Agriculture Loan	0%
Home Loan	17%

Loan on Deposits	10%		Unmarried	28%
Business Loan	9%		**Total**	**100%**
Vehicle Loan	10%		**Age**	
Employee Loan	0%		Below 18 Years	0%
Over Draft	4%		18-40 Years old	82%
No Loan	50%		41-60 Years old	18%
Total	**100%**		Above 60 Years	0%
Account Holding Time			**Total**	**100%**
New & Below 1 Year	8%		**Education**	
1-5 Years	58%		Up to High School	5%
5-10 Years	21%		Inter mediate	30%
Above 10 Years	13%		Graduate	33%
Total	**100%**		Post Graduate and Above	32%
Gender			Illiterate	0%
Male	59%		**Total**	**100%**
Female	41%			
Total	**100%**			
Business and Work				
Employed	40%			
Agriculturist	0%			
Business	30%			
Student	8%			
House Wife	22%			
Retired	0%			
Total	**100%**			
Marital Status				
Married	72%			

Demographic details are a significant part because results are based on the perception of these respondents. it is the details on 93% customers have at least one saving account and results highly reflect the saving account holder customer satisfaction and 50% people have a loan from the bank and it's a good ratio of loan holder people. 92% of respondents have more than one year bank account so the result following results and testing will reflect the satisfaction level from the long term banking performance.

Table 2. Customer Satisfaction of Almora Urban Co-operative Bank

Table 6.15 Customer Satisfaction of Almora Urban Co-operative Bank			
Constructs	**Items**	**Mean**	**Percentage**
Infrastructure and Instruments	Availability of forms	4.33	86.53%
	ATM services	3.91	78.22%
	Online banking services	3.67	73.47%
	Bank branch infrastructure (Seating, Water, Toilet…)	4.12	82.38%
	Parking facility	3.61	72.28%
	Bank has good and modern equipments	4.13	82.57%
	Bank branches are located in a convenient location	4.04	80.79%
	Information of account are sent by SMS	4.42	88.32%
	Complaint solution / Grievance Redressal Cell	3.88	77.62%
	Locker facility	3.88	77.62%
	Average of Infrastructure and Instruments	4.00	79.98%

Staff Competency	Help provided by the staff in filling up the forms	4.00	80.00%
	Account open process is easy and timely	4.03	80.59%
	Passbook & statement printing	4.19	83.76%
	Cheque clearing facility	4.10	81.98%
	Demand draft facility	3.92	78.42%
	Secured bank transactions	4.38	87.52%
	Services related Information	4.28	85.54%
	Providing service within reasonable time	4.31	86.14%
	Behaviour of Bank Employees	4.50	89.90%
	Bank collects loan in a gentle manner	4.01	80.20%
	Average Staff Competency	4.17	83.41%
Financial Activities	Bank accepts all type of currency	3.96	79.21%
	Cash deposit and cash withdrawal services on bank counter	4.35	86.93%
	Service charges	3.86	77.23%
	Process of loan taken is easy and timely	4.06	81.19%
	Rate of interest on deposits is reasonable	4.05	80.99%
	Interest on loan is justified	3.61	72.28%
	Average Financial Activities	3.98	79.64%
	Average	4.06	81.22%

Source: Primary Data

Figure 1.Customer Satisfaction of Almora Urban Co-operative Bank
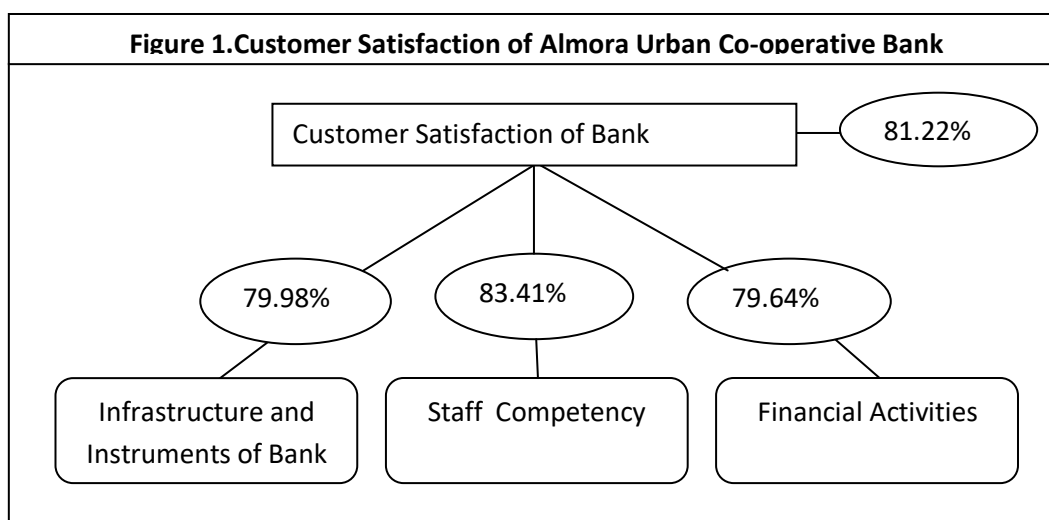
Source: Primary Data

Customer satisfaction of Almora Urban Co-operative Bank is 81.22%. It has consisted three-part of service namely "Infrastructure and Instruments of Bank", "Staff Competency" and "Financial Activities" on which customers' satisfaction levels are 79.98%, 83.41%, and 79.64% respectively. Staff competency is the most satisfactory service of Almora Urban Co-operative Bank and it has been a positive impact on overall customer satisfaction level.

Hypothesis Testing

H01: There is a moderate relationship between the customer satisfaction of Infrastructure and Instruments, Staff Competency and financial activities.

Table 3. Anova: Single Factor

SUMMARY					
Groups		*Count*	*Sum*	*Average*	*Variance*
Infrastructure and Instruments		10	39.99	3.999	0.068454
Staff Competency		10	41.72	4.172	0.036284
Financial Activities		6	23.89	3.981667	0.059977
ANOVA					
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.199405	2	0.099703	1.845551	0.180574	3.422132
Within Groups	1.242533	23	0.054023			
Total	1.441938	25				

P-value is greater than 0.05 (Alpha value 0.05<P-value 0.18); hence there is a moderate relationship between the customer satisfaction of Infrastructure and Instruments, Staff Competency and financial activities.

Conclusion and Suggestions

Customer satisfaction of Almora Urban Co-operative Bank is 81.22%. It has consisted three-part of service namely "Infrastructure and Instruments of Bank", "Staff Competency" and "Financial Activities" on which customers' satisfaction levels are 79.98%, 83.41%, and 79.64% respectively. Staff competency is the most satisfactory service of Almora Urban Co-operative Bank and it has been a positive impact on the overall customer satisfaction level.

P-value is greater than 0.05 (Alpha value 0.05<P-value 0.18); hence there is a moderate relationship between the customer satisfaction of Infrastructure and Instruments, Staff Competency and financial activities.

Almora Urban Co-operative Bank needs to improve the parking facility, interest rate on the loan, online banking services, service charge, locker facility, complaint solution/grievance Redressal cell, ATM services, demand draft facility, the bank accepts all types of currency, the help provided by the staff in filling up the forms.

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ANALYSIS OF A SYSTEM WITH TWO DISSIMILAR UNITS WITH REPLACEMENT OF SUBSTANDARD UNIT WITH CORRELATED LIFETIME

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ABSTRACT

In paper, we analyze two dissimilar units redundant system. One is of good quality and other is not of same quality. Substandard unit is either repaired or replaced by the similar one on failure. While replacing substandard unit our first unit may go to failure mode and waiting for repairing as repairman is busy replacing the substandard unit. Breakdown of system occurs if both units are in complete failure mode. Using Bivariate joint exponential distribution, failure and repair times are considered to be correlated. Analysis of system is done to find all measures of reliability. Taking time distribution of failure as exponential and general distribution of time for others, the various reliability measures are obtained which gives the effectiveness of the system. Average Time taken by System for Failure, Availability (uptime) of System, Number of Repairman's visits, Busy Period Analysis of Repair man for both partially failed unit and completely failed unit, Expected Profit obtained. The conclusions about MTSF, Availability and profit from the system are carried out by Graphical studies. Main emphasis is on correlation between repair time and failure time.

Keywords: *BVE; Correlated Lifetime; MTSF; Regenerative Point Technique; Semi Markov Process*

1. Introduction

A redundant system with two dissimilar units has been studied in reliability theory. Repair, Replacement is one of the important measures to increase the reliability of the system. Many authors have studied many systems with different repair/replacement policies.

Goel et al. [1] studied delayed replacement of a two-unit standby system. Goel et al. [3] analyzed two types of inspection and repair in three-unit redundant system. Rander et al. [2] involved in analysis of two unit system with replacement of standby unit. Taneja et al. [4] discussed the non availability of an expert in the system with an ordinary and an expert repairman. Deswal and Malik [11] studied stochastic analysis of two non-identical unit subjected to weather conditions. Gupta and Tomar [8] analyzed cost analysis of three unit system. Gupta et al. [6,7] did pioneer work on the complex system with correlated failures and repairs. Gupta et al. did great work on the concept of Replacement. Tuteja et al. [5] carried out cost analysis of a system where repair of main unit depends on subunit. Kumar [9] carried out comparison of a redundant system based on correlated lifetime. Kakkar [10] discussed the concept

of repair/replacement with appearance / disappearance of repairman with correlated lifetime. Singh and Poonia [12] used regenerative point technique to assess two unit parallel system. The aim of this paper is to study a system in which failure times correlated with repair times. The concept of correlation between failure and repair times is introduced by Goel, Gupta and other (1993) in the literature of reliability. In the analysis of models, they have assumed the joint distribution of failure and repair times as Bivariate exponential of the form suggested by Paulson 1973.

The p.d.f of the BVE is

$$f(x, y) = \alpha\beta(1 - r)e^{-(\alpha x + \beta y)}I_0(2\sqrt{\alpha\beta xy})$$

x, y, α, β > 0; 0 ≤ r < 1

Where

$$I_0(z) = \sum_0^\infty \frac{(\frac{z}{2})^j}{(j!)^2}$$

2. Assumptions

1. The system consists of two dissimilar units. Initially one unit is operative and the other is cold standby.
2. If operative unit fails, the cold standby unit (if available) becomes operative

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instantaneously, and failed unit goes under repair.

3. If a unit is under repair, it does not work for the system.
4. Each unit has an exponential distribution of time to failure while distributions of repair times are arbitrary.
5. Failure of a unit is detected immediately and perfectly repaired.
6. When both the units fail, the system is not operable.
7. When the repairman is called on to do the job, it takes a negligible time to reach the system.
8. After any repair, a unit works like a new one.
9. All the random variables are mutually independent.

3. Transition Diagram

Fig. 1 The Model

Good State   Down State   Regenerative Point
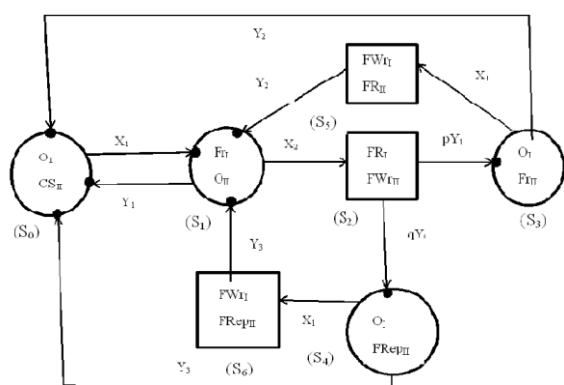
4. Notations for System States

S_0 : (O_I , CS_{II}) **:** First unit is operative and Second is cold standby

S_1 : (Fr_I, O_{II}) **:** First unit is failed, under repair and Second unit is operative

S_2 : (FR_r, FWr_{II}) First unit is failed, under repair from previous state and Second unit is failed and waiting for repair

S_3 : (O_I , Fr_{II}) **:** First unit is operative and Second is failed, under repair

S_4 : (O_I , $Frep_{II}$) **:** First unit is operative and Second is failed unit, under replacement

S_5 : (FWr_r, FR_{II}) First unit is failed, waiting for repair and Second unit is failed and under repair from previous state

S_6 : (FWr_I , $Frep_{II}$) **:** First unit is failed, waiting for repair and Second is failed unit, under replacement

5. States Description

E : Set of regenerative state $\{S_j ; j = 0,1,3,4\}$

$\bar{E}$: Set of non regenerative state $\{S_j; j = 2,5,6\}$

X_1, X_2 : Random variables representing the failure times of first unit and second unit with α_1, α_2 failure rates respectively.

Y_1, Y_2 : Random variables representing the repair times of first unit and second unit with β_1, β_2 repair rates respectively.

Y_3 : Random variable representing the replacement time of second unit .

$f_i(X,Y)$: Joint p.d.f. of (X_i, Y_i) ; i = 1, 2, 3 & $Y_2 = Y_3$

$$= \alpha_i \beta_i (1 - r_i)e^{-(\alpha_i x + \beta_i y)} I_0(2\sqrt{\alpha_i \beta_i r_i xy})$$

, $X, Y, \alpha_i, \beta_i > 0; \ 0 \le r_i < 1$

Where $I_0\left(2\sqrt{\alpha_i \beta_i r_i XY}\right)) =$

$$\sum_{j=0}^{\infty} \frac{(\alpha_i \beta_i r_i XY)^j}{(j!)^2}$$

p : probability that unit 2 is repairable on failure

q : probability that if unit 2 is not repairable on failure

P_{ij} : Transition probability from regenerative state S_i to S_j

$P_{i,j}^{(k)}$: Probability that the system transit from regenerative state S_i to S_j passing through the non-regenerative state k

μ_i : Mean sojourn time in state S_i

©/ ⓢ :Laplace Convolution / Laplace Stiejels Convolution

*/** : Laplace Transformation/Laplace Stiejels Transformation

6. Probabilities of Transition and Average Sojourn Time

Direct non conditional probabilities of transition from S_i to S_j are given as follows

$$Q_{0,1}(t) = 1 - e^{-\alpha_1(1-r_1)t} \qquad (6.1)$$

Direct conditional probabilities $Q_{ij|x}(t)$ of transition are :

$$Q_{1,0|x}(t) = \beta_1 e^{-(\alpha_1 r_1 x)} \sum_{j=0}^{\infty} \frac{(\alpha_1 \beta_1 r_1 x)^j}{(j!)^2} \int_0^t e^{-(\beta_1 + \alpha_2(1-r_2))u} u^j du$$

$$Q_{1,2|x}(t) = \beta_i e^{-(\alpha_1 r_1 x)} \sum_{j=0}^{\infty} \frac{(\alpha_1 \beta_1 r_1 x)^j}{(j!)^2} \int_0^t e^{-(\beta_1)v} v^j \left[1 - e^{-(\alpha_2(1-r_2))v}\right] dv$$

$$Q_{2,3|x} = p\beta_1 e^{-(\alpha_1 r_1 x)} \sum_{j=0}^{\infty} \frac{(\alpha_1 \beta_1 r_1 x)^j}{(j!)^2} \int_0^t e^{-(\beta_1)u} u^j du$$

$$Q_{2,4|x} = q\beta_1 e^{-(\alpha_1 r_1 x)} \sum_{j=0}^{\infty} \frac{(\alpha_1 \beta_1 r_1 x)^j}{(j!)^2} \int_0^t e^{-(\beta_1)u} u^j du$$

$$Q_{3,0|x}(t) = \beta_2 e^{-(\alpha_2 r_2 x)} \sum_{j=0}^{\infty} \frac{(\alpha_2 \beta_2 r_2 x)^j}{(j!)^2} \int_0^t e^{-(\beta_2 + \alpha_1(1-r_1))u} u^j du$$

$$Q_{3,5|x}(t) = \beta_2 e^{-(\alpha_2 r_2 x)} \sum_{j=0}^{\infty} \frac{(\alpha_2 \beta_2 r_2 x)^j}{(j!)^2} \int_0^t e^{-(\beta_2)v} v^j \left[1 - e^{-(\alpha_1(1-r_1))v}\right] dv$$

$$Q_{4,0|x}(t) = \beta_3 e^{-(\alpha_1 r_1 x)} \sum_{j=0}^{\infty} \frac{(\alpha_1 \beta_3 r_1 x)^j}{(j!)^2} \int_0^t e^{-(\beta_3 + \alpha_1(1-r_1))u} u^j du$$

$$Q_{4,6|x}(t) = \beta_3 e^{-(\alpha_1 r_1 x)} \sum_{j=0}^{\infty} \frac{(\alpha_1 \beta_3 r_1 x)^j}{(j!)^2} \int_0^t e^{-(\beta_3)v} v^j \left[1 - e^{-(\alpha_1(1-r_1))v}\right] dv$$

$$(6.2\text{-}6.9)$$

The two step conditional transition probability $Q_{i,j|x}^{(k)}(t)$ can be given as :

$$Q_{1,3|x}^{(2)}(t) = p\beta_1 e^{-(\alpha_1 r_1 x)} \sum_{j=0}^{\infty} \frac{(\alpha_1 \beta_1 r_1 x)^j}{(j!)^2} \int_0^t e^{-(\beta_1 v)} v^j \left[1 - e^{-(\alpha_2(1-r_2))v}\right] dv$$

$$Q_{1,4|x}^{(2)}(t) = q\beta_1 e^{-(\alpha_1 r_1 x)} \sum_{j=0}^{\infty} \frac{(\alpha_1 \beta_1 r_1 x)^j}{(j!)^2} \int_0^t e^{-(\beta_1 v)} v^j \left[1 - e^{-(\alpha_2(1-r_2))v}\right] dv$$

$$Q_{3,1|x}^{(5)}(t) = \beta_2 e^{-(\alpha_2 r_2 x)} \sum_{j=0}^{\infty} \frac{(\alpha_2 \beta_2 r_2 x)^j}{(j!)^2} \int_0^t e^{-(\beta_2 v)} v^j \left[1 - e^{-(\alpha_1(1-r_1))v}\right] dv$$

$$Q_{4,1|x}^{(6)}(t) = \beta_3 e^{-(\alpha_1 r_1 x)} \sum_{j=0}^{\infty} \frac{(\alpha_1 \beta_3 r_1 x)^j}{(j!)^2} \int_0^t e^{-(\beta_3 v)} v^j \left[1 - e^{-(\alpha_1(1-r_1))v}\right] dv$$

$$(6.10\text{-}6.13)$$

$Non-zero$ unconditional probabilities
$$P_{0,1} = 1$$
$$P_{1,0|x} = \beta_1' e^{-\alpha_1 r_1(1-\beta_1')x}$$
$$P_{1,2|x} = 1 - \beta_1' e^{-\alpha_1 r_1(1-\beta_1')x}$$
Where $\beta_1' = \dfrac{\beta_1}{\beta_1 + \alpha_2(1-r_2)}$

$$P_{2,3|x} = p$$
$$P_{2,4|x} = q$$
$$P_{3,0|x} = \beta_2' e^{-\alpha_2 r_2(1-\beta_2')x}$$
$$P_{3,5|x} = 1 - \beta_2' e^{-\alpha_2 r_2(1-\beta_2')x}$$
Where $\beta_2' = \dfrac{\beta_2}{\beta_2 + \alpha_1(1-r_1)}$
$$P_{4,0|x} = \beta_3' e^{-\alpha_1 r_1(1-\beta_1')x}$$
$$P_{4,6|x} = 1 - \beta_3' e^{-\alpha_1 r_1(1-\beta_1')x}$$
Where $\beta_3' = \dfrac{\beta_3}{\beta_3 + \alpha_1(1-r_1)}$

$$(6.14\text{-}6.21)$$

The 2 steps non-zero conditional probability $P_{i,j|x}^{(k)}$ is:

$$P_{1,3|x}^{(2)}(t) = p\left[1 - \beta_1' e^{-\alpha_1 r_1(1-\beta_1')x}\right]$$
$$P_{1,4|x}^{(2)}(t) = q\left[1 - \beta_1' e^{-\alpha_1 r_1(1-\beta_1')x}\right]$$
$$P_{3,1|x}^{(5)}(t) = 1 - \beta_2' e^{-\alpha_2 r_2(1-\beta_2')x}$$

$$P_{4,1|x}^{(6)}(t) = 1 - \beta_3' e^{-\alpha_1 r_1(1-\beta_1')x}$$

$$(6.22\text{-}6.25)$$

From above, unconditional probabilities with correlated coefficient:

$$P_{1,0} = \frac{\beta_1'(1 - r_1)}{1 - r_1\beta_1'}$$

$$P_{1,2} = 1 - \frac{\beta_1'(1 - r_1)}{1 - r_1\beta_1'}$$

$$P_{1,3}^{(2)} = p\left[1 - \frac{\beta_1'(1 - r_1)}{1 - r_1\beta_1'}\right]$$

$$P_{1,4}^{(2)} = q\left[1 - \frac{\beta_1'(1 - r_1)}{1 - r_1\beta_1'}\right]$$

$$P_{3,0} = \frac{\beta_2'(1 - r_2)}{1 - r_2\beta_2'}$$

$$P_{3,5} = P_{3,1}^{(5)} = 1 - \frac{\beta_2'(1 - r_2)}{1 - r_2\beta_2'}$$

$$P_{4,0} = \frac{\beta_3'(1 - r_1)}{1 - r_1\beta_3'}$$

$$P_{4,6} = P_{4,1}^{(6)} = 1 - \frac{\beta_3'(1 - r_1)}{1 - r_1\beta_3'}$$

$$(6.26\text{-}6.33)$$

From above

$$P_{0,1} = 1$$
$$P_{1,0} + P_{1,2} = 1$$
$$P_{1,0} + P_{1,3}^{(2)} + P_{1,4}^{(2)} = 1$$
$$P_{3,0} + P_{3,5} = 1$$
$$P_{3,0} + P_{3,1}^{(5)} = 1$$
$$P_{4,0} + P_{4,6} = 1$$
$$P_{4,0} + P_{4,1}^{(6)} = 1$$

Average Sojourn Time (μ_i):

$$\mu_i = \lim_{t \to \infty} \int_0^t P(t)\,[t; 0 < t < T]\,dt$$
$$\mu_0 = \frac{1}{\alpha_1(1-r_1)}$$

$$(6.34)$$

Conditional average sojourn time $\mu_{i|x}$ are as follows:

$\mu_{i|x}$

$$\mu_{1|x} = \frac{1}{\alpha_2(1 - r_2)}\left\{1 - \beta_1' e^{-\alpha_1 r_1(1-\beta_1')x}\right\}$$

$$\mu_{3|x} = \frac{1}{\alpha_1(1 - r_1)}\left\{1 - \beta_2' e^{-\alpha_2 r_2(1-\beta_2')x}\right\}$$

$$\mu_{4|x} = \frac{1}{\alpha_1(1 - r_1)}\left\{1 - \beta_3' e^{-\alpha_1 r_1(1-\beta_3')x}\right\}$$

$$(6.35\text{-}6.37)$$

Thus

$$\mu_1 = \frac{1}{\alpha_2(1-r_2)}\left\{1 - \frac{\beta_1{}'(1-r_1)}{1-r_1\beta_1{}'}\right\}$$

$$\mu_3 = \frac{1}{\alpha_1(1-r_1)}\left\{1 - \frac{\beta_2{}'(1-r_2)}{1-r_2\beta_2{}'}\right\}$$

$$\mu_4 = \frac{1}{\alpha_1(1-r_1)}\left\{1 - \frac{\beta_3{}'(1-r_1)}{1-r_1\beta_3{}'}\right\}$$

(6.38-6.40)

Non-conditional $m_{i,j}$

$$m_{0,1} = \mu_0 \qquad (6.41)$$

Conditional $m_{i,j|x}$

$$m_{1,0|x} = \int_0^\infty te^{-\alpha_1(1-r_1)t}k_1(t|x)dt$$

$$m_{1,2|x} = \int_0^\infty t\alpha_2(1-r_2)e^{-\alpha_2(1-r_2)t}\overline{K_1}(t|x)dt$$

$$m_{1,3|x}^{(2)} = p\int_0^\infty t\big(\alpha_2(1-r_2)e^{-\alpha_2(1-r_2)t}©1\big)\overline{K_1}(t|x)dt$$

$$m_{1,4|x}^{(2)} = q\int_0^\infty t\big(\alpha_2(1-r_2)e^{-\alpha_2(1-r_2)t}©1\big)\overline{K_1}(t|x)dt$$

$$m_{3,0|x} = \int_0^\infty te^{-\alpha_1(1-r_1)t}k_2(t|x)dt$$

$$m_{3,5|x} = \int_0^\infty t\alpha_1(1-r_1)e^{-\alpha_1(1-r_1)t}\overline{K_2}(t|x)dt$$

$$m_{3,1|x}^{(5)} = \int_0^\infty t\big(\alpha_1(1-r_1)e^{-\alpha_1(1-r_1)t}©1\big)\overline{K_2}(t|x)dt$$

$$m_{4,0|x} = \int_0^\infty te^{-\alpha_1(1-r_1)t}k_3(t|x)dt$$

$$m_{4,6|x} = \int_0^\infty t\alpha_1(1-r_1)e^{-\alpha_1(1-r_1)t}\overline{K_3}(t|x)dt$$

$$m_{4,1|x}^{(6)} = \int_0^\infty t\big(\alpha_1(1-r_1)e^{-\alpha_1(1-r_1)t}©1\big)\overline{K_3}(t|x)dt$$

(6.42-6.51)

Thus

$$m_{1,0|x} + m_{1,2|x} = \mu_{1|x}$$

$$m_{1,0|x} + m_{1,3|x}^{(2)} + m_{1,4|x}^{(2)} = \frac{1}{\beta_1}\{\alpha_1 r_1 x + 1\} = k_{1|x}(say)$$

$$m_{3,0|x} + m_{3,5|x} = \mu_{3|x}$$

$$m_{3,0|x} + m_{3,1|x}^{(5)} = \frac{1}{\beta_2}\{\alpha_2 r_2 x + 1\} = k_{2|x}(say)$$

$$m_{4,0|x} + m_{4,6|x} = \mu_{4|x}$$

$$m_{4,0|x} + m_{4,1|x}^{(6)} = \frac{1}{\beta_3}\{\alpha_1 r_1 x + 1\} = k_{3|x}(say)$$

(6.52-6.57)

Now we have

$$m_{1,0} + m_{1,2} = \mu_1$$

$$m_{1,0} + m_{1,3}^{(2)} + m_{1,4}^{(2)} = \frac{1}{\beta_1(1-r_1)} = K_1$$

$$m_{3,0} + m_{3,5} = \mu_3$$

$$m_{3,0} + m_{3,1}^{(5)} = \frac{1}{\beta_2(1-r_2)} = K_2$$

$$m_{4,0} + m_{4,6} = \mu_4$$

$$m_{4,0} + m_{4,1}^{(6)} = \frac{1}{\beta_3(1-r_1)} = K_3$$

7. Analysis of System Performance

Different measures of the system performance are obtained by solving above probabilities and recursive relations obtained.

Mean Time to System Failure (T_0) = N/D

Steady State Availability $(A_0) = N_1/D_1$

Busy Period Analysis of repairman $(B_0) = N_2/D_1$

Expected Number of Visits by Repairman $(V_0) = N_3/D_1$

Expected Number of Replacements $(RP_0) = N_4/D_1$

Where

$N = \mu_0 + \mu_1$

$D = 1 - P_{10}$

$N_1 = \mu_0\,[1 - p_{13}^{(2)}p_{31}^{(5)} - p_{14}^{(2)}p_{41}^{(6)}] + \mu_1 + \mu_3\,p_{13}^{(2)} + \mu_4\,p_{14}^{(2)}$

$D_1 = \mu_0\,[P_{10} + p_{13}^{(2)}p_{30} + p_{14}^{(2)}p_{40}] + K_1 + K_2\,p_{13}^{(2)} + K_3\,p_{14}^{(2)}$

$N_2 = K_1 + K_2\,p_{13}^{(2)} + K_3\,p_{14}^{(2)}$

$N_3 = P_{10}(1 - p_{13}^{(2)}p_{31}^{(5)} - p_{14}^{(2)}p_{41}^{(6)})$

$N_4 = p_{14}^{(2)}$

8. Cost-Profit Analysis

The expected profit is

$$P = C_0 A_0 - C_1 B_0 - C_2 V_0 - C_3 RP_0$$

(6.58)

Where

C_0 = Revenue per unit up time of system

C_1 = Cost per unit time for which repairman is busy

C_2 = Cost per visit by repairman

C_3 = Cost per replacement in the system

9. Numerical Study and Graphical Analysis

Graphs are plotted for MTSF, Availability and profit of the system for various different values of failure rate and repair rate. Fig. 2

shows the graph between MTSF (T_0) and failure rate (α_2) for different fixed values of repair rate (β_1) and correlation coefficient (ρ_1) The graph reveals that the MTSF decreases with increase in the values of failure rate (α_2).
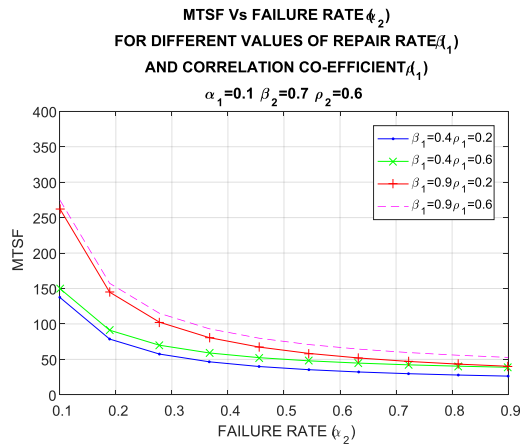

Fig. 2 MTSF versus Failure Rate

Fig. 3 shows the behaviour of MTSF w.r.t. correlation coefficient (ρ_1) for different values of correlation coefficient (ρ_2). This graph shows that MTSF increases with increase in correlation coefficient. It is higher for higher values of correlation coefficient (ρ_2).
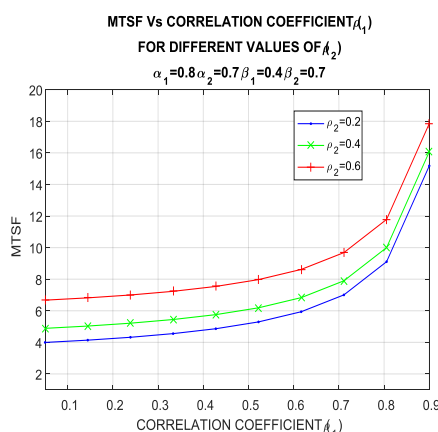
Fig. 3 MTSF versus Correlation Coefficient

Fig. 4 shows the behaviour of Availability (A_0) with respect to repair rate (β_1). It is clear from the graph that Availability (A_0) increases with increase in the values of repair rate (β_1) for different fixed values of failure rate (α_1) and is lower for higher values of correlation coefficient (ρ_1).
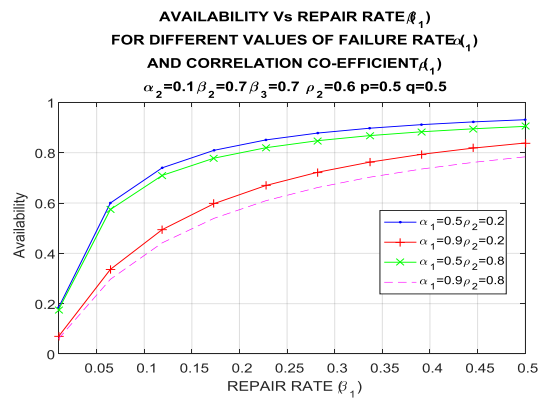

Fig. 4 Repair Rate versus Availability

Fig. 5 shows the pattern of profit w.r.t. repair rate (β_1) for different values of failure rate (α_1) and correlation co-efficient (ρ_1).The profit increases with increase in the values of repair rate (β_1). From the figure, it is clear that profit is lower for higher values of failure rate (α_1) and correlation co-efficient (ρ_1).

Thus we get following conclusions:
(i) For $\alpha_1 = 0.2$, $\rho_1 = 0.4$, P< or = or > 0 according as β_1 < or = or > 0.0752. Thus the system is profitable if $\beta_1 > 0.0752$.
(ii) For $\alpha_1 = 0.2$, $\rho_1 = 0.6$, P< or = or > 0 according as β_1 < or = or > 0.0801. Thus the system is profitable if $\beta_1 > 0.0801$.
(iii) For $\alpha_1 = 0.4$, $\rho_1 = 0.4$, P< or = or > 0 according as β_1 < or = or > 0.0894. Thus the system is profitable if $\beta_1 > 0.0894$.
(iv) For $\alpha_1 = 0.4$, $\rho_1 = 0.6$, P< or = or > 0 according as β_1 < or = or > 0.0920. Thus the system is profitable if $\beta_1 > 0.0920$.
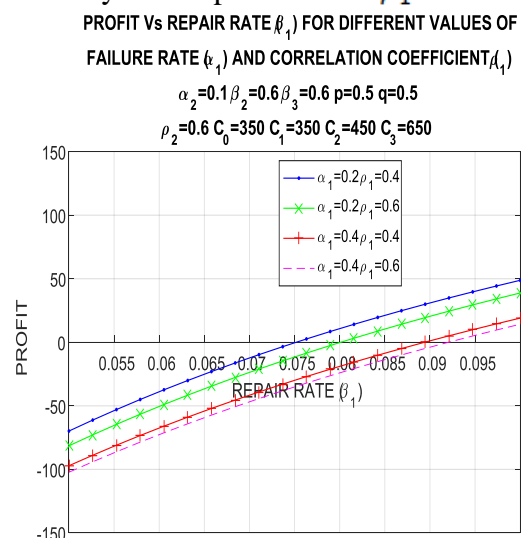
Fig. 5 Repair Rate versus Profit

Fig. 6 shows the pattern of profit P_6 w.r.t correlation co-efficient (ρ_1) for different values of correlation co-efficient (ρ_2). It is clear from the graph that profit increases with increase in values of (ρ_1) upto the $\rho_1 = 0.7067$, after this value profit get decrease and become constant at $\rho_1 = 1$.

From the figure it may be observed that

(i) For ρ_2 =0.7, the profit P is > or = or < 0 according as ρ_2 is > or = or < 0.2889. Hence the system is profitable to the company if correlation coefficient between failure and repair times is $\rho_2 > 0.2889$.

(ii) For ρ_2 =0.8, the profit P is > or = or < 0 according as ρ_2 is > or = or < 0.1890. Hence the system is profitable to the company if $\rho_2 > 0.1890$.

(iii) For ρ_2 =0.9, the profit P is > or = or < 0 according as ρ_2 is > or = or < 0.1188. Hence the system is profitable to the company if $\rho_2 > 0.1188$.
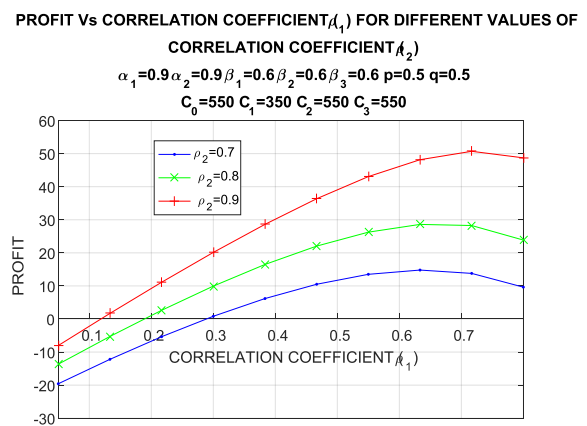

Fig. 6 Profit versus Correlation Coefficient

10. Observations and Discussion

From the analysis of graphs, it can be observed that MTSF decreases with increase in the values of failure rate and increases for higher values of correlation coefficient. Availability decreases with increase in the values of failure rate and increases with increase in repair rate. Profit decreases with increase in the values of failure rate and increases with increase in repair rate and correlation coefficient. The cut off points for the profit of the system w.r.t revenue per unit up time for cost per unit time for which repairman is busy are also obtained. This would help to decide how much be the revenue per unit up time to have positive profit from the system.

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APPLICATION OF SATELLITE IMAGERY IN VARIOUS DOMAINS: REVIEW

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ABSTRACT

In remote sensing, Satellite Image Time Series (SITS) algorithms are an important aspect for change detection in land cover to maintain ecological balance. Researchers and scientists have shown keen interest in satellite image processing to acquire all information about earth's surface and utilizing these captured facts for wide range of applications. A lot of work has been done for detecting changes of Land Use and Land Cover mapping that covers the research of applying SITS algorithms based on simple statistics to deep neural networks. Researchers have obtained optimum accuracy in algorithms for change detection. But a systematic review, will help researchers to know about the techniques developed over a decade and their contribution in various applications. This paper presents a detailed review about working of various SITS algorithms in different domains like observing deforestation and forest fires, classification of crops and monitoring crop growth from seeding to full growth, land cover distribution into different areas covering shrubs, evergreen forests, impervious area, deciduous forests etc. and how urbanisation is evolving by comparing images taken at two different times. This paper will provide a comparative study of techniques utilized in SITS algorithms with their results. It will be a stimulus for further research in this field of change detection and acts as a baseline for developing new algorithms for monitoring Land Use and Land Cover.

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Keywords: SITS algorithm, satellite imagery, urbanisation, LULC, BFAST,PCA, LSTM

I. Introduction

Satellite imagery illustrates spectral, radiometric, temporal and spatial resolution facts about the surface of the earth. With the advancement in technology for high definition images and enhanced capability of satellite images to capture the time series images has provided new prospects for detection of changes occurring in Land use and Land Cover (LULC) with more accuracy. A satellite image time series (SITS) is a collection of satellite images captured for same geographical area at different times. SITS makes use of available satellite sources to produce large series of data of two images within a short span of time interval. Detecting changes in SITS is essential for studying the land cover mapping. Tracking the changes in landscape over time using satellite imagery is most vital in remote sensing applications like evolution of urbanization, analysing deforestation, land cover classification, crop changes, monitoring of natural disasters etc. that impacts the earth's ecological system.

The availability of satellite images in a huge number obtained using numerous earth observation missions encourage researchers to consistently work for developing efficient SITS algorithms by utilizing high resolution images for monitoring the land cover.

There are two main techniques for detecting changes in Land Use /Land cover: Post and pre classification Comparison (PCC). In PCC, land classification is done by registering different image time series whereas pre comparison methods like difference analysis, ratio analysis and change vector analysis using spectral features intensity to avoid classification errors. Some other approaches of land classification are Maximum likelihood classification (MLC), Random Forests, classification and regression trees (CART) and Support vector Machines, (Hu *et al.*, 2018). This study reviews the work carried out by different researchers to detect change in land cover using numerous Satellite Image Time Series (SITS) algorithms utilizing Vegetation Index, Principal component Analysis (PCA), Breaks for Additive Season and Trend (BFAST), Long Short Term Memory Network (LSTM), Machine Learning and Neural Network deep learning techniques. The main objective of this paper is to depict how SITS algorithms helps in preservation of stability of environment by analysing different ecological applications in various sections like Monitoring of deforestation, Crop Classification, Land Cover Classification and Evolution of Urbanisation.

A. Monitoring Deforestation

Monitoring of forest was consistently done by using the vegetation index which provides spectral transformation of spectral bands from satellite images. Different authors have used various vegetation index for detecting deforestation like Normalised Difference Vegetation Index (NDVI) (Rouse Jr. *et al.*, 1974), Normalised Difference Moisture Index (NDMI) (Kimes *et al*., 1981), Enhanced Vegetation index (EVI) (Liu & Huete, 1995) (Jiang *et al*., 2008) and Normalised Burn ratio (NBR) (Key & Benson, 2006). Every Vegetation index gives different results depending on climatic condition and forest type. So, selection of a particular index becomes a major challenge for monitoring deforestation. To optimise the change detection of satellite image at different time (Lu *et al*., 2017) utilised PCA on multispectral time series to overcome the challenge of using a single vegetation index for prediction. PCA is a long established orthogonal dimensional reduction approach that reduces dimensions and removes noise from multi-spectral satellite imagery (Green *et al*., 1988), (Nielsen *et al*.,

1998), (Elogne & Leuangthong, 2008), (AlNielsen, 2007).Their proposed work was applied on forests of different seasonality captured from Landsat multispectral bands of time series which utilized surface reflectance of available Terrain corrected (L1T) Thematic Mapper (TM) and Enhanced Thematic Mapper plus (ETM+) to find the projection matrix that projects an image to a new axis that gives new index SRI (Seasonality Reduced index) which reduces seasonality in time series data. MEFP is applied on SRI to monitor deforestation by observing the cumulative difference between new acquired data and historical observation under stable parameters, then threshold was applied on Gaussian Stochastic Process (Fluctuating) to detect the change. Their results showed an enhancement in accuracy with SRI than other indices in an area with strong seasonality which is depicted in Table 1 and graphically in Figure 1.

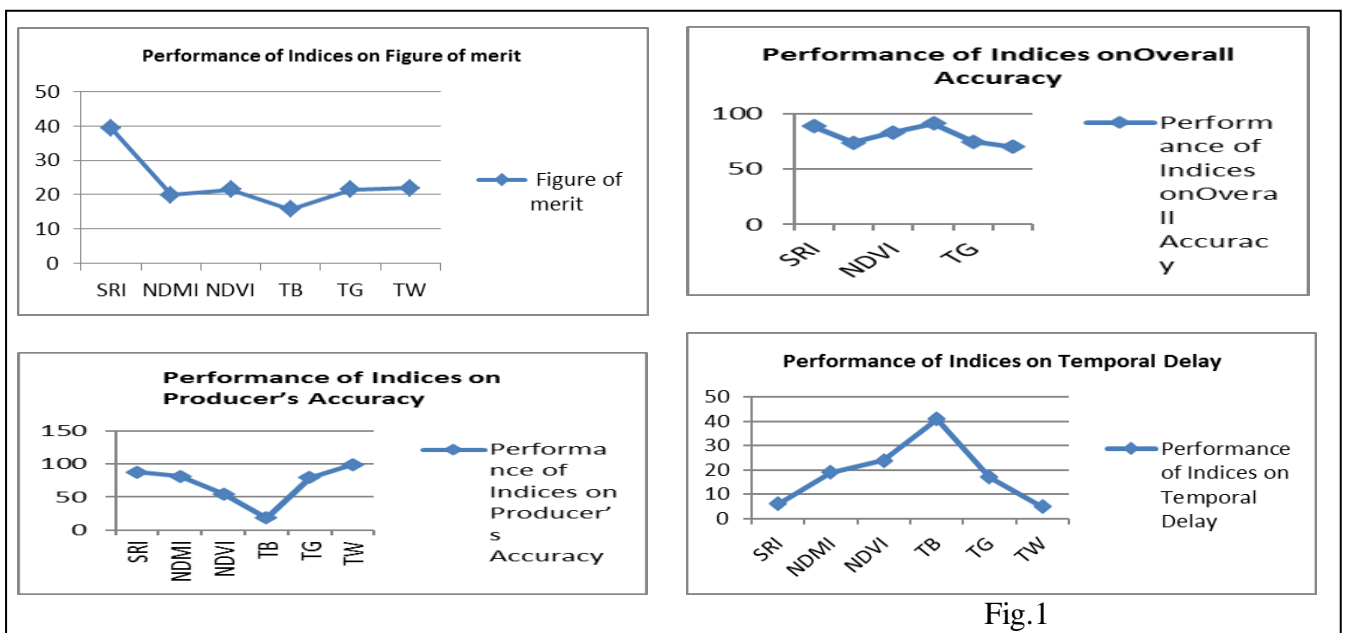| INDEX	Figure of merit	Producer's Accuracy	User's Accuracy	Overall Accuracy	Temporal Delay
SRI	39.4	87.5	41.8	88.6	6
NDMI	19.9	81.3	20.8	73.8	19
NDVI	21.5	54.6	26.2	83	24
TB	15.8	18.4	52.8	91.1	41
TG	21.5	79.6	22.7	74.9	17
TW	22	99	22	70.3	5

Table I

Fig.1

(Grogan *et al.*, 2016) implemented BFAST algorithm on filtered MODIS time series with three indices: NDVI (Normalized Difference Vegetation Index), EVI (Enhanced Vegetation Index) with LSWI (Land Surface Water Index) which acted as base for analysis by extracting three predictor variables for forest clearing pixel by pixel from BFAST algorithm: trend break magnitude (bmag), seasonal amplitude difference (sdiff) and negative slope between each two segments. For training and validating the model, Landsat based forest clearing map designed by (Grogan *et al*., 2015) was used and Random forest (Breiman, 2001) applied to classify each MODIS pixels on the random sample of 150 pixels from each class of evergreen forest, mixed deciduous forest, dry deciduous forest and a combined planted

forest class respectively and it was labelled manually by using a combination of Landsat and high resolution imagery taken from Google earth. Function of three predictor variables was modelled for binary responses to segregate the change and stable forest and to depict a non-linear relationship between response and Kennedy predicted values shown a non-parametric statistical model MARS (Multivariate Adaptive Regression Splines) was used. Their study indicated that area under curve (AUC) estimations for different regression models using combination of break magnitude, trend and seasonal components along with forest type gives better forest clearance detection than using single parameter only represented in Table II and graphically in figure 2. (Grogan et al., 2016).

Variables	Evergreen Forest	Mixed Forest	Deciduous Forest	Planted and Regrowth
bmag + sdiff + slp	0.98	0.96	0.89	0.92
bmag + slp	0.97	0.96	0.89	0.92
bmag + sdiff	0.96	0.94	0.79	0.87
Bmag	0.93	0.90	0.78	0.83
Sdiff	0.94	0.86	0.61	0.72
Slp	0.79	0.70	0.68	0.74

Table II

To have more accurate change detection (Lin *et al*., 2019) designed an algorithm for detection of spatial temporal-spectral change to distinguish original land cover and false detections. For achieving the same, after eliminating the noise by applying CF mask the

time series was decomposed into Seasonal component (S_t) and Trend component (T_t) by defining breakpoints in seasonal component using the equation 1 Y_t observed data, and e_t remainder component, variation in data.
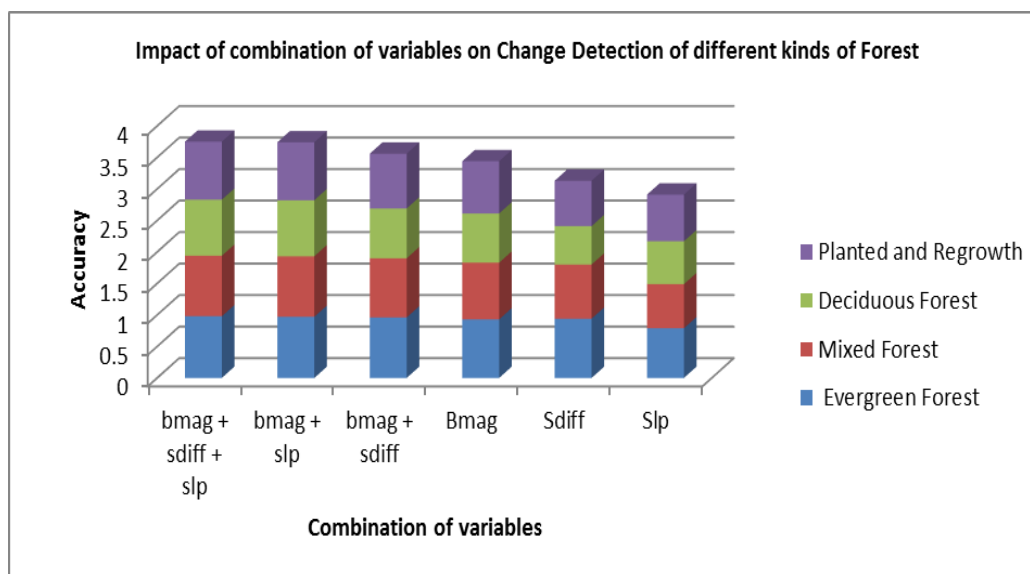

Fig.2

Random forest classifier worked on breakpoint positions to indicate different landcover types.

$$Y_t = T_t + S_t + e_t \quad (t = 1, 2, \ldots, n) \qquad ---- (1)$$

To validate the accuracy of above stated algorithm, a random sample of 2000 images (1000 changed and 1000 non-changed data) from Google earth images random sample were tested and gave overall accuracy of 88.16% which is much higher than BFAST algorithm with the accuracy of 56.48%. So, the spatial temporal spectral change detection algorithm gave better results by reducing false detection while sustaining low omission errors.

Kong *et al*. (Kong *et al*., 2018) proposed a framework for detecting online disturbances in satellite image time series (SITS). The framework was based on long short term memory network (LSTM) algorithm which involved training prediction and detection. System was trained by historical SITS to predict new data set of time series, then predicted data was compared with real data to calculate deviation means disturbance. Proposed Algorithm was implemented on forest fire data in each time series which is generated using MODIS (Moderate Resolution Imaging Spectroradiometer land product. It used Global environment monitoring index for calculating the change detection in geographical/ spatial area pixel by pixel using thresholding. It stated that LSTM with multiple steps performed better than LSTM with one step and BFAST algorithm thus it can be applied to any real time application of analysing remote sensing data at different times.

Yin *et al.* (Yin *et al.*, 2014) combined machine learning and SITS algorithm to analyse land use and land cover changes (LULCC) yearly. This trajectory-based detection approach applied on MODIS time series data of Inner Mongolia located in china by using MODIS Tera vegetation Index (VI) that includes NDVI, EVI, surface reflectance in the blue, red near Infrared (NIR), Mid Infrared (MIR) wavelength and pixel quality data. To predict land cover class probabilities, Random forest classifier was trained on Chinese Academy of Sciences land use/ land cover change dataset (Jiyuan *et al*., 2002) obtained from Landsat TM and CBERS-1 (China-Brazil Earth Resources Satellite-1) and Google imagery of inner Mongolia. Out of predicted land cover probabilities, MODTrendr (Sulla-Menashe *et al*., 2014) algorithm was applied on five land cover probabilities for detecting and describing changes in each pixel class probability over time. To evaluate accuracy of algorithm a disproportionate stratified estimator at pixel level was applied that resulted in overall accuracy of 92% for detecting change in time series.

B. Crop Classification

Jayanth *et al*. (Jayanth *et al.*, 2020) performed crop type classification of satellite images using Deep learning neural network. Image is captured using Landsat satellite and utilized both multispectral and multi-temporal image to optimise the classification. Deep learning neural network consists of 4 layers, 3 hidden and 1 output layer, transfer function introduces radiometric features for classification and rectified linear activation function provides stability in performance of classification based on features. Their system using RLU improved classification about 5 to 15% as compared to support vector machines that can classify crops up to 85% accurately.

Rashmi & Hemantha (Rashmi & Hemantha Kumar, 2020) applied multithreading technique to perform clustering of multiplane and multispectral satellite images having high resolution orthoimagery and Landsat MSS datasets in parallel processing environment. For parallel computation of datasets for clustering is demonstrated by assigning tasks to each thread individually in cores of processor in conventional system using GPU. The proposed system of parallel k-means clustering is implemented using Matlab2017@ environment on three different datasets- NAIP (NATIONAL AGRICULTURE IMAGERY PROGRAM), orthoimagery and Landsat1-4. This parallel approach reduced latency in comparison to serial k-means clustering. This technique can also be applied on hyperspectral satellite images using Graphical processing units.

Ananthi (Ananthi, 2020) developed an algorithm to monitor crops and plants from their initial to full growth stage for detecting deficiency of nutrients in crops by applying segmentation on fused images.

Tan *et al*. (Tan *et al*., 2011) come up with a technique of blending two techniques entropy decomposition and support Vector Machine to optimise the accuracy in classification of crops. Comparison is performed using NN, SVM, EDNN and EDSVM on multi-polarization images. Feed forward Neural network is implemented using ENVI software, both NN and SVM takes diagonal elements of coherency matrix as features to classify images, whereas EDNN and EDSVM is implemented using MATLAB in which raw data is converted to coherency matrix to compute H and σ for each pixel using ED, H and σ are feature vectors for image classification. The performance with window size 9 for each technique is depicted below in Table III.

Name of the Technique	Accuracy (%)
NN	70.82%
SVM	76.70%
EDNN	91.06%
EDSVM	97.52%

Table III

3. Land cover classification

Kalinicheva *et al*. (Kalinicheva *et al*., 2020) presented an unsupervised framework which can achieve both change detection and clustering of SITS that too independant of temporal resolution and its representation in the form of evolution graphs. Proposed SITS algorithm analyse spatiotemporal entities and perform clustering according to three type of temporal behaviours- area with no change, seasonal change and non-trivial changes. Instead of multi-temporal methods they applied bi-temporal change detection algorithm on whole Satellite images with the base of joint AE, the network is trained in unsupervised way with same input and output. Both, Convolution AE and Fully convolution AE was used for detecting change, feature extraction and reducing dimensions. For erecting an evolution graph, image segmentation is done using a graph-based algorithm for merging tree segments (Felzenszwalb & Huttenlocher, 2004) which produces large segments without merging, with a combination of graph and data mining techniques (Khiali *et al.*, 2019), (Guttler *et al*., 2017) for construction. In comparison to LSTM, more efficient

hierarchical clustering with gated recurrent units auto encoders were applied on two different SPOT-5 and sentinel-2 time series data to obtain clusters. Its performance is compared with hierarchical agglomerative clustering with DTW (Rakthanmanon *et al*., 2013), a distance measure and showed that GRU auto encoder gives better results for small number of classes.

Guidici & Clark (Guidici & Clark, 2017) designed 1-D convolutional neural network for land cover classification and carried out his research on hyperpsectral imagery of San Farnsisco Bay area in California taken by NASA's Airborne Visible Infrared Imaging spectrometer (AVIRIS) Sensor for producing the dataset. System was trained with the help of Google earth imagery covering 12 land cover components- evergreen needle leaf trees (ENT); evergreen broadleaf trees (EBT); deciduous broadleaf trees (DBT); shrubs; herbaceous; dune vegetation; tidal marsh; annual crops; perennial crops; impervious surfaces; urban landscape; and, barren lands. For critical analysis of developed system two famous machine learning algorithms RF and SVM was trained on same dataset and land classification results were compared which proved that CNN's classifier performance for classification into single season or three seasons (Spring, Summer and fall) is shown in Table IV with average producer's accuracy of 76.7% and average user accuracy of 80% was superior as compared to the two approaches depicted in the figure 4 to classify all land cover components using CNN and SVM.

	CNN	SVM	RF
Single Season	88.0(0.86)	87.5(0.86)	78.7(0.75)
Three Season	89.9(0.88)	89.5(0.88)	82.2(0.80)

Table IV

To take the full advantage of CNN Kim *et al*. (Kim *et al.*, 2018) used a 2-D spectral curve of multi-temporal satellite imagery as an input to classification of land cover types. They implemented their approach on two different sites-one is concord site images were captured with the help of Landsat-8 operational land Imager and other one is Korean site images taken were using Geostationary Ocean Color

Image (GOCI). To train the CNN classifier 80% of the Google Earth imagesand Land cover reference images for Concord and Korean site respectively and rest 20% for testing. The converted 2-D spectral curve of multi-temporal pixel values were fed as an input
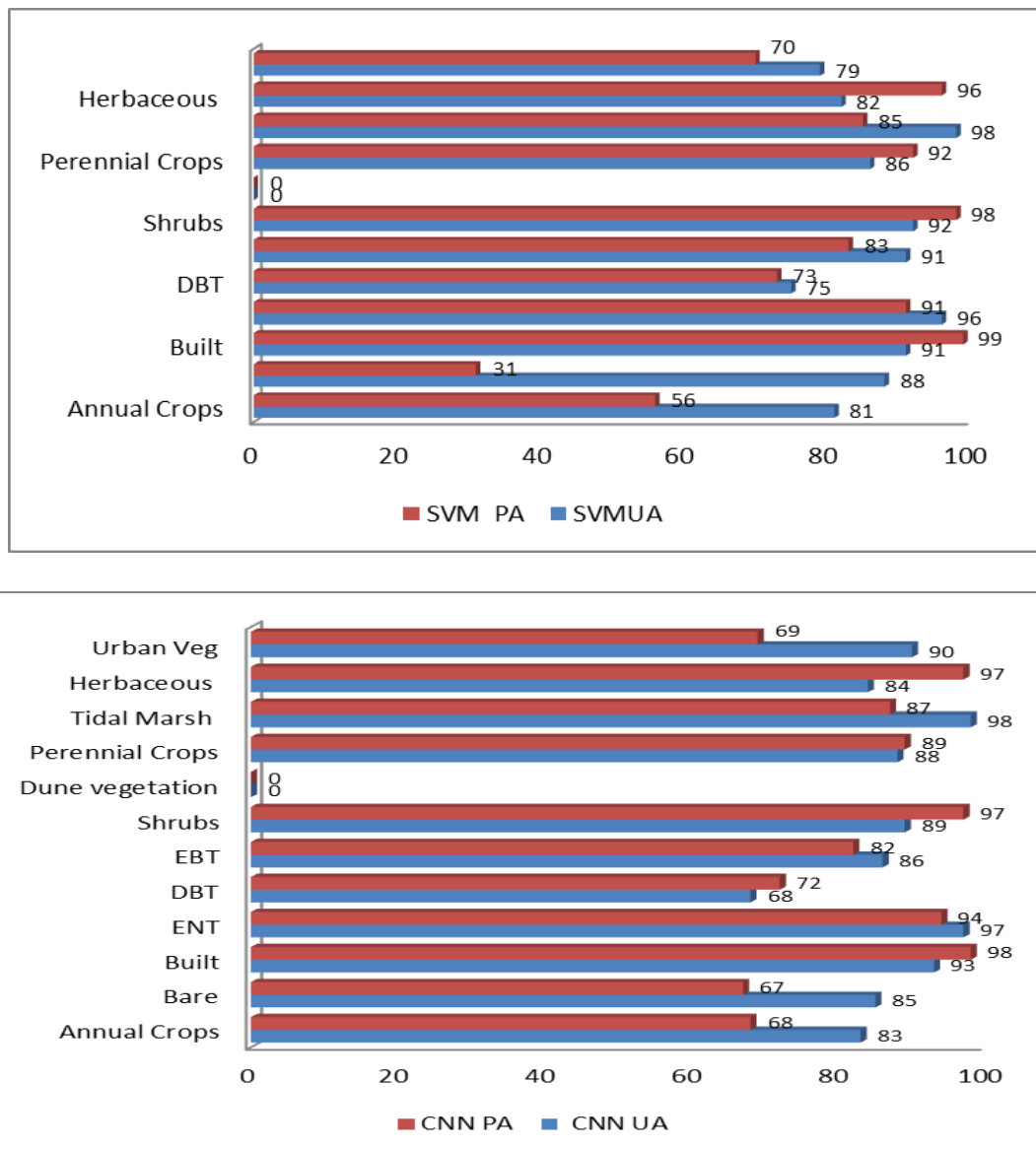

Fig. 4

which represents spectral curve of images extracted from each pixel and comprises of values of image pixels in bands to the CNN's by using Rectified Linear Unit (Relu) as an activation function for classification of Land types into ten and nine classes of Concord and Korean site respectively. This CNN based land cover classification approach gave better results when compared to traditional Remote Sensing classification approaches in Machine Learning-RF and SVM's which can be seen in below figure 5 and figure 6 for Korean and Concord site with its classes respectively.

D. Evolution of Urbanisation

The major reason of changes occurring in landscape is evolving of urbanisation changes made
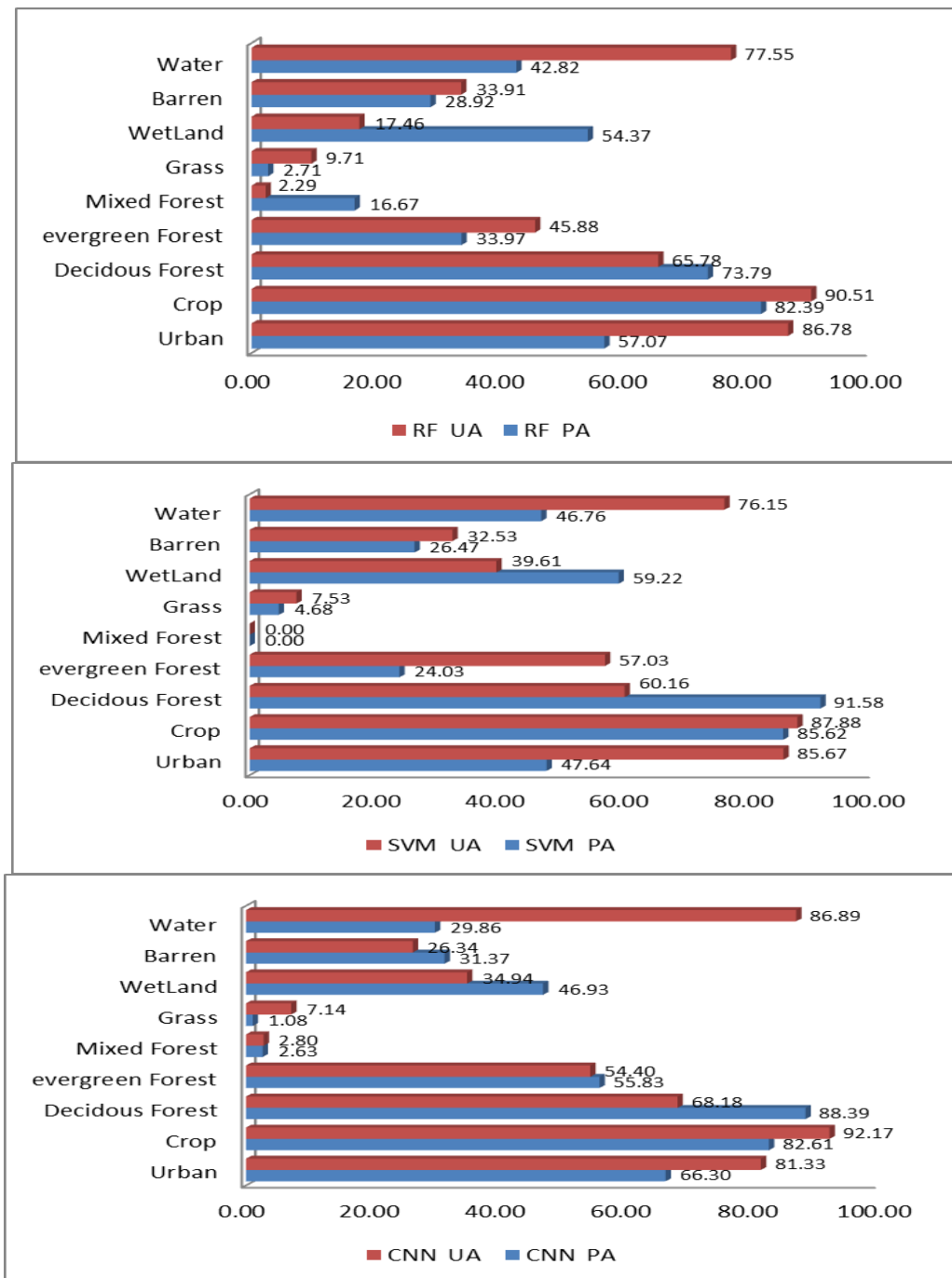
Fig.5 Korean site

by it are irreversible and long lasting. Various researchers conducted research in different areasof world to detect these unpredictable changes using satellite imagery time series. Mulla *et al*. (Garouani *et al*., 2017) applied most traditional approach of maximum likelihood supervised classification on the Fez city of Morocco to depict the relationship between the increase in urbanisation and changes occurring in land use. To perform the analytical study they considered datasets of 2 seasons- spring and summer, satellite images captured using Landsat TM, Operational Land Image Thermal Infrared sensor(OLI_TIRS) and Google Earth images for year 1984 and 2013 respectively including images obtained from United States Geological Survey (USGS), multi-temporal
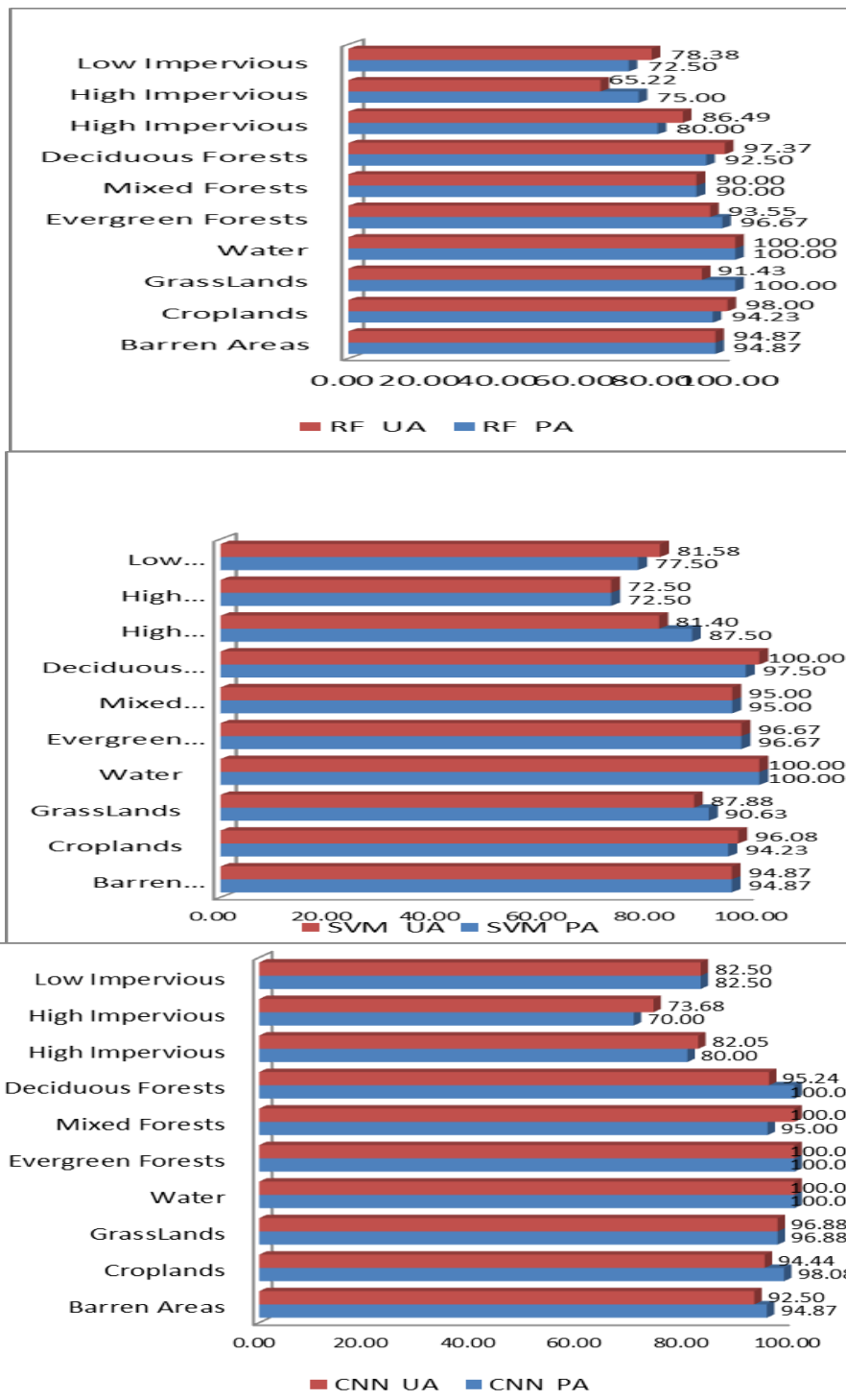
Fig.6 Concord Site

and topographic data. These images were pre-processed using software and digitized for geometric correction to obtain Vegetation Soil Water (VSW) index using scatter plot of Red band and near infrared band to analyse a feature set of grouped pixels to discriminate vegetation, soil and water elements which is a key for detecting urban areas. Maximum Likelihood was applied on Landsat bands and VSW index for analysing the changes in spatial and temporal factors involved in land use and land cover. To improve the accuracy of classifier error matrices was applied to give up to 87 % user's (Field) class and 78.5% producer's class accurate results which showed there is a great change in land use pattern with respect to growing population.

To automate the detection of changes in land cover Hu *et al*. (Hu *et al*., 2018) utilized Classification and Regression Tree (CART), a supervised post classification method, use of Change Vector analysis in posteriori

probability space (CVAPS) algorithm and time series of a surface biophysical parameter (NDVI) played an important role in detecting changes in western CHINA with the help of Google Earth Engine. Initially CART was applied on randomly selected training point for primary land classification, then histogram entropy method (KSW) threshold adapted for both satellite images taken over different periods of time and NDVI time series data to extract changes occurred on land with respect to time. Spatial intersection method selects the optimum of two changes detected above. Depending on the land type and training points ratio (ϕ) is calculated for number of samples within the same land type, a threshold was applied on ϕ finding the reliable training points for land classification. Their new blend of CART,CVAPS and NDVI time-series analysis with GEE cloud computing compared with CART-CVAPS and analysed that it requires less time for updating land maps, in terms of accuracy either in classification or change detection CART-CVAPS-NDVI was 4 to 5 times higher in comparison to CART-CVPAS method without NDVI temporal analysis and suggested that for more efficient and accurate change detection algorithms Landsat TM, ETM+ and OLI images can be used.

Statistical measures always play an important role in computer vision for image analysis, Sparavigna (Sparavigna, 2016) utilized these statistical measures to evaluate the urbanisation in different areas of England using satellite and aerial images. To evaluate the urbanisation, he considered grayscale images instead of full color RGB image, grayscale image is divided into squares of PxP to calculate average brightness, standard deviation and ratio of standard deviation to mean, and largest value among ratio is used to define a colour tones. Depending upon the small and large deviation, 2 colour tones are defined bright and dark representing houses/streets and agriculture field respectively. In this way the input image is processed to give maps for applying texture transition to discriminate urban from rural areas using histograms showing transitions from unimodal to bimodal histograms. This statistical approach gave a quantitative measures of comparison as compared to results of simple pixilation software GNU Image Program (GIMP).

Blend of advance statistics and deep neural network can predict urbanisation in more efficient manner. Ahn (Ahn, n.d.) used CNN model trained using the concept of transfer learning, a technique that focus on knowledge obtained at the time of solving one problem and using it on different yet related. For training the model, all daytime satellite images of different regions were captured periodically and a customised dataset made by four human annotators for south Korean site. The model adopted mean and standard deviation for utilizing all satellite images and projected high dimensional data to a lower dimensions to embed vector by feature extractor and predicted whether image belong to rural, urban or forests. This combination of statistics and deep learning made a model lightweight and fast in prediction of urbanisation and can be used by developing countries to solve the problems to attain Sustainable development Goals.

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SENTIMENT ANALYSIS OF SOCIAL MEDIA DATA USING LEXICON-BASED TECHNIQUES

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ABSTRACT

Online Social Networks (OSNs) have created a new platform for information exchange. Huge amount of information in the form of texts, videos and images has been accumulated on web and this information is continuously increasing day-by-day. Anyone can share his/her views, experiences, ideas, comments and suggestions on OSNs. By extracting and analysing this information, decision making process can be facilitated to a great extent but manual extraction and analysis of such information is not a feasible solution. Also, information is available in unstructured format. Most of the content is available in natural language, so Natural Language Processing techniques are required. Hence, automated extraction, conversion in structured format and analysis of such information is required. Automated extraction and analysis of this accumulated information is a very challenging task. It has opened a new research area which is termed as Opinion Mining or Sentiment Analysis. Sentiment Analysis is the process of identifying sentiments in social media data. This paper focuses on the concept of sentiment analysis andits techniques especially lexicon-based approach.

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Keywords: NLP (Natural Language Processing), Sentiment Analysis, Machine Learning Techniques, Lexicon-Based Techniques, Corpus, Polarity, Sentiment Score

Introduction

Huge amount of data is being generated at a very fast speed via social media platforms, reports, reviews, customer's feedbacks etc. This high velocity of data stream and analysis of such data is very difficult to handle. There is a need of new kind of algorithms which can deal with high velocity and high volume of streaming data. With the increasing use of social media (like Facebook and Twitter), this user-generated content is being generated very rapidly as people share professional/personal activities on these media.[1]Hence, struggle of handling these huge datasets is also increasing at exponential rates. Also, most of the data is in unstructured format (for example: interpersonal communications such as chats, e-mails, social media conversations, surveys and many more). Hence, it becomes very difficult to analyse such data for detecting sentiments in a timely manner. Sentiment analysis is used for analysing such data.

Sentiment Analysis is the process of finding patterns in the data and polarity (positive, negative or neutral) of data i.e. identifying sentiments in the data generated via social media platforms. Sentiment analysis is also termed as opinion mining and subjectivity analysis.Sentiment analysis comes under the domain of Natural Language Processing (NLP) for automatic extraction, classification and summarization of sentiments. Sentiment Analysis uses Natural Language Processing (NLP) to identify whether the given data is positive, negative or neutral. Real-time sentiment analysis can detect malicious users immediately so that corrective action can be taken timely. Mainly three elements are used in sentiment analysis: object features, opinion and opinion orientation. For example, car is an object then engine type, model, colour are its features/attributes. Feature extraction process generates lexicons which are further processed for finding the polarity.[2]

Sentiment Analysis is a process of extracting the semantics for determining the attitude/reaction (either positive, negative or neutral) of a speaker. [3]Sentiment analysis can be categorized into three groups:**Rule-based** (these systems perform sentiment analysis automatically based on a set of manually crafted rules), **Automatic (**these systems usually depend on machine learning algorithms to learn from data) and **Hybrid** (these systems combine both rule-based and automatic approaches).Sentiment analysis is the process

of analysing the opinions, feelings and semantic orientation of the writer to calculate the polarity (positive, negative or neutral). [4]Sentiment analysis focuses on identifying polarity (positive, negative and neutral), feelings, emotions (happy, sad, frustration and angry), urgency, intentions (interested and not interested) etc.Polarity precision can be determined either by using complex machine learning algorithms (Supervised Learning) or lexicons - a list of words along with the emotions that these words convey (Unsupervised Learning). Sometimes, hybrid (a combination of above mentioned) techniques are used for determining the valuable information out of the given data.
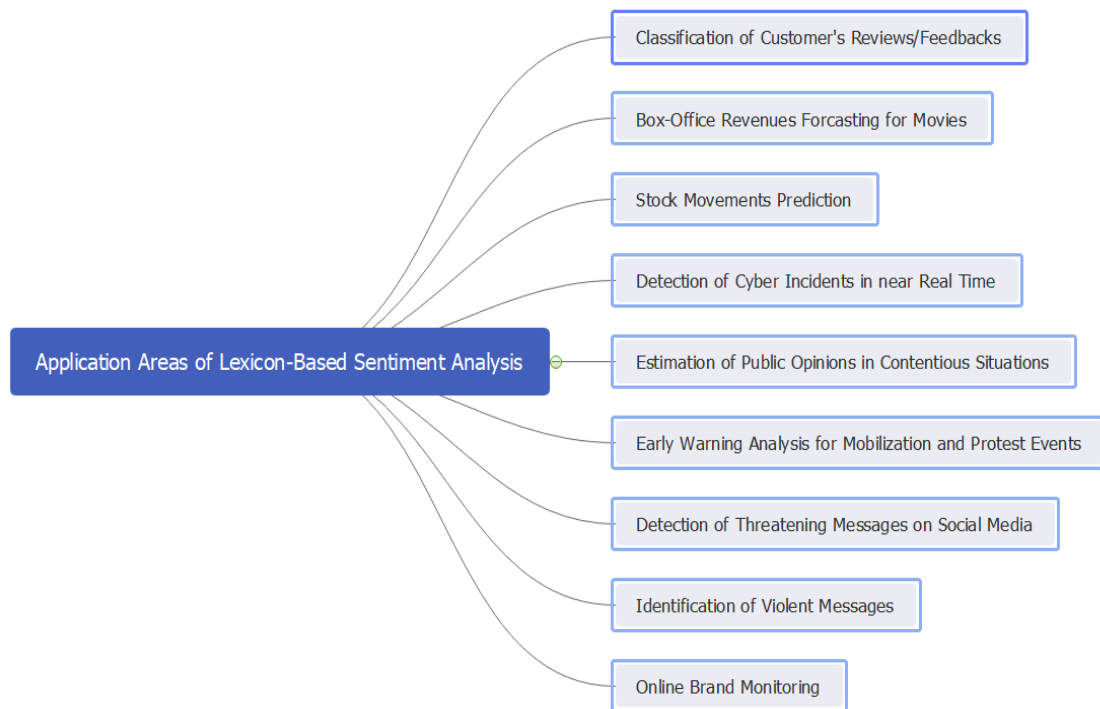
Applications of Sentiment Analysis

Social media provide a convenient platform for sharing the messages and people of all ages use these media. Also, the content of social mediais of interest for the organizations and law agencies. Hence, analysis of such data is required because organizations and law agencies are utilising social media data for customer support activities and investigation purposes respectively. Social media is used for both purposes, for collecting crime related information and anticipating crime activities. Also, sentiments related to events that are planned in the future indicate the public attitude towards such events and are very useful in calculating the level of disruption that may happen during the events.Customerscan check the opinions of other customers before purchasing any product online. Also, manufacturers or producers can estimate the strengths and weaknesses of their products on the basis of sentiments of customers.Detailed analysis is required to derive meaning out of this data as opinions are central for almost all personal and professional activities and are key influencers of behaviours that can help in decision making process not only for individuals but also for organizations.[5]In addition to this, following are the application areas of Supervised, Semi-Supervised, Unsupervised Machine-Learning Based and Lexicon-Based Sentiment Analysis:
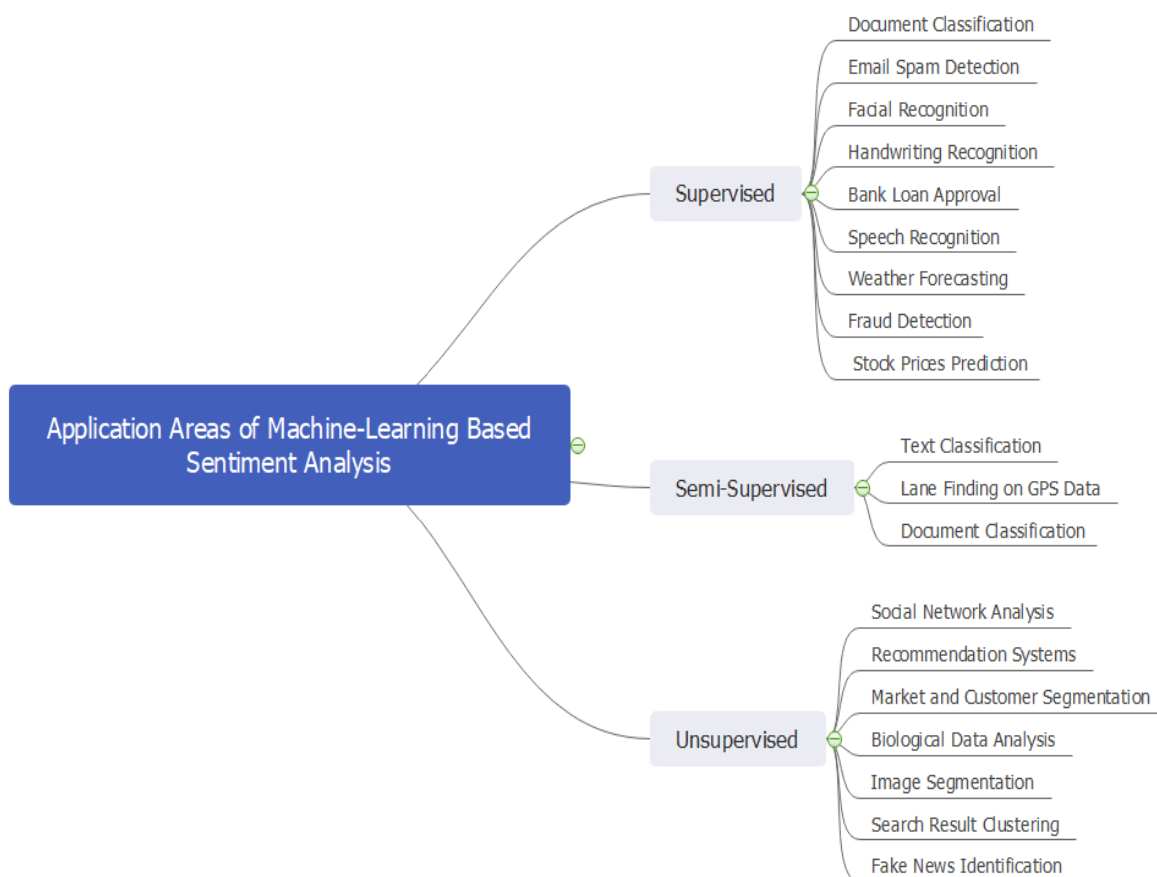
Fig 1: Application Areas of Machine-Learning Based Sentiment Analysis [6] [7]

Fig 2: Application Areas of Lexicon-Based Sentiment Analysis [5] [8]

Levels of Sentiment Analysis

There are three levels of sentiment analysis: Document Level, Sentence Level and Aspect-based Level

Document Level:

In document level sentiment analysis, sentiments/emotions/opinions of an entire document are analysed. At this level, sentiments of the whole document are taken into consideration to know the overall theme of the document/report. Positive and negative sentiments of the whole document are analysed as a general assessment. At the end, it is estimated that whole document is either positive or negative. Application areas of document level sentiment analysis are analysis of client satisfaction, analysis of patients, mental and social examinations by applying casual associations. This level of sentiment analysis is used for extracting the overall sentiment of a document. This level assumes that the given document is usually about a single topic/entity/service/product.[9]

Sentence Level:

In this level, sentiments of an entire sentence are extracted to determine whether the sentence is positive, negative or neutral. This technique is used for tweets, Facebook posts, in case when user has given reviews/comments in one sentence and short messages.[10]

Aspect-based (or Feature-based) Level:

In this level, classification is based on the aspects/features. This technique is used when the sentiments about certain features in reviews of customers are required. In aspect-based technique, aspects are the features or attributes of the products (like user's experience related to a new product, response time of query handling, ease of maintenance, ease of integration etc.) that is being talked about. For example, detailed analysis of feedbacks of customers for facilitating the decision-making process so that companies create product and services to meet the needs of customers. Feature-based sentiment analysis helps companies in automated sorting and analysis of feedbacks of customers. Manual sorting and analysis of such massive amounts of data is very difficult and time-consuming process. Aspect-based sentiment analysis determines sentiments from the reviews to help customers in making better decisions while selecting and buying products. Aspect level is the opinion mining and summarization based on features. The classification is done by identifying and extracting product features from the source

data. This level is used when sentiments about desired aspect/feature in a review are needed.[7] [11]

Techniques of Sentiment Analysis

Various techniques can be used for performing sentiment analysis, out of which Machine-learning and lexicon-based techniques are mostly used. Sometimes, in order to improve the overall performance combination of these techniques (hybrid) is used. Hence, techniques of Sentiment Analysis can be categorized as:Machine-Learning Techniques, Lexicon-based Techniques and Hybrid Techniques.
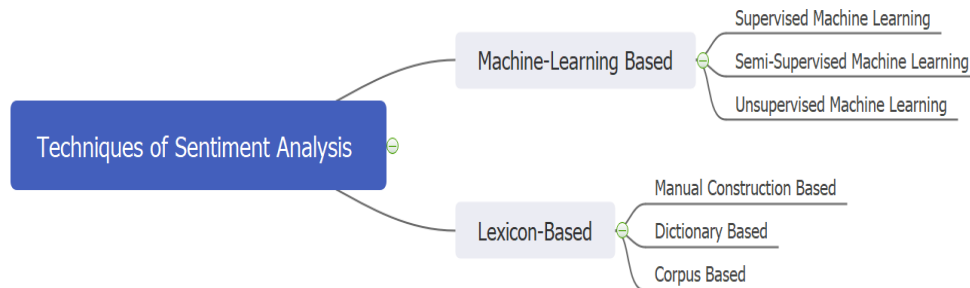
Fig 3: Techniques of Sentiment Analysis

Machine-Learning Based Techniques

Machine-learning based sentiment analysis can be performed by supervised as well as unsupervised machine learning techniques but mostly supervised machine learning is preferred for sentiment analysis. Machine-Learning is of three types: Supervised Machine-Learning, Semi-Supervised Learning and Unsupervised Machine-Learning.

Supervised Machine Learning:
Supervised learning techniques work on labelled data. In supervised learning, two stages are there.First stage: In first stage, inputs as well as the corresponding outputs are provided to train the model. This collection of inputs and corresponding outputs is termed as "Training Set".Second stage: Once the training is completed, model is tested with a new set of data which is termed as "Test Set".A suitable algorithm (classifier such as SVM (Support Vector Machine), Naïve Bayes, Random Forest, Decision Trees etc.) is used for identifying the input of given test set, mapping it to a specific class and predicting the output.

For example, if we want to design a model for identifying the images of vegetables using Supervised Learning then we will provide input and corresponding output to train the model by different labels such as shape, size, colour and taste of each vegetable (Training Set) then the model is applied to new data set (Test Set) to check its accuracy. By using suitable algorithm or classifier, model predicts the output that is identification of vegetable.

In supervised learning, classifier compares the given data with already tagged data (data that has been tagged with the correct answers in the training stage) for determining the output. Classification and Regression algorithms are used in supervised machine learning.[2]

One major limitation of supervised machine learning is that lots of efforts are required for creating training samples. Providing correct output for each and every input is a very time-consuming task. For example: Tagging 1,00,000 tweets/posts with the correct sentiment (positive, negative or neutral) requires a group of persons for reading and tagging each tweet. Hence, collection of quality tagged training data is a great challenge in supervised machine learning algorithms.

Semi-Supervised Learning:
Semi-Supervised learning techniques are applied for problems in which only some of the data is labelled out of the large amount of input dataset.Semi-supervised machine learning techniques are used in order to counter the disadvantages of supervised and unsupervised machine learning techniques. In this, algorithms are trained for both labelled as well as unlabelled data. Firstly, out of the given data, similar data is clustered by using unsupervised learning techniques and then

labelled data is used for labelling the rest of the unlabelled data. Semi-supervised algorithms assume that points which are closer to each other tend to have the same output label.[12] [13]

Unsupervised Machine Learning:
Labelling of data is very expensive and time-consuming whereas unlabelled data is cheap and easy to collect and store. Unsupervised machine learning techniques work on unlabelled data, these techniques can be used to discover and learn the structure in the input variables.In unsupervised learning, clustering and association algorithms are used. In this trained dataset is not provided rather machine analyses the similarities and differences in the given dataset and after identifying the patterns, machine classifies the given dataset into different clusters.

In unsupervised learning techniques, only input is needed there is no need to provide the desired output. In these techniques, hidden patterns and relations between the training examples are discovered. Model extracts the hidden patterns by its own from the given unknown unlabelled dataset. Unsupervised learning is considered more similar to artificial intelligence as the model learns by itself. For example, clustering algorithms are used to find similar instances based on the input. Depending on the input, similar ones are recommended.Unsupervised machine learning produces less accurate results in comparison with supervised machine learning.[14]

By applying algorithms such as Clustering, K-NN (K-Nearest Neighbor) and Apriori algorithms model will train itself by its own by dividing the items on the basis of similarities between them into different groups. Unsupervised machine learning is used for solving clustering and association problems.

Lexicon-based Techniques

Dictionary Meaning of lexicon is "Vocabulary of a language".Lexicons are the list of words with prior polarities (positive, negative or neutral). Lexicons are the key drivers for sentiment analysis process.Emotions and intentions could be detected by using lexicons (a list of words along with the emotions these words convey). Lexicon-based technique uses a predefined set of words where each word is correlated with a particular feeling/emotion and has been assigned a score. Lexicons can be created either manually or by expanding automatically from a seed of words.[15]Various Lexicons are available that can be applied directly to the unlabelled text data. Some of them areAFINN (contains 3382 words), SentiWordNet (gives positive and negative values in the range [0,1], VADER (Valence Aware Dictionary and sEntimentReasoner), TextBlob, Bing, WordNet, SentiNet, SentiStrength, ANEW (Affective Norms for English Words), General Inquirer, LabMTetc.[16]

Lexicon-based approach is based on the assumption that by calculating the polarities of individual words overall polarity can be calculated. In this technique, first of all the given sentence is tokenized and each token is matched with the words that are available in the dictionary to find out the sentiment. At the last, a function such as sum or average is used for predicting the overall context.

One of the limitations of using lexicons is that people express their opinions or emotions in different ways. They use same words in different contexts. For example, people may use "kidding" word for expressing anger as well as happiness. Like in the sentence: "What are you saying? Are you kidding me?" and "Don't take this seriously. I was just kidding.". In the first sentence, they have used the "kidding" in negative context (i.e. anger) whereas in second sentence they are using it in positive context (i.e. happiness).

Three approaches of Lexicon-Based Sentiment Analysis are Manual-Construction-Based approach, Dictionary-Based approach and Corpus-Based approach.

Manual-Construction-Based approach:
Lexicons can be generated manually by using any open-source dictionary as a baseline. Comparatively more efforts and high cost is involved in creating the lexicons manually whereas automatic methods produce noisy lexicon resources. Manual annotation requires a lot of effort, butit is not a bad approach, only one time effort is needed.Limitations of this approach can be addressed by using automated word collection methods such as dictionary-based and corpus-based.[17]

Dictionary-Based approach:

In this approach, a set of words is taken as seed, these words are then compared with online available standard dictionaries. Antonyms and synonyms are extracted from these dictionaries and added to the set of words. Dictionary-based approach is more effective than corpus-based approach.[14] [15]

Corpus-Based approach:

Corpus-Based approach is not as effective as dictionary-based approach because it is very difficult to create a huge corpus to cover all the English words. The main advantage of this approach is: it is very helpful in finding the domain and context-specific words.[15]Corpus-based approach is more complex than dictionary-based approach. In this approach, dictionaries are created with context-specific words only. For example, dictionaries having words related to teaching/feedback etc. Polarity and scores are assigned according to domain. For example, the word "fine" has different semantic orientations in different scenarios. Like in education-related scenario, the word "fine" can be used negatively (consider the sentence "Fine of rupees 500 has been imposed") and in health-related scenario, the word "fine" is used positively (consider the sentence "My health is fine now").Hence, polarity changes with respect to domains and contexts.[14]Dictionary-based method includes words with semantic orientations whereas corpus-based method includes words with and without sentiments. Both corpus and dictionary-based approaches are needed. Dictionary usually does not give domain or context dependent meanings (corpus is needed for that). In corpus-based approach, it is hard to find a very large set of opinion words (dictionary is good for that). In practice, corpus, dictionary and manual approaches all are needed.[10]

Process of Sentiment Analysis

A lot of work has been done where researchers have extracted sentiments from posts, tweets, product's reviews, movie's reviews, opinions, views, feedbacks etc. Likert scale can be used for quantitative score but for calculating/processing the responses of open-ended questions, sentiment analysis is used.Various steps are involved in the sentiment analysis process using lexicon-based technique:

Collection of Data:

Data may be structured, semi-structured or unstructured. For sentiment analysis, data needs to be collected. Social media platforms like Facebook and Twitter provide their respective APIs for facilitating the data extraction process. First of all, data which is to be analysed is collected. Data can be collected either manually (by taking feedback from parents, students or customers) or by using Graph API (in case of Facebook and Twitter),standard dataset that are freely available online (like Amazon product data, IMDB movie reviews dataset or Stanford sentiment treebank), spy & caller identification apps, penetration testing tools or web scraping tools and techniques.[18] [19]

Pre-Processing of Data:

This includes removing noisy/unwanted data. It includes tokenization (process of breaking text into a list of words), stemming (process of reducing the words into their root form for simplifying the sentiment analysis process because same word may be used in different forms for making grammatically correct sentence), case conversion (process of converting text into either uppercase or lowercase because in some cases feedback data is converted into lowercase if the words present in sentiment word database (lexicon) are in lowercase and vice versa), punctuation removal (process of erasing punctuation characters as punctuations do not provide any meaningful information), emoticon detection and stop-word removal (process of removing prepositions, articles, helping verbs etc. because stop words do not provide any meaningful information for sentiment analysis). Stop words are usually the non-semantic words like articles, prepositions, conjunctions and pronouns.Stop-words in English can be extracted by using online open sources like NLTK's list of English stop words, stop words of R-studio package etc.After removing the unnecessary words, a list or an array of sentiment words is created for every Feedback/Facebook Posts/Tweets.[20] [21] [22]

Mapping:

After cleaning of data, lexicon analysis is performed. Sentences are divided into words which are termed as lexemes. These lexemes are matched with the words of dictionaries. These dictionaries are created either manually or through automated process. These dictionaries contain positive as well as negative words.[3] Also, each word in the lexicon is assigned a value within a particular range.Sentiment dictionaries contain a list of words along with polarity (positive, negative or neutral). Several corpora have be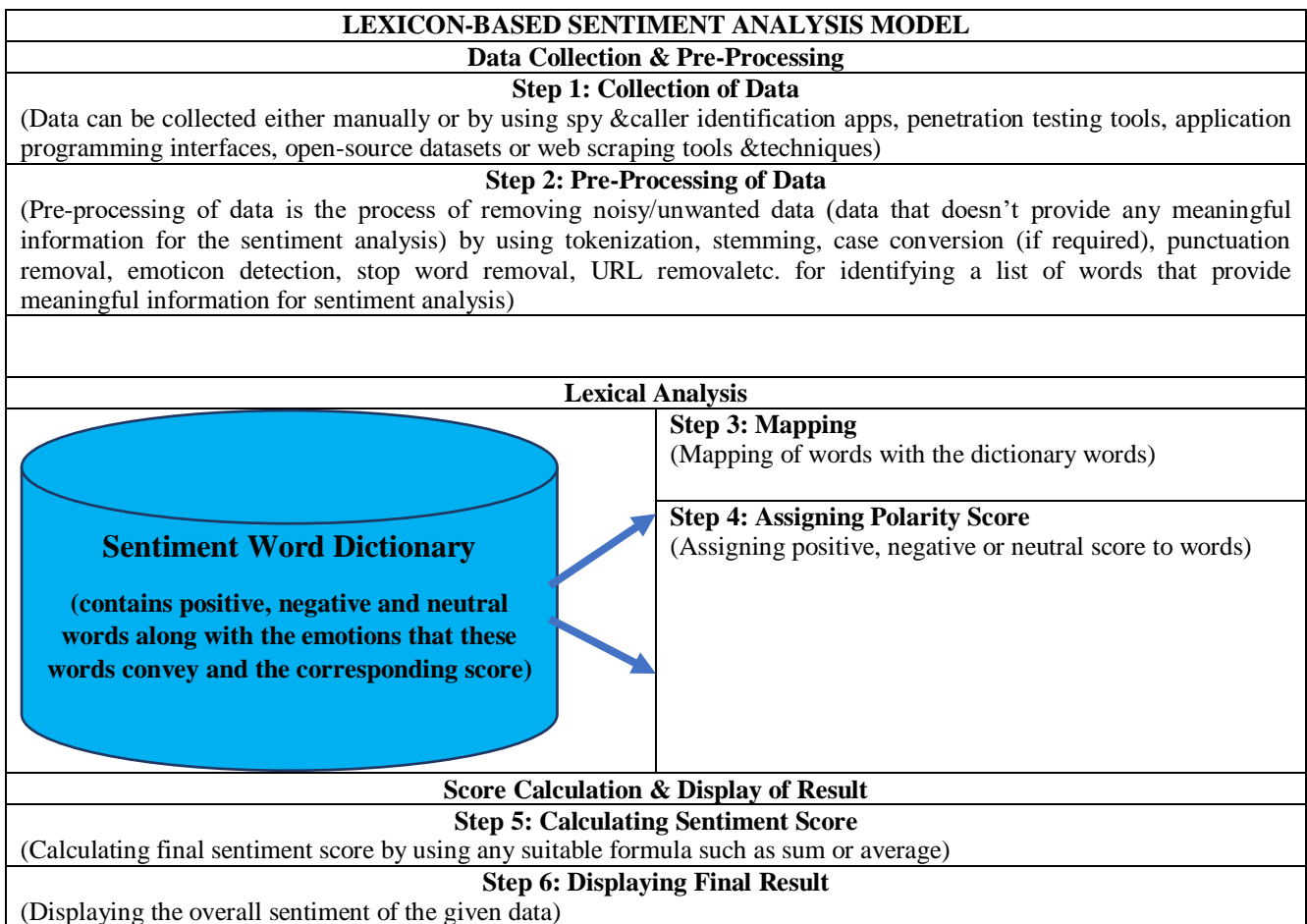en developed and made available as open-source by the researchers. For example: SentiWordNet Dictionary. Mapping is the process of assigning positive, negative or neutral tags to words on the basis of their assigned polarity in sentiment dictionary. Also, neutral words are removed as they do not contribute towards sentiment analysis.

Assigning Polarity Score:

Process of converting the polarity (positive, negative or neutral) into numerical value.

Calculating Sentiment Score:

Process of calculating the overall sentiment score by using any suitable formula such as sum or average.[23]

LEXICON-BASED SENTIMENT ANALYSIS MODEL
Data Collection & Pre-Processing
Step 1: Collection of Data
(Data can be collected either manually or by using spy &caller identification apps, penetration testing tools, application programming interfaces, open-source datasets or web scraping tools &techniques)
Step 2: Pre-Processing of Data
(Pre-processing of data is the process of removing noisy/unwanted data (data that doesn't provide any meaningful information for the sentiment analysis) by using tokenization, stemming, case conversion (if required), punctuation removal, emoticon detection, stop word removal, URL removaletc. for identifying a list of words that provide meaningful information for sentiment analysis)
Lexical Analysis

Sentiment Word Dictionary

(contains positive, negative and neutral words along with the emotions that these words convey and the corresponding score)

Step 3: Mapping
(Mapping of words with the dictionary words)

Step 4: Assigning Polarity Score
(Assigning positive, negative or neutral score to words)

Score Calculation & Display of Result
Step 5: Calculating Sentiment Score
(Calculating final sentiment score by using any suitable formula such as sum or average)
Step 6: Displaying Final Result
(Displaying the overall sentiment of the given data)

Fig 4: Model of Sentiment Analysis using Lexicon-Based Technique

Hybrid Techniques

Although supervised machine learning techniques provide better accuracy than lexicon-based techniques(dictionary-based) but without sufficient training set, supervised machine learning methods cannot perform well.[10] Hybrid technique is a combination of supervised machine learning and lexicon-based techniques. Some researchers have combined these techniques to improve the overall sentiment classification.

Comparative Analysis of Sentiment Analysis Techniques

Supervised learning techniques provide higher accuracy but accuracy depends on the training

of the model. Lots of efforts are required for creating training samples. Providing correct output for each and every input is a very time-consuming task. For example: Tagging tweets/posts with the correct sentiment (positive, negative or neutral) requires a group of persons for reading and tagging each tweet/post. Hence, collection of quality tagged training data is a great challenge in supervised machine learning techniques.[24] Also, supervised learning techniques are not able to predict the correct output if the test dataset is different than that of training dataset.

No training is required in Lexicon-based techniques but these techniques have certain disadvantages like big data handling, use of informal languages, use of abbreviations, use of slang words, use of emoticons, spelling mistakes, typo mistakes, ambiguity (people use same words for different emotions) or ambiguous sentences like "you are feeling good or bad", Hashtag based detection etc. Also, some of the words are positive in one context and negative in another context. For example, "Fine" is a negative word in the fee management system context (consider the sentence "you are required to pay the fine on time") whereas "Fine" is a positive word in the student's feedback system (consider the sentence "Teacher is good and her teaching style is fine"). Another challenge in lexicon-based approaches is the use of hybrid language (combination of Hindi and English) because resources for such languages are less in comparison with other languages.[3] In English language, various complex features (like intensifiers and mitigators) are added to the sentence. For example, intensifiers like "very" increases the sentiments of its adjacent word. Here the word "very" adds more points to the positive polarity (for example, very good). Also, mitigators like the word "few" reduces the positive polarity (for example, few support).[14]

Another disadvantage is finite number of words are there in lexicons. Fewer words in lexicon (dictionary) leads to major decrease in performance. Incorrect sentiment scoring of opinion words by the existing lexicons is also a limitation. Also, lexicons are not available for all the languages especially less resourced languages. Overall accuracy depends upon the lexical resources used. [25]

Findingsand Conclusion

Results of sentiment analysis may vary depending on the dataset provided. Also, results of supervised machine learning depend upon the training i.e. accuracy of this technique depends upon the defining rules whereas results of unsupervised learning i.e. lexicon-based technique depends upon the vocabulary/lexical resources/dictionaries. Lexicon-based techniques work effectively and efficiently in analysing social media data and is easy to understand in comparison with supervised machine learning techniques.Both supervised machine learning and unsupervised lexicon-based techniques have certain advantages and disadvantages.Machine learning techniques have the high accuracy of classification but classifier trained on the texts in one domain may not work with other domains in most of the cases. Also, efficiency and accuracy of this technique depends on the defining rules. On the other hand, lexicon-based technique does not require labelled data and also learning is not required but it needs powerful linguistic resources which are not always available.Hence, process of sentiment analysis can be improved by implementing pre-processing of given dataset and then by using a combination of supervised machine learning and unsupervised lexicon-based techniques on filtered and noise free dataset. Also, techniques like collaborative filtering along with suitable string similarity functions can be applied to improve the accuracy of the results of overall sentiment analysis process.

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ONLINE FAKE IDENTITY DETECTION: A COMPREHENSIVE SURVEY ON TWITTER

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ABSTRACT

Twitter is a large platform of OSNs(Online Social Network). A significant volume of spam has penetrated increasingly rising online social networking sites.In this paper, I focus on one of the most popular sites Twitter as an example to study the fake account/profile and spammingbehavior by these accounts. It can be a big threat to society. So, Timely and accurate detection of the presence of a fake identity is essential to combat malicious attacks. We thoroughly covered Twitter social network issuesrelatedto spamming. This paper includes a literature survey of spam detection approaches on Twitter too. Researchers have so far suggested several methods of identification and protection to defend Twitter users from spamming activities.We are motivated to workout a survey about Twitter spam detection techniques. This survey includes two parts: 1) A discussion on the ways of spam induction by spammers. 2) A literature review on the state-of-art: this part provides detailed analysis i.e. Taxonomies and predisposition on feature selection and discussion (e.g. pros and cons on each typical method).

1. Introduction
1.1 Online Social Media

Social media sitesi.e.OSNsallow for social interactions between users, where people can follow each other and make friends. Social media are immensely popular in the dissemination of breaking news and emerging stories. Twitter is one of the renowned OSN.

A social media account or profile is an entry of userson social media websites. A user may have multiple accounts and an account can also be controlled by multiple users. An identity set by the user can be real, false, or fake[1].

- **Real Account**: Real accounts are accounts that keep the Twitter Rules.
- **False Account**: An account created by a user with somebody's identity instead of his/her own identity is called a false account.
- **Fake Account**: An account created by a user with freely invented names and other information that cannot be attached to any real person in any country, so-called fake account.

1.2 Twitter – Large platform of OSN

Twitter is an Online Social Network (OSN) where users can share anything and everything, such as news, opinions, and even their moods. It has rapidly become an online source for acquiring real-time information about users[2]. When a user tweets something, it is instantly conveyed to his/her followers, allowing them to outspread the received information at a much broader level.

Tweets can be published by sending e-mails or sending SMS text messages. Twitter allows users to publish and exchange 140 character messages capacity, directly from smartphones using a wide range of Web-based services. Twitter spreads information to a large group of real-time, active users.

Pitfalls of Twitter

The continued success of Twitter as a platform for large-scale communication and thenexpansion of efforts to mine their data for new and novel applications related to public health, economic development, scientific dissemination, etc. necessitates confidence in the authenticity of its users. But this success in social networking has led to numerous problems including the risk of exposing their users to incorrect information via fake accounts resulting in the dissemination of false content and misleading site ranking[3].False identities play an important role in advanced persisted threats (APT), i.e. coordinated, lasting, complex efforts at compromising targets in governmental, non-governmental, and commercial organizations and are also

involved in other malicious activities like spamming, artificially inflating the number of users in an application to promote it, etc. The openness and availability of social media services also make it easier for malicious users to misuse social media services.This condition will lead to massive harm to society in the real world.

1.3 Spam detection in OSNs

Spammers can induce spam either through a single user's account/profile or via coordinated activities which spam a large group of accounts[4]. So, Twitter spam detection approaches are classified on behalf of above aspects:

A. The approach of a single user's account is divided into four classes on behalf of a specific model, technique, and detection algorithm i.e.FakeContent, Spam based on URL, Detecting Spam in Trending Topics and Fake User identification.

➤ **Fake Content**: Spammers generally combine spam data with a topic or keywords that are malicious or contain the type of words that are likely to be spam through temporal analysis. In this analysis,thetemporal distribution of tweets is calculated based on the number of tweets posted per hour. Different models used to identify fake content are detailed in Table 1.

Table 1: Showing Different models and their specifications

S.No	Model Name & its specification
1.	**Regression Prediction model:**(Gupta *et al., 2013):* It worked in-depth characterization of the components is done that is affected by the rapidly growing malicious content. This study considers user-based features like the average number of verified accounts that were either spam or non-spam and the number of followers. The metrics used to identify fake content are social reputation, global engagement, topic engagement, likability, and credibility.
2.	**Malware alerting system:**(Concone *et al., 2017):*This provides malignant warnings by using a specified collection of real-time tweets i.e. Twitter tweeting, acknowledging admissible event development, and reporting on the event itself. This malware alerting system comprises real-time data extraction of both tweets and users, filtering system based on a preprocessing schedule, and on Naïve Bayes algorithm to discard the tweets containing inaccurate information, data analysis for spammer detection, the alert subsystem that is used after the establishment of the event and feedback analysis. The approach is claimed to be efficient and effective for the detection of some invasive and admirable malignant activities in circulation.
3.	**Den Stream Clustering algorithm:** (Eshraqi*et al.,2013.*): It is based on content features, time features, and a den stream-based clustering algorithm to recognize the spam tweets. The tweets are subsequently categorized as spam and nonspam with high accuracy and precision.
4.	**Fun scheme approach:** (Chen *et al.,2017*): Fun stands for learning for unlabeled tweets. The framework of this scheme comprises two components, i.e., learn from detected tweets (LDT) and learn from human labeling (LHL). This approach improves the accuracy of spam detection significantly in real-world situations
5.	**Fake news detection through automation:** (Buntain *et al.,2017*): In this model, fake news is detected on Twitter automatically using a feature set. These features are extracted from users' behavior and tweets.

➤ **URL based spam detection**

The fake content approach is somewhat difficult because of the lengthlimit of the tweet description. So, spammers find it more promising to post URLs to spread malicious content than the plain normal text.

➤ **Detecting Spam in Trending Topic**

Hashtag or keywords, which are often seen in tweets at a specific time, appear in the Twitter list of trending topics and are likely to contain spam. Gharge*et al.(2017)* initiated a method, considering two aspects i.e. Recognition of spam tweets without any prior information about the users and the exploration of language for spam detection on Twitter trending topic at that time. Feature extraction separates the characteristics construct based on the language model that uses language as a tool and helps in determining whether the tweets are fake or not.

➤ **Fake User Identification**

Fake users help to introduce malicious activities against OSN users. So, it is imperative to identify these fake users.

B. Crowd surfing

A specific type of large scale fake account creation campaign is referred to as Crowdturfing[5]. Crowd surfing is typically involved in the dissemination of malicious Links in social media. It aims to gain or destroy the reputation of people, products, and other entities through spreading biased opinions and framed information.It is such malicious activities that are performed by real people and organized by crowdsourcing. The methods used to detect crowdsourcing activities can be unsupervised through discovering the anomalous traffic or based on patterns of historical crowdturfing activities. But, this detection scenario is subjected to various challenges. These can be as follows:

- **Absence of ground truth**: Unlike traditional data mining issues, the basic truth of social media crowdturfing data sets can hardly be annotated manually. So, the absence of ground truth exacerbates the difficulty of posing the problem as a supervised machine learning task.
- **Analyzing content:** Analyzing the massive amount of content information in social media is the biggest challenge. In Twitter, the number of monthly active users exceeds 300 million and the number of tweets per day is over 500 million, it is almost impossible to process the massive data.
- **Evolving strategies:** Machine learning approaches focus on identifying patterns of adverse activities, which may be difficult to cope with novel strategies of emerging crowdturfing campaigns. The emerging crowdturfing technique can easily circumvent the static filtration of conventional approaches to detection.
- **Evolving participants:**Crowdsourcing is famous as it offers a way for people to turn their spare time into opportunities for monetization.
- **Heterogeneous data**: Multimedia information is increasingly prevalent on social media platforms. Even Twitter is commonly used to disseminate pictures and short videos.

Investigating Principles behind Crowdturfing in Social Media

Fundamental principles that have been used for investigating crowdturfing are Mining and profiling social media users as well as Modeling information diffusion in social media.

➢ **Mining and Profiling social media users**
In social media platforms, People interact with each other through making friends and exchanging information. These activities induce an attributed network among social media users that helps to understand patterns of crowdturfing and other adverse attacks.

- **Social networks**: A social network structure is set up by joining links generated when Social media users follow each other to subscribe to other people's shared information. This structure has been used to identify adverse behaviors in social networks. The information that has been used includes the number of links, contents, and profiles of friends, and the community structures and hierarchies induced by the social network.
- **Conversations**: Commenting leads to sharing and exchanging opinions, which result in conversations between users. The ideas expressed in the comments can be regarded as an indicator of the quality of information.
- **Textual streams**: In social networks, content is continuously generated that comprises a stream of texts. Since campaigns are time-sensitive and during specific periods, specific patterns may exist, such as hibernation (low activity traffic volume in a long period) and abrupt bursts (high activity traffic volume in a short period). These temporal and quantitative patterns can be a good measure for indicating abnormal activities.
- **Temporal and spatial patterns**: Analyzing user behaviors help to detect abnormal activities. A topic that is trending on social media is usually related to certain times and locations, so the time and location of users, combined with the content they posted, can be taken as an indicator of the norm of information.

- **Information Originality:** The originality of information describes the uniqueness and novelty of information.The corresponding material should be less diverse and have a more restricted vocabulary since crowdturfing is typically structured.But, measuring the originality of information is more challenging since the amount of information is massive, and many people may post other people's content without citation.

➢ **Modeling information diffusion in social media**

Posting new content and forwarding information from other people to friends, and writing comments are common activities for social media users. The activities that portray these people as actors in social networks and help them to influence other people to result in the diffusion of information between social media users over time. The basic models of information diffusion include the SIR model, tipping point model, independent cascade model, and linear threshold model.

Crowdturfing Detection

Different approaches for crowdturfing detection are categorized into content-based, behavior-based, and diffusion-based approaches.

- **Content-based approaches:** Examines the social media content and identify similar and duplicate posts.
- **Behavior-based approaches:** Focus on social media users' behavior which isinvolved with crowdturfing to reveal the abnormal activities.
- **Diffusion-based approaches:** Modify existing information diffusion models to understand and detect adverse activities. The diffusion models can not only facilitate the detection of crowdturfing but also help intervene in the process and minimize the after-effects of disinformation.

Crowdturfing is malicious crowdsourcing. Several works have been done on crowdturfing. Fayazi et al. (2015) study manipulation in online reviews. Song et al. (2015) study how to detect objects of crowdturfing tasks on Twitter. Wang et al (2012) described the operational structure of crowdturfing systems. Wang et al (2014) studied the applicability of machine learning approaches to detect crowdturfingcampaigns.Lee et al (2014, 2015) proposed a classifier method to detect crowdturfingcampaigns.Song et al (2015) suggested a method to detect while focusing on detecting target objects of crowdturfing tasks (like post, page, URL). The distinguishing features used by this classifier include the variability of the number of followers over time, the graph density of the worker accounts, tweeting activity, and ratio of friends and followers.

1.4 Twitter spam detection Features

A feature is an individual observable property of a phenomenon being observed. Several Twitter spam detection features are extracted from user accounts and the tweets that can help to identify spam[4][6]. These features are categorized into several classes, namely user, content, graph, structure, URL, and time.

Name of Features	Attributes
User Feature	Number of followers&followees The fraction of followers per followees Age of user account Reputation Number of user favorites Number of visits Propagation of Bidirectional Number of replies
Content Feature	Number of tweets &retweets Number of hashtags Number of user mention Number of URLs Number of characters Number of Digits Number of Tweets Spam words
Graph Features	Local clustering coefficient Bidirectional link ratio In/Out degree Betweenness
Structure Features	Average tweet-length The time between first-last tweet (Thread lifetime) Depth of conversion tree Tweet frequency
Time feature	Tweet sent in the time interval Idle time in days
URL based features	Domain tokens Path tokens

	Query parameters of the URL Redirect chains URL redirect chain length The relative number of different initial URLs

Yang et al (2011) also studied finding robust features to detect spammed accounts. The graph-based features and neighbor-based features were combined with automation-based features and timing-based features to construct four different classifiers.

Benevenuto *et al.*(2010) consider content as well as useful features for the detection of spammers. Content attributes have the property of the wordings of tweets that are posted by the users which gather features that are relevant to the way users write tweets. while, user behavior attributes gather particular features of the users' behavior in the context of the posting frequency, interaction, and impact on Twitter.

1.5 Machine Learning Algorithms

As tweets are retrieved in a streaming way and twitter provides the streaming API for developers and researchers to access public tweets in real-time. Data, feature, and model are three aspects that evaluate the performance of machine learning-based streaming spam

detection methods. As for real-time spam detection, features are extracted for tweet representation. Then spam detection in the feature space was turned into a binary classification problem, and traditional machine learning algorithms can solve that.

Before classification, a classifier that contains the knowledge structure should be trained with the prelabeled tweets. After the classification,themodel gains the knowledge structure of the training data, it can be used to predict a new incoming tweet. Thus, the whole process involves learning and classifying. The first features of tweets are extracted. By any approach like manual inspection, class labels ie. Spam or nonspam are found out. These features and class labels are combined as one instance for training in a 1:1 ratio. One feature and one class label make a pair. The training set is the input of the machine learning algorithm. Then the classification model is built after the training process. In the classifying process, the timely captured tweets are labeled by the trained classification model.A classification model tries to draw some inference from the values given for training inputs. It will predict the class labels/categories for the new data.
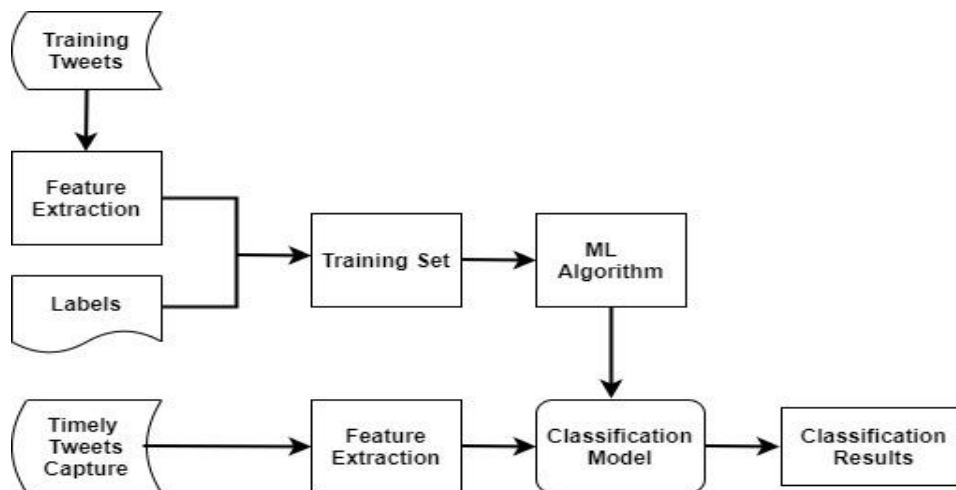

Figure 1: ML-Based Detection Process[7]

Different Classification Algorithms of Machine Learning[8][9]

➢ **Logistic Regression:** It is a machine learning algorithm for classification. In this algorithm, the probabilities describing the possible outcomes of a single trial are modeled using a logistic function

(Definition). For this reason, logistic regression (classification) is structured and is most useful for understanding the effect of multiple independent variables on a single outcome variable (Advantage). Works, only when the predicted variable is binary, assumes all predictors are

independent of each other and assumes data is free of missing values (Disadvantage).

➢ **Naïve Bayes':** This algorithm is based on Bayes' theorem with the assumption of independence between every pair of features. Naive Bayes' classifiers work well in many real-world situations such as document classification and spam filtering (Definition). This algorithm requires a small amount of training data to estimate the necessary parameters. Naive Bayes classifiers are extremely fast compared to more sophisticated methods. This is mainly used for filtering the spam tweets and also used in text classification (Advantage). Naive Bayes is known to be a bad estimator (Disadvantage).

➢ **Stochastic Gradient Descent:** This is a very efficient approach to fit linear models. It is particularly useful when the number of samples is very large. It supports different loss functions and penalties for classification (Definition). Efficiency and ease of implementation (Advantage). Requires several hyper-parameters and it is sensitive to feature scaling (Disadvantage).

➢ **K-Nearest Neighbours:** Neighbours based classification is a type of lazy learning as it does not attempt to construct a general internal model, but simply stores instances of the training data. Classification is computed from a simple majority vote of the k nearest neighbors of each point (Definition). This algorithm is simple to implement, robust to noisy training data, and effective if training data is large (Advantage). Need to determine the value of K and the computation cost is high as it needs to compute the distance of each instance to all the training samples (Disadvantage).

➢ **Decision Tree:** Given a data of attributes together with its classes, a decision tree produces a sequence of rules that can be used to classify the data (Definition). Decision Tree is simple to understand and visualize, requires little data preparation and can handle both numerical and categorical data (Advantage). A decision tree can create complex trees that do not generalize well, and decision trees can be unstable because small variations in the data might result in a completely different tree being generated (Disadvantage).

➢ **Random Forest:** Random forest classifier is a meta-estimator that fits several decision trees on various sub-samples of datasets and uses an average to improve the predictive accuracy of the model and controls over-fitting. The sub-sample size is still the same as the sample size of the original input but the samples are drawn with a substitution (Definition). Reduction in over-fitting and random forest classifier is more accurate than decision trees in most cases (Advantage). Slow real-time prediction, difficult to implement, and complex algorithm (Disadvantage).

➢ **Support Vector Machine (SVM):** Support vector machine is a representation of the training data as points in space separated into categories by a clear gap that is as wide as possible. New examples are then mapped into that same space and predicted to belong to a category based on which side of the gap they fall (Definition). Effective in high dimensional spaces and uses a subset of training points in the decision function so it is also memory efficient (Advantage). The algorithm does not directly provide probability estimates, these are calculated using an expensive five-fold cross-validation (Disadvantage).

Discretization in case of Machine Learning

Discretization is useful for machine learning algorithms that directly handle continuous variables, thereby, can significantly impact the performance of classification algorithms used in the analysis of high-dimensional data. Discretization refers to the method of translating or partitioning to discrete or nominal attributes/features/variables/intervals continuous attributes, features, or variables.Itis typically used as a pre-processing step for machine learning algorithms that handle only discrete data. Discretization methods can be unsupervised (which do not use any information in the target variable) andSupervised(which do use). Supervised discretization is more beneficial to classification than unsupervised discretization.Several machine learning

classification algorithms such as Support Vector Machines (SVM) and Random Forests (RF) and Naïve Baiyes benefit from discretization[2].

Ying Yang et al. (2009) show that why discretization is effective on Naïve Bayes learning. They discuss the factors that might affect Naïve Bayes classification error under discretization. Discretization is an alternative to probability density estimation when Naïve Bayes learning involves quantitative attributes like in our social media dataset. Under discretization, each value corresponds to an interval. Since the probabilities of a qualitative attribute can be properly estimated from corresponding frequencies using good training instances, there is no need to assume the probability density function. However, because the qualitative data have a lower level of measurement than quantitative data discretization might suffer from information loss. As a summary, they want to maximize the number of intervals to minimize discretization bias but at the same time ensure that each interval contains sufficient training instances to obtain low discretization variance.

Chen *et al.* (2015) evaluated machine learning algorithms to detect spam tweets. The authors pondered over various features like spam to non-spam ratio, size of the training dataset, time-related data, factor discretization, and sampling of data for spam detection. After the identification of spam tweets, gathered features are divided into user-based features and tweet-based features.

Bucket Ersahin (2017) proposed a classification method for detecting fake accounts on Twitter. The data is preprocessed by a supervised discretization technique named Entropy Minimization Discretization (EMD) on numerical features and analyzed the results of the Naïve Bayes Algorithm. This approach is based on detecting fake accounts via a feature-based approach that monitors the behavior of the user such as the number of tweets by that user, friends, etc. but the results are less efficient as compared to using graph techniques.

2. Literature Survey

It is essential to recognize spams in the OSN sites to save users from various kinds of malicious attacks and to preserve their security and privacy. The present research focuses on the literature review of the state-of-the-art research aimed at detecting spammingon Twitter.

Chu et al. (2010) aimed at differentiating Twitter accounts operated by humans, bots, or cyborgs (i.e., bots and humans working in concert). To detect spamming accounts, an Orthogonal Sparse Bigram (OSB) text classifier is used that uses pairs of words as features. To assess the regularity of tweets and some account properties such as the frequency and types of URLs and the use of APIs, other detecting components are accompanied. In this way, the system was able to accurately distinguish the bots and the human-operated accounts.

Lee et al (2010) extended the studies of **Chu et al (2010)** who worked on detecting spam on Twitter, by expending the set of features via number and type of connections. He found a Decorate Metaclassifier on the weka interface to check the accuracy of the classifier. The author also worked on graph-based features to distinguish legitimate and illegitimate accounts. In the streamline, Message similarity is used to find the presence of patterns like to add friends and ratio of friend requests. For this, Random Forest is used as a classifier.

Chen *et al.* (2015) conducted a study on the concept of the content polluter. These features were categorized into two classes, i.e. direct and indirect features. Direct features are the features that can be obtained from the unprocessed JSON tweets, are further categorized into tweet based and profile-based features. The indirect features cannot be extricated from the unprocessed JSON tweets such as the history of tweets, social relationships, etc. According to the observation, the indirect features can assist to enhance the rate of detection with the surrender of time performance. The authors identified superior features from the time and accuracy perspective. The feature selection via recursive feature elimination (RFE) is used to select robust features and abolish the worst or best features. Random forest classifier achieves high spam detection accuracy in real-time.

Shen *et al.* (2015) proposed a technique to detect spammers on Twitter. This technique

combines characteristics withdrawal from text content and information on social networks. The authors used matrix factorization to determine the underline feature matrix or the tweets and then came up with a social regularization with an interaction coefficient to teach the factorization of the underline matrix. Many of the data mining algorithms used to detect spam and patterns of misuse on SNSs are designed with the assumption that the data and the classifier are independent. However, in the case of spam, fraud, and other malicious content, users will often modify their behavior to evade detection, leading to degraded classifier performance and the need to re-train classifiers frequently.To tackle this adversarial problem, **David *et al.* (2016)** used feature engineering to upgrade the classifier in case of a modification of user behavior. He presented a feature-based approach for identifying fake user's identity from the Twitter platform. User profiles features and timeline-based features (further classified into content-based and metadata-based features) were used to produce a feature set. Metadata based features refer to all the information that supports or defines the main content. The variable importance is used for finding the best feature combination from the feature set effectively and efficiently.

Meda*et al.* (2016) presented a technique that utilizes a sampling of non-uniform features inside a machine learning system by the adaptation of the random forest algorithm to recognize spammer insiders. The random forest is a learning algorithm for the categorization and regression that works by assembling several decision trees at preparation time and selecting the one with the majority votes by individual trees. The scheme incorporates a bootstrap aggregating technique with unplanned feature selection. This Non-uniform feature sampling method gives the upper bound of the random forest error generalization.

Related study to Machine learning approaches

Machine learning techniques and honeypot harvesting approaches have been used to classify Twitter accounts as legitimate or not. Honeypot techniques help identify spammers by attracting them to their sites and embedding themselves into their networks with the goal of harvesting information from them. (Lee et al., 2010). Machine learning techniques use spammer profile information, obtained via approaches such as honeypot harvesting, to train themselves to understand spammer behavior and thus aiding in the development of detection techniques (**Stringhini et al., 2010).**

M. McCord and M. Chuah (2011)

This study was based on traditional classical methods. It was based on some user-based and content-based features that are different between spammers and legitimate users as well as facilitates spam detection. Random ForestClassifier is a part of this classifier.Several classic classification algorithms are compared, for example, Random Forest, Naïve Bayesian, Support Vector Machines, and K-nearest neighbors. The author also suggested some user-based and content-based features that can be used to distinguish between spammers and legitimate users on Twitter[10].

Alex Hai Wang (2012)

The researcher proposed a directed social graph model to explore the "follower" and "friend" relationships among users to facilitated spam detection considering content-based features and graph-based features. Classic evaluation metrics are used to compare the performance of various traditional classification methods. Experiment results show that the Bayesian classifier has the best overall performance in terms of *F*-measure. For the content-based features, most spam accounts have multiple duplicate tweets. This is an important feature to detect spam. However, not all spam account postmultiple duplicate tweets, and some legitimate users also post duplicate tweets. In this way, we can not only rely on this feature[11].

Mateen *et al.* (2017)proposed a hybrid methodology using user-based, content-based, and graph-based characteristics for the identification of spammer profiles. Because of the relationship and properties of user accounts, user-specific features are created. Append user-based functions to the spam detection model is important. Spammers post content to spread fake news and these contents contain malicious URLs to promote their product[12].

Abdullah Talha Kabakus (2017)

This paper presents the features of Twitter spam detection and discusses their effectiveness in spam detection. Then, the proposed works in literature are discussed after divided this work into four categories i.e.Account-based, Tweet-based, Graph-based, and Hybrid spam detection methods which use a combination of others. It also highlights Twitter's obsolete apps, which are widely used by Twitter spam detection approaches[13].

Guanjan Lin (2017)

The author compared the performance of a broad range of popular machine learning algorithms to identify those that provide adequate detection efficiency and stability based on a wide range of ground-level truth data. To achieve real-time Twitter spam detection capability. The researcher further evaluated the algorithms in terms of scalability. The performance study evaluates the detection accuracy, the true/false-positive rate, and the F-measure; the stability examines how stable the algorithms perform using randomly selected training samples of different sizes. The scalability aims to better understand the impact of the parallel computing environment on the reduction of the training/testing time of machine learning algorithms[14].

TingminWu(2017)

The author included the three parts as a state of the art of the survey. It wasadetailed analysis of different methods as well features, Comparative studies in terms of various typical methods on a universal testbed (*i.e.* same datasets and ground truths) to provide a quantitative understanding of current methods and the unsolved challenges in current Twitter spam detection techniques[15].

Himank Gupta (2018)proposed a technique to consolidate tweet's text information along with the user based features. Tweet text feature helps to identify the spam tweets even if the spammer creates a new account which was not possible only with the user and tweet based features. Four different machine learning algorithms i.e.Support Vector Machine, Neural Network, Random Forest, and Gradient Boosting are studied in works. It is observed that Neural Network, helps to achieve an accuracy of 91.65%[16].

Rutuja Katpatal (2018)

Various spam detection techniques are used to detect spamming activities in twitter-like Lfun,ASL,Binary Detection Model are some of the spam detection techniques used. These techniques identify spam tweets from incoming tweets. It is observed that the Lfun technique is better than other techniques on the detection rate by 4%. Although its accuracy is less than the Binary detection model, fun removes the Twitter Spam Drift problem[17].

K Subba Reddy (2019)

These works are based on the classifier created based on SVM and Naïve Bayes' using a set of content-based features to detect spam tweets. It is observed that the SVM classification model gives better performance compared to Naive Bayes' classifier in most cases with cross-validation[18].

K. Jino Abisha (2019)

This author worked on semi-supervised learning techniques to detect spam tweets on Twitter. The classification is created on behalf of user-based and tweet based features. The benefit of using tweet text features is that the spam tweets can be identified even if the spammer creates a new account which was not possible only with the user and tweet based features. The work has been evaluated with three different machine learning algorithms i.e.Support Vector Machine, Neural Network, Random Forest. With Naive Bayes' classifier, about 80% of accuracy is obtained[19]

Richa Ramesh Sharma (2019)

This study gives a comparison of a wide range of conventional machine learning algorithms in terms of performanceto identify those that offer satisfactory detection and stability performance based on a large amount of true field data. Scalability algorithms are evaluated to realize real-time spam detection capabilities. Scalability aims to better understand the impact of reducing training time learning algorithms. It is also found that classifiers can detect Twitter spam in a better way in a near real-world scenario.The system also identified that Feature discretization is an important preprocessing to machine-learning based spam detection but increasing training data only cannot bring more benefits to detect Twitter spam after a certain number of training samples[20].

N.NoorAllema(2020)

The author proposed atechniquebased on content-based features and Graph-based features. In this system algorithm named Naïve Bayes classifier algorithm is used with a combination of many other principles relyingupon "Bayes theorem" wherein the methods share a common mode of working[21].

Conclusion & Future scope

Considering different studies, it is observed that data, features, and models are three aspects that can be used by spammers to induce spamming and these aspects that can be helpful to detect spamming too. However, the selection of the most feasible techniques and methods is highly dependent on the available data. The number of features or its attributes doesn't mean accuracy even a smaller but efficient set of attributes is enough to gain higher accuracy. Several rumors are posted on OSNs often which always panic or misguide the social users. It also creates distrust of social users on that OSN after finding the reality. Further study can be done on the identification of rumor sources on social media.

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PERCEPTION OF THE TRIBAL FARMERS TOWARDS ORGANIC TURMERIC CULTIVATION IN KANDHAMAL DISTRICT OF ODISHA

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ABSTRACT

Turmeric is an important commercial grown spice crop in India. And it is used in diversified forms as condiment, flavouring and colouring agent and as an important ingredient in Indian culinary as curry powder. Now a day's organic turmeric is mostly preferred by the consumers for healthy life and the perception of the farmers toward it also important for developing positive attitude to increase organic turmeric areas of cultivation. To address this the present study was under taken with the objective to study the perception of the respondents towards organic turmeric cultivation. The data was collected with the pre tested interview schedule directly from the 100 farmers in Kandhamal district of Odisha form 4 randomly selected villages from 2 randomly selected blocks. Data analysis was done by following proper statistical methods. The result showed that most of the respondents generally perceived that organic turmeric cultivation increase the soil fertility and is a best way to cultivate turmeric, clean and deep tillage practices required to increase the turmeric production and ploughing across the slope reduces soil erosion. The tribal farmers perceived that the mother rhizome were found to be better than the finger rhizome for use as planting material and mulching is beneficial for proper germination of seed rhizome. For disease and pest management application of neem oil, biocontrol agent and burning the field perceived as better than the chemicals pesticides. Farmers also perceived that proper method of harvesting and curing method is essential to increase the curcumin content. As a whole it was found that majority of the farmers had medium level of perception towards organic turmeric cultivation and land under turmeric, social participation and extension agent contact has a significant effect on the perception of the farmers.

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Introduction

Turmeric (*Curcuma longa L*), the ancient and sacred spice of India referred to as 'Indian saffron' is a vital business spice crop grown in India. It is known as the "golden spice" as well as the "spice of lifestyles. There are two dominant types of turmeric found on the world market: 'Madras', and 'Alleppey', both named after the regions of production in India. Alleppey turmeric contains about 3.5% to 5.5% volatile oils and 4.0% to 7.0% curcumin, users prefer it as a spice and a food colourant and in contrast, Madras type contains only 2% of volatile oils and 2% of curcumin and it has high demand in British and middle eastern markets for its more intense brighter and lighter yellow colour, better suited for the mustard pest and curry powder or pest used in oriental dishes. (FAO, Plotto 2004)

It is one of the multi-use merchandise that have many precious residences and uses. It is notably used in food, textile, remedy and beauty industries. The curry powder is one of the quintessential ingredients within the Indian meals, which contains 5 to 30 per cent of the turmeric powder in its total content material. Turmeric has colouring residences because of the curcumin content and therefore its product used as an herbal colouring agent for meals stuffs, jellies and fruit beverages. The dye made out of turmeric is used in cosmetic industries for its peculiar properties which include pores and skin cleaning assets. It checks growth of hairs and provide beauty to the face. Turmeric performed an outstanding role within the medicinal industries as it has anti-cancer, anti-viral activities and consequently reveals use in the drug industry, serving as a component for the practice of treasured drops for the various issues in humans. Kum-kum', popular with every house spouse, is also a by-product of turmeric. It reveals a place in services on religious and ceremonial activities.

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India has 231637 hectares under turmeric cultivation with the entire production of 863460 tonnes (Spices Board India, 2017-18). Telangana is referred to as the "turmeric bowl of India'' because it crowned each in place (50150 ha) and production (294560 tons) with 34% of general production in India. There are some other states like Karnataka, Andhra Pradesh, Tamil Nadu, Orissa, West Bengal, Gujarat, Meghalaya, Maharashtra, Assam are widely cultivating turmeric.

In the meantime Odisha is the sixth biggest producer of turmeric in India with area (27870 ha) and production (43610 tons). [Spice Board of India Ministry of Agriculture government of India (2017-18). In Odisha, turmeric is an important cash crop grown by tribal families for his or her livelihood and more than 50% of this crop grower is tribals. Odisha contributes about 21% of India's turmeric cultivation in terms of area and Kandhamal makes up for over 50% of state's share. Odisha produced turmeric 59361 t from 24733 ha. Kandhamal district stands first in turmeric area as well as production (28,828 t from 11,088 ha). Koraput is the second largest producing district (7,761 t from 3,168 ha). *[Babu, Shukla, Tripathi and Prusty (2015)]*

A year after the famed organic turmeric of Odisha's Kandhamal district received the geographical indication (GI) tag, thousands of farmers who hoped to make a profit out of the tag are cursing themselves.

Organic cultivation is a crop production approach which encourages sustainable agriculture by way of enhancing the biological cycles in nature. It aimed towards a healthy atmosphere for crops to yield. The excess use of artificial fertilizers, chemical pesticides, food components etc. has added big loss to human health. According to Codex, Organic farming is described as a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activities (FAO-committee on agriculture, Jan 29, 1999). Organic turmeric is gaining importance due to its health benefits in immunity booster, healing of wounds, prevention of cancer, reducing the cholesterol level, controlling the blood sugar level etc.

Government also giving importance towards the promotion of organic method of cultivation of different crops, several initiatives are also taken at central and state level to promote organic farming. The perception of the farmer towards organic farming is also an important factor in developing positive attitude and promotion of organic farming. By considering this the present study was under taken based on the perception of the farmer towards organic turmeric cultivation.

Objective

To study the perception of the respondents towards organic turmeric cultivation.

Research Methodology

The study was conducted in Kandhamal district of Odisha as the organic turmeric cultivation totally confined to this district. Out of 12 blocks 2 blocks i.e. Phiringia and Tikabali blocks were selected randomly. Two villages were selected from each block and from each village 25 tribal farmers associated with organic turmeric farming were selected randomly, thus total 100 farmers were selected for this study as respondents. Data was collected through pre-tested interview schedule and ex-post factor research design was confined for the research study. The independent variables for the study were Age, Education, housing quality, Family Type, Land holding, Land under turmeric cultivation, Social participation, Experience in organic turmeric cultivation, Annual income from turmeric cultivation, Contact with extension agencies, Mass-media contact and there were two dependent variables such as Knowledge level of farmers on organic turmeric cultivation and Perception level of turmeric growers regarding organic turmeric cultivation. To measure the level of perception of the turmeric growers regarding organic turmeric cultivation, a 3 point rating scale containing i.e. Most perceived, Perceived, Not perceived respectively was employed to assess the level of perception. The respondents were asked to indicate any one of the three alternative responses (3 score for most, 2 score for perceived and 1 score for not) against each selected 10 main items (Land preparation, Soil Analysis, Variety, Planting, Nutrient

Management, Water management, Cultural management, Disease and pest management, Harvesting, Post-harvesting Management). Overall perception of the respondents were classified into three categories such as low, medium and high on the basis of mean ± standard deviation.

Result and discussion

Based on the several parameters the perception of the farmers towards organic method of cultivation of turmeric is presented in the table 01 and table no 02.

Crop cultivation by following inorganic method is cost effective and harmful to the ecosystem and it also reduces development of microbial activities in the soil. Considering this about 61 per cent farmers mostly perceived that growing turmeric organically is best thing to do, less expensive method of cultivation (by 81 per cent respondents), environmental friendly (by 57 per cent respondents) and increase the soil fertility level (by72 per cent of the farmers).

Land Preparation

About 92 per cent turmeric farmers mostly perceived that the clean and deep tillage practices increase the turmeric yield as deep tillage increase the soil aeration, which helps in proper development of turmeric rhizome, and remaining 8 per cent of the farmers relatively less perceived it. 44 per cent farmers perceived that solarisation of the bed reduce the incidence of disease and pest followed by 37 per cent farmers did not perceived it, due to lack of knowledge and remaining 19 per cent farmers shows higher perception towards solarisation of bed. 64 per cent turmeric growers shows a higher perception towards incorporation of green manure increases the fertility of soil whereas 36 per cent farmers comparatively less perceive it. About 91 per cent of the turmeric farmers of that area mostly perceived about the ploughing the field across the slope reduces the soil erosion, followed by 6 per cent farmers perceived it necessary to follow this technique in their field while only 3 per cent farmers did not perceived it. Majority (97 per cent) turmeric growers did not perceived that use of implements in organic field which are previously exposed to inorganic field affect

organic farming whereas, about 3 per cent of the farmers perceived the statement as some farmers were cultivating rice and other cereals inorganically along with organic turmeric affect the organic crop.

Soil Analysis

Coming to soil about 50 per cent of the respondents mostly perceived that soil testing is required for proper nutrient management, followed by 29 per cent less perceived it as essential for growing healthy crop and 21 per cent of the farmers did not perceived it essential for their crop because they don't get such facilities to test their soil.

Variety

Majority of the farmers about 44 per cent did not perceive that the use of recommended variety gives more yield as they are growing local variety (*Kandhamal* Haladi) followed by 37 per cent farmers perceived the statement and very less farmers about 19 per cent mostly perceived it as they are getting improved variety from KASAM organization.

Planting

About 52 per cent farmers did not perceive that growing turmeric under shade is beneficial for rhizome development as they were using that land for other crop cultivation followed by 45 per cent of the farmers perceived with it. 50 per cent of the farmers perceived that selection of healthy rhizome for planting reduce disease pest incidence followed by 25 per cent of the farmers mostly perceived it and 25 per cent of farmers did not perceived it. About 67 per cent of the respondents perceived that recommended spacing helps in proper development of rhizome followed by 20 per cent of the farmers relatively less perceived it and about 13 per cent of the farmers did not perceived it. For intercropping 66 per cent of the farmers perceived it beneficial 28 per cent farmers mostly perceived it as profitable. In case of multi-storied cropping about 71 per cent farmers did not perceived as profitable for the farmer, 22 per cent of the farmers perceived it as beneficial and only7 per cent farmers mostly perceived it. 75 per cent of the farmers perceived that returns from inter cropping is higher in compare to mono-cropping followed by 7 per cent farmers mostly perceived that

intercropping increase the yield but about 18 per cent farmers did not perceived it. Coming to the planting material 89 per cent of the turmeric farmers mostly perceived that mother rhizome were found to be better than the finger rhizome followed by 11 per cent farmers relatively less perceived. 52 per cent of farmers perceived that improved method of planting is more productive followed by 10 per cent farmers mostly perceived it but 38 per cent farmers did not perceived with it.

Integrated Nutrient Management Increases Yield.

Application of FYM improves soil fertility, mostly perceived by majority 78 per cent of the turmeric farmers whereas 19 per cent farmers comparatively less perceived it and only 3 per cent farmers did not perceived it. In case of use of bio fertilizer 80 per cent of the farmers did not perceived it as beneficial towards the enhancement of plant growth due to lack of knowledge followed by equal percentage (10 per cent) of farmer have higher and relatively lower level of perception. And in case of application of neem cake 49 per cent of the farmers perceived that it increases organic matter content, water holding capacity of soil followed by 18 per cent of the farmers mostly perceived it as beneficial.

Water Management

About 74 per cent of the turmeric growers mostly perceived that application of water at proper time with adequate quantity increase the yield. While about 20 per cent farmers relatively less perceived it and very less 6 per cent farmers not perceived with it.

Cultural Management

Mulching beneficial for proper germination of seed rhizome mostly perceived by 91 per cent farmersfollowed by 6 per cent farmers relatively less perceived it and 3 per cent farmers did not perceived it as essential for turmeric. For weeding 33 per cent farmers perceived that proper weed management is necessary to maximise the yield and only 3 per cent of the farmers did not perceived with it.

Disease and Pest Management

All the farmers perceived that burning the field before planting is effective against shoot borer. Farmers reported that spraying neem oil @ 0.5 per cent during July-October (at 21 day intervals) is effective against the shoot borer. About 43 per cent of the turmeric growers perceived with it. Followed by 15 per cent farmers mostly perceived it useful to control the pests. However, about 42 per cent of the farmers did not perceived it. Coming to the application of several bio-control agent about 26 per cent farmers perceived it as beneficial and only 7 per cent of progressive farmers of the locality mostly perceived it and applied in their field.

Harvesting

Harvest of rhizome at 270 days after planting gives highest yield, perceived by more than 50 per cent farmers followed by 47 per cent farmer mostly perceived it as correct time of harvesting.Curcumin content increases in the turmeric, harvested in the month of November-December,about 77 per cent perceived with it followed by 12 per cent farmers mostly perceived and they were doing delayed harvesting to increase the curcumin content however, 11 per cent farmers did not perceived with it. Coming to the harvesting method about 33 per cent farmer perceived that hand picking is the best method followed by 22 per cent of the farmers mostly perceived it and 45 per cent farmers did not perceived with it.

Post-harvesting Management

About 92 per cent of the turmeric farmers mostly perceived that curing is beneficial and gives attractive colour and aroma, followed by 8 per cent of the farmers were relatively less perceived it. Coming to the grading about 73 percent turmeric farmers mostly perceived that grading gives more income followed by 27 per cent farmers relatively less perceive it.

Table no. 01 Distribution of the turmeric growers based on their perception toward organic turmeric cultivation

Sl No.	Statement	Most perceived		Perceived		Not perceived	
		F	%	F	%	F	%
1	Growing turmeric Organically is best thing to do.	61	61	33	33	6	6
2	Organic production of turmeric is more expensive	13	13	6	6	81	81
3	Organic turmeric cultivation is environmental friendly	43	43	57	57	0	0
4	Organic turmeric cultivation increase the soil fertility	72	72	28	28	0	0
A	**Land Preparation**						
5	Clean and deep tillage practice Increases turmeric Production**.**	92	92	8	8	0	0
6	Solarization of bed reduce the disease pest incidence.	19	19	44	44	37	37
7	Incorporation of green manure Increases soil fertility.	64	64	36	36	0	0
8	Ploughing across the slope reduces soil erosion.	91	91	6	6	3	3
9	Use of farm implements which are previously used in inorganic affects the organic farming.			7	7	93	93
B	**Soil Analysis**						
10	Soil testing required for proper nutrient management.	50	50	29	29	21	21
C	**Variety**						
11	Use of recommended variety gives more yield than local variety.	19	19	37	37	44	44
D	**Planting**						
12	Growing turmeric under shade suitable for rhizome development.	3	3	45	45	52	52
13	Selection of healthy Rhizome reduces the disease pest incidence in future.	25	25	50	50	25	25
14	Recommended spacing helps in proper development Of Rhizome.	67	67	20	20	13	13
15	Practice of intercropping is more profitable.	28	28	66	66	6	6
16.	Multi-storied cropping of turmeric under fruit trees increase the profit of farmer.	7	7	22	22	71	71
17.	Net return is higher under intercropping as compared to mono-cropping.	7	7	75	75	18	18
18	Mother rhizome were found to be better than the finger rhizome for use as planting material.	89	89	11	11	0	0
19	Improved method of planting is more productive than traditional method of planting.	10	10	52	52	38	38
E	**Nutrient Management**						
20	Integrated nutrient management increases yield.	16	16	34	34	50	50
21	Application of FYM improves soil fertility.	78	78	19	19	3	3
22	Use of biofertilizer enhances sustainability and stimulating plant growth.	10	10	10	10	80	80
23	Application of neem cake increases organic matter content, water holding capacity of soil.	18	18	49	49	33	33
F	**Water Management**						
24	Application of water at proper time with adequate quantity increase the yield	74	74	20	20	6	6
G	**Cultural Management**						
25	Mulching beneficial for proper germination of seed rhizome.	91	91	6	6	3	3
26	Weeding in proper time increase the yield of turmeric	66	66	31	31	3	3
H	**Disease and Pest Management**						
27	Burning the field before planting is effective against shoot borer.					100	100
28	Application of neem oil to shoot borer(0.5%).	15	15	43	43	42	42
29	Application of bio control agent(*Trichoderma Viride*, *Beauveria Bassian* and pseudomonas control rhizome rot.	7	7	27	27	66	66

I	**Harvesting**					
30	Harvest of rhizome at 270 days after planting gives highest yield.	43	43	57	57	0	0
31	Curcumin content increases in the turmeric harvested in the month of November-December.	12	12	77	77	11	11
32	Proper method of harvesting gives more yield(hand picking).	22	22	33	33	45	45
J	**Post-harvesting Management**					
33	Curing of raw turmeric is essential for development of attractive colour and characteristic aroma.	92	92	8	8	0	0
34	Graded turmeric give more income	73	73	27	27	0	0

F= Frequency   %= Percentage

Overall Perception

It was evident from the table no 02 and figure no 01 that majority about 75 per cent farmers were medium level of perceived towards organic turmeric cultivation with score (63-80).

Almost 15 per cent farmers were highly perceived and remaining 10 per cent of the farmerswere relatively less perceived that is low level of perception towards organic turmeric cultivation.

Table no.02 Distribution of the turmeric farmers on the basis of their overall perception towards organic turmeric cultivation (N=100)

Sl. No.	Category	Frequency	Percentage
1.	Low (≤62)	10	15.0
2.	Medium (63-80)	75	75.0
3.	High (>80)	15	10.0
	Total	100	100.0
Mean = 71		S.D = 9	

Figure no: 01 Distribution of the turmeric farmers on the basis of their overall Perception towards organic turmeric cultivation
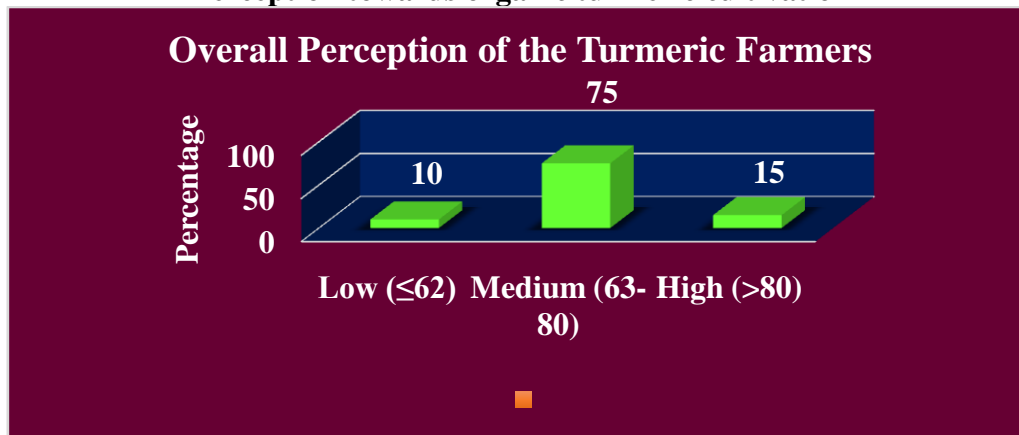
Regression analysis between several socio-economic characters with the perception of the farmers.

Table no 03 presented the regression analysis of several independent variables with the perception of farmers, the table revealed that the land under turmeric cultivation, social participation and extension agent contact significantly affect the perception of the organic turmeric farmer. Whereas other variables show no significance. Social participation and extension agent contact contribute positively at 0.05 level of probability and the land under turmeric cultivation shows highly significance at 0.01 level of probability.

Table no 03 multiple regression analysis of the independent variables with perception

(N=100)

Sl.No.	Variables	Regression Co-efficient	Standard error	't' value
1.	Age	0.023	0.059	0.392
2.	Education	0.745	0.608	1.224
3.	Family type	-0.910	1.163	-0.782
4.	Housing quality	-0.198	1.173	-0168
5.	Land holding	-0.165	1.188	-0.877
6.	Land under turmeric cultivation	9.319**	1.186	7.857
7.	Social participation	0.792*	0.595	1.330
8.	Experience	-0.021	0.063	-0.339
9.	Annual Income	-8.4E-06	2.71E-05	-0.310
10.	Extension agent Contact	0.288*	0.259	1.113
11.	Mass media contact	-0.040	0.196	-0.205
R^2 = 0.653		Multiple R = 0.808		
**Significant at the 0.01 level		*Significant at the 0.05 level		

Conclusion

The study provides a deep and rich information about the perception of the farmer towards organic cultivation of the turmeric. The study identifies that farmers had very good level of perception toward organic turmeric cultivation (about 75 per cent farmers more perceived towards organic turmeric cultivation) starting from land preparation to post-harvest management. This is because they have a clear idea that inorganic chemicals had a bad effect on the soil health, environment, in our ecosystem and also have an ill effect in our health and in long run it will create a devastating situation. The tribal farmers of the study area simply follow the traditional organic method of farming and wants to maintain the original quality of the turmeric for which the district gets the GI tag. But the indigenous technical knowledge acquired by the farmers need to be tested and refined with modern techniques of crop cultivation so that they can increase the production level and meet the organic turmeric demand of the consumers.

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IMPLEMENTATION OF CRM THROUGH INFORMATION TECHNOLOGY INNOVATION IN MODERN ORGANISATIONS

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ABSTRACT

In today's generation, giving the best service and product is not sufficient to help organizations to expand their businesses and increase profit. Building sustainable and healthy relationships with customers have also become an utmost priority. To build trust, retain faith, and gain retention (attracting the existing customers) CRM solutions are embedded in the systems of different organizations to enable a more interactive and lively approach to meet the customer demands and track the user experience. CRM uses the latest technologies in IT to fuel and meet the growing expectations of the userbase. CRM enables businesses to implement a more data-driven approach to skyrocket their profits. Models which include CRM solutions have benefitted miraculously. The top trends of CRM in the coming data will be in AI, machine learning, automation, data integration, and distribution tools. CRM boosts sales by collecting better revenues, storing customer interactions, and then retrieving the data, this benefits the associates in better serving the customers which assures hyper sales growth.Sample of 149 respondents was collected from respondents through, a "standard questionnaire," which was created on five-point interval scale.

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Keywords: Innovation, Customer Interactions, Associates, Automation, Processing

Introduction

CRM goes by Customer Relationship Management. CRM initially referred to a customer database where the contact information of customers and their addresses, etc. used to be recorded to keep a track of their purchasing patterns. However, today CRM means a plethora of applications and relationship intelligence that is stored by the companies as a piece of essential information for the entire customer relationship management. The definition was changed as the evolution progressed with the advanced technology and greater connectivity among the masses (Chi, 2021).

The term CRM was first coined in the 1970s, earlier annual surveys and front-line asking were practiced by marketing and management teams to get to know the customer's experiences and demands better. In that era, businesses relied on Standalone Mainframe Systems to record sales but the available technology permitted them to categorize customers into spreadsheets and documents. Farley File was one of the most popular systems that enabled CRM in that era, it was made by James Farley, it was useful to record detailed information of the customer profile and purchase behaviors. This trend was followed by newer systems like Database Marketing(DM), ACT! etc. ACT! was based on the theory of Digital Rolodex, which revolutionized CRM. As we progressed into industrialization, the customers increased rapidly, thus front-line asking and annual surveys became an impossible feat to carry out. Therefore, the industrialists and the marketers came with this idea of CRM which would help them track the customer's journey easily which can be further used to increase their sales and improve their services (Pedron, et al., 2018).

Customer demands and needs are growing day by day. To meet these needs there is also a growing call for technology innovation and newer channels to fulfill the requirements of the market thereby improving Customer Relationship Management (CRM). All the interactions, events, transactions, and touchpoints are part of the CRM which will enable the sellers to meet the growing demands of their customers more readily and effectively. CRM technology platforms are a group of applications that help the customer and management interactions by efficient collection and processing of customer contacts, data, entries, word of mouth, feedbacks, accounts in one main storage database. This database also includes information related to leads, sales, profit, future implementations, strategies,

marketing opportunities in the same database (Lin, et al., 2010).

The database can be accessed by sales, marketing, accounts, services, management, and other departments of the company to improve the CRM better knowing the behaviors, needs, purchase patterns, expectations of the existing and potential customers. The first companies to include embedded CRM modules around 2005 were Oracle, SAP, Peoplesoft, Navision, they enhanced their capabilities, increased their sales and capabilities by implantation of CRM. Though popularization and rigorous use of CRM was done by Siebel, Gartner, and IBM. Today, CRM is used by more or less every other digital company as it has become a necessity (Altarifi, 2020).

Literature Review

According to many surveys done all over the world, it was found that around 80% of the companies in the USA use AI in their organizations to aid and enhance their capabilities. In this era of the rapidly evolving world of technology, we see AI helping CRM platforms in the given ways:

Customer service: chat box bots are used in websites of different organizations to handle their customer requests, queries, support, and guides. Through this chat, box information is now recorded and stored through CRM applications that are then leveraged for different applications and studies in marketing. For example; suppose in an insurance policy website the customer is interested in learning about the policies, available options, terms, and conditions. In that case, the chatbox with AI technology, can interact with the person by itself and collect necessary information like their name, address, income, passport, pan card, etc. which then can be used by this AI bot to go through the available options and help the customer by suggesting them a suitable vehicle in their budget. These AI bots are very smart and can learn from the feedback they get from the customers and improve themselves automatically (Lokuge, et al., 2020).

This promotes readily available services to a huge number of customers without having to employ an actual human being to sit on the table for 24 hours. This feedback loop that the bot gets can be taken up by the developers and can be further used for more improvements and better interaction layouts. Second, leading management can also be handled by AI. Thirdly, AI can also predict the next best option available in any strategical scenario. It does that by using business rules and corporate models. AI coupled with CRM software can recommend steps to assist the customer, it can also appoint an associate to the customer to help them with their problems, it can also process service requests and see-through available sell opportunities. As associates take up the calls of the customers, AI can navigate and analyze the data given by the customer to look for an offer to purchase, add-ons, and conditions of the product (Ghafari, et al., 2011).

The offers and guidance given by an AI bot are not generic but based on the circumstances and demands of the customer. The use of AI here is to guide the service associate and relief his work in finding the entries, data, and other information related to the customer in line. This saves time for both the service provider and user. This way the problem of the user is solved in an instant and the association does not have to go through the tiresome process of going through the registers/databases to find the optimal solution. AI not only finds the possible solutions but also keep a record of the issue that was faced by that particular individual and use the acquired knowledge to help associate and other users in the future (Sjöberg & Wallgren, 2013).

IT innovations in processing and automating advances are also a part of CRM technologies. Organizations have been using CRM technology on daily basis to automate basic work mechanisms, through which events and actions will trigger automatically by set commands or requests. Automated emails and texts are a major part of automated services. Customers receive emails and texts messages when a portal has some information to convey to the user, they are provided with links to further process, success texts, pending and submission notifications duly on time with the help of such automated bots. Suppose, a user submits a service request, the AI goes through the request and directs procedures or appoints an associate to the customer readily. It then

checks for advances in the case and waits until it gets any response from the user or the associate. If the query and issue are resolved, the request is then closed automatically by informing the customer that their case has been solved and their request is closed (Battor & Battor, 2010).

Another crucial tool in CRM is task automation. What is task automation? It defines the set of works that should be appointed to a machine and the set of work that is to be completed by humans. It categorizes the tasks by their difficulty, complexity, and nature, then it decides how the task should be taken and solved. Finally, it decides who should be the right candidate that can deal with the situation. Of course, all of this is pre-decided by management teams and coded accordingly such that the AI can work as an associate manager than can deploy and appoint works for the employees or the machines by itself. Task automation means there is a structured and prescribed system for what steps might/ should be taken based on the input received, user profile, and other terms and conditions. The tool that is used by task automation consists of processes and low codes by business-oriented models. For example, a company will have their business analyst take up a task that decides how to process an insurance application using a 3d model tool that would take the analyst through every stage, decision making steps, and predictive results during the interaction with the automated tool (Aljawarneh, et al., 2020).

Work distribution is one more area that can be achieved by automated processes. Work distribution refers to the specification of tasks and duties that can be performed by a certain set of skilled individuals or employees of the organization. Such tasks and duties can be processed by automation with code and technologies that will assign the work by going through the profiles of the associates and employees that possess the abilities and skills to complete the assigned work. This may also mean the capability of a system to assign tasks to even other professionals that may not be a part of the organization by possessing the quality and skill to complete the task. Thus, work distribution can be both external and internal based on the circumstances (Farmania, et al., 2021).

There exist many Businesses Process Monitoring (BPM) solutions that assigned work by distributing and routing while tracking the performance of the work that has been appointed. These are achieved by highly integrated systems throughout enterprises (Ahearne, et al., 2007).

Data Integration is one more aspect of IT innovations that has been popularized recently. CRM systems store and process huge amounts of data. With the technological advancements, CRM technologies currently integrate corporate models and systems such as accounting, Enterprise Resource Planning (ERP), claims to process, and billings that recoup transactional data. Then how is data integrated? Data is integrated with the help of third-party applications and the internet of things (IoT). Talking about third-party systems refers to accessing third-party applications like Google Maps, Text messages, Cellular Telecommunication services, digital profile records, web searches, etc.are used to integrate with the systems of the services to help and assist them. For example, a lot of the home delivery services take the assistance of Google Maps to reach the desired locations and residences of the customer to deliver their orders. This is mainly done because for a local delivery agency to build their mapping application will be very expensive and unaffordable. So, the tale they help of existing applications to aid their services (Bahrami, et al., 2012).

IoT (Internet of Things) are systems installed in refrigerators, automobiles, medical devices, home appliances, smart TVs, smart glasses, smartwatches, etc. To make a realistic idea of how IoT functions in such devices, we can break the major components of these devices that use IoT directly. The following are the breakdown of the components: sensors, gateways, cloud databases, middleware, firmware, and protocols, all of these technologies use IoT to function. IoT sensors, sensors, and protocols are used heavily in the tuning of such devices. IoT firmware is usually coded in python, node.js, or C in these devices. The cloud databases of IoT can be classified into transformation as a service (PaaS) and

Infrastructure as a Service (LaaS).IoT is allowing digital marketers to collect and gather customers' behavior, purchasing patterns, location, and other information like it was never done before. Previously, the efficiency of contextual marketing was limited to only telephonic conversations or verbal reviews that marketers had to take from customers to understand their needs, behavior, desires, and expectations (Chung, et al., 2012).

Another innovation that is currently ongoing is the implementation of blockchains. Blockchains are interlinked records called blocks. They create an open archive that tracks the transactions done between the user and parties. It verifies if the transactions are done are secure are safe. Deployment of blockchain can be done cheaply in our homes, which works as a secured layer between gateways and devices that constantly check for any data breaches and suspicious activities without affecting the written code. Presently, people are not educated and aware of the functions of blockchain in ensuring safety when dealing with IoT but with the advancement of time, slowly but surely blockchain will play a bigger role in ensuring security to us (Ahn, et al., 2003).

Objectives

1. To identify the benefits of implementation of CRM through Information Technology.
2. To know the impact of CRM implementation through Information Technology.

Methodology

The study is empirical in nature. 149 respondents participated in the study. The data was collected from them through a structured questionnaire. Mean and t-test application was done to identify the results. The method of sampling was convenience sampling.

Finding of the study

Table 1 displays the gender, where male respondent is 57.72%, and female respondent is42.28%. The age of the respondents were 20 and 25 years are 27.52%, those between the Ages of 25 to 30 years are 39.60%, and one who are 30 years & above are 32.88%. Looking at the Experience, 1 – 3 years are 22.15%, 3 – 5 years are 43.62%, and 5 years & above are 34.23%.

With reference to the type of organization, in Retail, respondents are 31.54%, Consumer durables are 35.57%, and other industries are 32.89%.

Table1 Respondent's Details

Variables	Number of respondent	%age
Gender		
Male	86	57.72%
Female	63	42.28%
Total	**149**	**100%**
Age		
20 to 25 years	41	27.52%
25 to30 years	59	39.60%
30 years & above	49	32.88%
Total	**149**	**100%**
Experience		
1 - 3 years	33	22.15%
3 – 5 years	65	43.62%
5 years & above	51	34.23%
Total	**149**	**100%**
Type of Organization		
Retail	47	31.54%
Consumer Durables	53	35.57%
Other Industry	49	32.89%
Total	**149**	**100%**

Table2 Benefits & Impact of implementation of CRM through Information Technology

Sr. No.	Statements	Mean Value	t-Value	Sig.
1.	Information Technology in CRM helps organization to build lively and interactive interaction with their customers	4.01	13.40	0.000
2.	Technological CRM helps in efficient collection and processing of customers data and feedback	4.23	13.53	0.000
3.	IT enabled CRM helps understand customer's needs and demands more deeply	4.39	17.26	0.000
4.	Customer service chat boxes are helpful to handle customer's queries and requests	4.13	13.37	0.000
5.	AI bots helps customers with all their queries related to particular products and services and collect feedback for improvements	4.27	13.59	0.000
6.	AI coupled with CRM appoints an associate for the customer to help them process service requests	4.06	14.06	0.000
7.	Technology enabled CRM not just resolve issues, but also keep record of it for future reference	4.19	13.09	0.000
8.	Automated emails and personalized messages to reach directly to customers	4.10	13.66	0.000
9.	AI chat bots deal with pre-sale and post-sale servicing in real time.	4.30	15.38	0.000
10.	Technological CRM keep records of queries, behavior pattern to review	4.33	14.23	0.000

Table 2 displays the Mean values for statement with reference to the "Benefits & Impact of implementation of CRM through Information Technology," Looking at the benefits & impacts, the highest mean score of 4.39 is for the statement "IT enabled CRM helps understand customer's needs and demands more deeply." The second highest mean value of 4.33 is about the "Technological CRM keep records of queries, behaviour pattern to review," "AI chat bots deal with pre-sale and post-sale servicing in real time" have scored mean value of 4.30. Statement "AI bots helps customers with all their queries related to particular products and services and collect feedback for improvements" and "Technological CRM helps in efficient collection and processing of customers data and feedback" has the mean score of 4.27 and 4.23 respectively. "Technology enabled CRM not just resolve issues, but also keep record of it for future reference" has the mean value of 4.19. The statement "Customer service chat boxes are helpful to handle customer's queries and requests" shows the mean score of 4.13. The last three statements are "Automated emails and personalized messages to reach directly to customers", "AI coupled with CRM appoints an associate for the customer to help them process service requests," and Information Technology in CRM helps

organization to build lively and interactive interaction with their customers scored the mean score for these statements are 4.10, 4.06, and 4.01 respectively. T-value of all statements in context of Benefits & Impact of implementation of CRM through Information Technology are significant, because t-value statements are found to be positive and significance value also less than 0.05.

Conclusion

CRM innovation trends can be categorized into four major touchpoints. The first and the most effective of them is Artificial Intelligence (AI) and AI-powered customer support. Artificial intelligence (AI)contains a plethora of technologies like machine learning, language processing, predictive analytics, and robotics. Companies using CRM are heavily investing in AI, trying to acquire and build capacities that leverage AI to optimize and maximize customer interactions. Organizations implementing and using the above technologies and innovation trends have the potential to skyrocket their revenues and boost their sales dramatically. It is important to note that CRM technologies when implemented correctly can help organizations achieve miraculous feats. Given that, if it is implemented incorrectly can harm the entire customer experience and complicate things for the associates working

(Piskar and Faganel, 2009). T-test has been done to find out the outcome of the research, all the statements are found to be significant as the significant values for all statements is less than 0.05.

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EFFECT OF PANDEMIC ON THE NEXUS BETWEEN LIQUIDITY AND FINANCIAL PERFORMANCE: EVIDENCE FROM SELECTED ALUMINUM COMPANIES IN INDIA

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ABSTRACT

The present study aims to investigate the effect of the world pandemic situation on liquidity management and its impact on the financial performance of the selected Aluminium companies listed in the BSE. The secondary financial data has been collected for nineteen Aluminum companies listed in the BSE from 2017 to 2021. The researchers has been used proxy variable pandemic for the pandemic years to examine its impact on the liquidity management and financial performance has been measured in terms of ROA and ROE. The findings of the study reveal that there is no significant relationship between liquidity and profitability of the Aluminium manufacturing industries in India. However, a significantly positive relationship has been observed between QR and ROA. This observation may not be a chance happening but the industries need to keep an eye on the liquidity position as it affects the ROA. ROCE is not at all affected by the liquidity but the leverage of the industries needs to be increased to improve ROCE as it exhibits a significantly positive relationship. Moreover, the pandemic situation has not at all affected the liquidity and profitability position.

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Introduction

On the corporate landscape, optimal financial structures are typically presented in two-time spans; short-term and long-term. Working capital management and liquidity management are the two areas that reflect the short-term financial as well as operational efficiency of an organisation. Liquidity management, along with working capital management, has recently gained popularity as a result of the global financial crisis induced by various external forces. Liquidity management attempts to manage current assets and current liabilities by establishing the ideal amount of each element of current assets and current liabilities in the company. Working capital management has been critical for increasing the value of corporates claimed by many researchers (Smith 1980). Efficient liquidity management necessitates careful consideration and judicious deliberation (Jose et al. 1996).

Working capital management has a significant impact on the business liquidity and profitability (Shin and Soenen, 1998). The optimal degree of working management can only be ensured through a proper liquidity and profitability equilibrium, which increases a firm's value. Optimizing the working capital involves lowering the amount of working capital without compromising the maximum likelihood of earning (Ganesan 2007). In business decision making, management of working capital seeks to achieve a balance between liquidity and profitability. Corporate executives strive to develop successful strategies to achieve optimal liquidity while maximizing profits.The theoretical framework of working management includes methods that are primarily characterized as aggressive and conservative approaches. The aggressive working capital policy emphasises low liquidity and high profitability at the expense of a higher level of risk. Conservative working capital approaches, on the other hand, strive for a high level of liquidity reduced level of profitability and a low level of risk. Between these two extremes, the middle path termed as the moderate approach involves maintenance of average liquidity, profitability and risk. Financial managers must demonstrate their dexterity across these three spectrums. In simple terms, a company must establish a delicate balance between liquidity and profitability while carrying out its everyday activities.

Working capital management is built around liquidity management. A proper liquidity

management strategy is critical for all sorts of businesses. The relevance of a firm's liquidity may be assessed from a variety of perspectives. For instance, short-term creditors are considered the most sensitive aspect of liquidity management. As a result, from a creditors perspective, the liquidity position of a company should be substantial. Furthermore, a certain amount of cash is indeed necessary to make quick payments. It enables businesses to take advantage of discount opportunities.

Receivables are yet another element of liquidity that can help with revenue growth. Likewise, account payables are a critical component of short-term financing that must be paid in time. The need for liquidity management is further shown by some researches demonstrating firms' reliance on current liabilities due to an unwillingness to acquire long-term finance which is a costly source of funds (Petersen and Rajan, 1997). The payment of current liabilities is referred to as liquidity management includes the dues that must be paid within a short period which is not possible without adequate liquidity. Therefore, proper liquidity management guarantees that companies do not suffer a liquidity shortage or liquidity splurging. All businesses must maintain an optimal amount of liquidity. Failure to maintain an adequate amount of liquidity could result in two scenarios: surplus or shortage of liquidity. Typically, corporations do not consider improving liquidity management until they are in a crisis scenario (Nicholas 1991). A company's liquidity status has, therefore been assessed using the liquidity ratios like current ratio, quick ratio, and cash ratio.

Research Problem

Excessive liquidity indicates that funds are tied up in the liquid assets of a company, thereby making the fundsunproductive and cannot be used immediately for any other operational requirements that may lead to increased profitability.As a result, businesses should strive to find the right balance between the competing goals of liquidity and profitability. The liquidity of the company should neither be excessively high nor too low. Excessive reliance on liquidity suggests a build-up of idle money that does not generate any benefit for

the company. Insufficient liquidity, on the other hand, may undermine the goodwill, degrade its credibility, and may result in the forced liquidation of the firm's assets leading to closure. Thus, the current research is being carried out to determine the relationship between liquidity and profitability of listed trading aluminium industries in India.

Literature Review

Many studies explain that liquidity is regarded as an organization's ability to meet its short-term cash obligations promptly. According to a few schools of thought, having a large amount of cash on hand indicates that companies will be able to meet their financial commitments effectively when they are due without defaulting (Syed 2015; Lyndon and Paymaster 2016; Raykov 2017; Ejike and Agha 2018; Abubakar et al. 2018). The liquidity of assets is determined by the forms of assets owned by companies and the convenience with which those assets may be converted into cash. Short term Investments and bonds, for example, are classified as liquid assets because they may be exchanged into cash easily without losing much value; however, assets such as land, buildings, and machinery, require more time to convert into cash (Lyndon & Paymaster, 2016; Mohd & Asif, 2018; Mulyana & Zuraida, 2018; Onyekwelu et al. 2018).

Multiple research articles on liquidity and profitability have been reviewed in this paper to outline an understanding of the behaviour of these two variables in large scale businesses. Several studies have focused on the relationship between company liquidity and profitability across a wide range of nations, using a variety of factors to investigate the presumed subject.

A study by Vishnani & Shah (2007), specially focussed on the trade-off between liquidity and profitability in the case of the Indian Consumer Electronics sector, claims that an optimal level of working capital is highly required to enhance the value of the firm measured in terms of profitability. The findings of the study are based on the financial data collected for 10 years starting from 1994–95 to 2004–05.

Chakraborty (2008) has examined the correlation between working capital management and profitability in

selected Indian pharmaceutical industries. His study draws a distinction between two schools of thought. Firstly, only working capital is not a significant determinant of profitability, therefore there may be a negative relationship between them. Secondly, it remains a fact that a company without investing in working capital, cannot sustain its sales and output since all the fixed assets would remain inactive without working capital.

Similarly, Sharma& Kumar (2011) looked at the impact of working capital on the profitability of Indian businesses. The research examined at 263 non-financial BSE 500 indexed companies in India. The data collected from the years 2000 to 2008 reveal a contradicting result from the other studies that have been done on the same subject. They conclude that in the landscape of Indian firms, there exists a strong relationship between working capital management and profitability.

Bagchi & Khamrui (2012) investigated the relationship between working capital management and profitability of the FMCG companies in order to identify the factors that have the greatest impact on profitability. The study examines the financial data of ten FMCG (Fast Moving Consumer Goods) firms over a ten-year span, from 2000–01 to 2009–10. As per the findings, there exists a significant inverse relationship exists between the determinants of working capital management and profitability.

The relevance of optimum working capital in the capital goods industry was highlighted by Kaur & Singh, (2013). They used 10 years of financial data from 2000-01 to 2009-10 of 14 selected capital goods manufacturing firms listed in BSE, India. According to the report, a suitable amount of working capital leads to effective liquidity and profitability in the selected organisations. They used three parameters to arrive at the conclusion such as; Performance Index, Utilization Index, and Efficiency Index. Further, the research proposed a series of measures to help Business organisations become more profitable.

Using a sample size of 18 firms, Bagchi& Chakrabarti (2014) investigated the impact of liquidity on the profitability arena of India's fast-moving consumer goods sector. The study spans a ten-year period, beginning with 2001 and ending with 2011. The study demonstrates a strong negative relationship between liquidity indicators and firm profitability using a variety of statistical tools. In conclusion, it is clear that the research literature is awash in studies on working capital, liquidity, and profitability.

Liquidity and profitability are the two important aspects of any business which need continuous observation and the movement of one parameter invariably affects the movement of the other (Puneet & Parmil 2012; Garcia & Martinez 2007). Therefore, a balance needs to be maintained between these two variables (Dash & Hanuman, 2008). According to the trade-off theory, an equilibrium trade-off need to be established between liquidity and profitability as the focus of any industry is to keep an ideal level of liquidity that achieves an optimum level of profitability for the business (Orshi, 2016).

The costs of maintaining cash include the minimum rate of return on current assets as a result of the liquidity premium and possible tax burdens, whereas, the benefits of keeping cash include avoiding exchange costs to raise reserves and not having to give up resources to meet obligations, as well as the ability to use liquid capital to support projects if other forms of financing are unavailable (Dash & Hanuman, 2008; Saluja & Kumar, 2012; Orshi, 2016). As per the trade-off theory, enterprises with a high level of leverage incur substantial costs in repaying their debt, putting their financial sustainability at risk. Holding cash has become a concern for both small as well as large businesses at a certain stage, necessitating a state of equilibrium between liquidity and profitability in order to maintain the appropriate amount of liquid assets (Lazaridis & Tryfonidis, 2005; Akella, 2006; Raheman & Nasr, 2007; Samiloglu & Demirgunes 2008; Kusumawati & Setiawan, 2019; Christopoulos et al., 2019; Czerwińska-Kayzer et al. 2021). Numerous studies have been conducted on the liquidity and profitability analysis and the findings of which give conflicting outcomes for different companies. For example, a study by Kanga and Achoki (2017) on the agriculture industry in Kenya revealed a positive relationship between liquidity and profitability measured in terms of ROA and ROE. Similar

observations were made by Ali and Bilal (2018) and Kimondo et al. (2016) in their studies conducted on industrial firms in Jordan and non-financial firms in Kenya. On the other hand, Schulz (2017) reported a negative relationship between liquidity and profitability ROA in their study conducted on 3,363 unlisted Dutch small and medium-sized enterprises. However, profitability measure ROCE was reposted to be positively predicted by the firm's liquidity.

Similarly, in India, a recent study conducted by Saripalle (2018) observed a positive relationship between liquidity and ROA of the logistic industry. Likewise, Syed (2015) in his study on some utility firms in India noticed an inconsequential impact of liquidity on the economic viability of the companies. On the contrary, Jepkemoi (2017) observed no significant relationship between a firm's liquidity and profitability.Opoku (2015) also observed that firms liquidity measured in terms of the cash conversion cycle, average collection period, average payment period have no significant role in affecting the returns. Mohd and Asif (2018) in their study conducted on ten years of financial data of SAIL (Steel Authority of India ltd.) came up with the conclusion that the current ratio has a positive impact on the ROCE of the industry under study. Similar outcomes also observed by a few other researchers conducted studies on different listed companies of several countries like Mongolia (Batchimeg 2017), Kenya (Nyamiobo et al. 2018), Indonesia (Mulyana & Zuraida 2018), Turkey (Isik 2017),non-financial quoted firms in Kenya (Banafa et al. 2015), energy sector in Turkey (Mehmet & Mehmet 2018)manufacturing firms in India (Swagatika & Ajaya 2018), pharmaceutical establishments in Nigeria (Ejike & Agha 2018),pharmaceutical and chemical sector in Bangladesh (Kaysher & Rowshonara 2016), Commercial banks in Bangladesh (Akhter, 2018), Cement Industry in India (Neupane, 2020), the manufacturing sector in Srilanka (Madushanka & Jathurika, 2018).In contrary, some studies also gave a conclusion that liquidity has nothing to do with the profitability of the manufacturing firms in Kenya (Ayako et al. 2015), the sugar industry in India (Ashutosh & Gurpreet 2018), non-financial companies of

Saudi Arabia (Mohammed et al. 2015), non-financial stock exchange-listed firms in Ghana (Mohammed and Yusheng 2019),energy and petroleum sector firms in Kenya (Mutwiri 2015).

So, from the above observations, it can be inferred that the study on the aluminium manufacturing sector in India is rare and as such no studies till now have verified the impact of the global pandemic on the nexus between liquidity and profitability of such selected industries. Moreover, the prior studies conducted in different countries gave contradicting outcomes even for similar industries. Therefore, it is worth investigating the role of liquidity management on afirm's profitability in the Indian aluminium industries which has both unique global competitiveness and market share in India.

Objectives of the Study

Following are the objectives of the present study.

- To understand the relationship between liquidity and profitability in a profit-driven business enterprise.
- To determine the nature and extent of the relationship between liquidity and profitability.
- To examine the effect of the pandemic on the liquidity position of the aluminium sector.
- To examine the impact of the pandemic on the relationship between liquidity and profitability.

Hypothesis of the Study

Following are the hypotheses framed based on the objectives.

1. Liquidity has no significant impact on the profitability of the selected firms.
2. The global pandemic has no significant impact on the liquidity of the selected firms.
3. The global pandemic has no significant impact on the profitability of the selected firms.
4. The global pandemic has no significant impact on the nexus between liquidity and profitability of the selected firms.

Research Methodology

Sample and Data: Secondary data have been obtained from the Money control website for the listed aluminium manufacturing industries listed in the Bombay Stock Exchange (BSE) for the analysis. In addition to this, different articles of repute have been referred to and reviewed to draw a clear understanding of what have already been studied and what are yet to be studied which have been represented as the research gap. The study used five-year financial data starting from 2017 to 2021 of 19 selected aluminium industries. This gives rise to a sample of 95 company-year data was analysed using statistical softwareEViews version 10. A fixed and random effect model has been developed to verify the relationship between the dependent and independent variables.

Variables: Dependent variables used in this study includethe Return on Asset (ROA) and Return on Capital Employed (ROCE). The independent variables includethe Current Ratio (CR), Quick Ratio (QR), Inventory Turnover Ratio (ITR), Debtors Turnover Ratio (DTR), Number of Days in Working Capital (NDWC). The control variables include the firms' Age, Size, Leverage, pandemic year. The detailed estimation formulas of the ratios used in this paper have been provided in Table1.

Table 1: Variables Used in the Analysis

Variables	Explanation
Return on Asset (ROA)	Net Income / Total Assets
Return on Capital Employed (ROCE)	Net Income / Total Capital Employed
Current Ratio (CR)	Current Assets/Current Liabilities
Quick Ratio (QR)	(Current Assets - Inventory)/ Current Liabilities
Inventory Turnover Ratio (ITR)	Cost of Goods Sold/ Average Inventory
Debtors Turnover Ratio (DTR)	Credit Sales/Average Debtors
Number of Days in Working Capital (NDWC)	(Average Working Capital X 365) / Sales
Firms Age	Log (Firms Age)
Firms Size	Log (Total Assets)
Leverage	Long term Debt/Owners Fund
Pandemic Year	Proxy of the year when the effect of Pandemic is experienced taken as '1', otherwise '0'

Source: Authors own interpretation

Results and Discussion

Descriptive

Table 2 provides detailed information on the descriptive statistics of the variables included in the analysis. The study usesfive-year financial data starting from 2017 to 2021. The average age of the selected Aluminium industries is 32.79 years with a standard deviation of 12.40. The age of the selected industries range from 7 to 63 years with the maximum number of companies are as old as 31 years. The information relating to profitability measures ROA and ROCE shows a mean value of 93.50 and 8.35 respectively and ROA has a higher standard deviation compared to ROCE. Moreover, ROA has a range of -81.57 to 685.90 and ROCE has a range of -137.62 to 71.28. The measures of liquidity such as the CR and QR show a mean value of 3.21 and 4.69 respectively with a standard deviation of 9.29 and 9.41 which are nearly equal. The CR of the selected industries shows values as low as 0.15 and as high as 72.87. As such, ITR shows a mean value of 8.22 with a standard deviation of 8.91 ranging between 0 to 61.40 which is nearly equal to the DTR with a mean of 9.14, SD of 11.35 with a range of 0 to 62.31. On the other hand, NDWC shows very fluctuating or volatile results with a mean of 277.55 days and SD of 1066.54 days. However, the median value is 72.89 days. The leverage of the selected firms ranges between 0 to 3.58 with a mean value of 0.18 and a standard deviation of 0.45. The proxy variable pandemic has two options like 0 and 1 with a mean of 0.40 and SD of 0.49.

Table 2: Descriptive statistics of the Variables

Variables	Mean	Median	SD	Minimum	Maximum
FY	2019.00	2019.00	1.42	2017.00	2021.00
AGE	32.79	31.00	12.40	7.00	63.00
ROCE	8.35	8.22	21.26	-137.62	71.28
ROA	93.50	52.28	121.16	-81.57	685.90
CR	3.21	0.86	9.29	0.15	72.87
QR	4.69	2.04	9.41	0.10	72.87
ITR	8.22	6.46	8.91	0.00	61.40
DTR	9.14	5.33	11.35	0.00	62.31
NDWC	277.55	72.89	1066.54	-3246.89	7929.77
LEV	0.18	0.06	0.45	0.00	3.58
Pandemic	0.40	0.00	0.49	0.00	1.00

Source: Authors own interpretation of secondary data

Correlation

Table 3: Correlation Matrix of the Variables

	ROA	ROCE	CR	QR	ITR	DTR	NDWC	LEV	LAGE	LSIZE
ROA	1									
ROCE	0.166	1								
CR	0.085	-0.022	1							
QR	0.052	-0.050	0.952**	1						
ITR	-0.082	0.068	-0.222*	-0.111	1					
DTR	0.078	0.030	-0.178	-0.260*	-0.020	1				
NDWC	0.006	-0.042	0.231*	0.345**	0.076	-0.198	1			
LEV	-0.077	0.197	0.326**	0.271**	-0.096	-0.057	-0.049	1		
LAGE	0.181	-0.051	0.124	0.075	-0.030	0.045	-0.077	0.084	1	
LSIZE	-0.355**	-0.003	-0.147	-0.204*	0.347**	-0.129	-0.425**	-0.008	0.077	1
Pandemic	0.029	-0.043	-0.046	-0.017	-0.104	0.051	0.013	-0.105	0.104	-0.144

Source: Authors own interpretation of secondary data

The inter variable correlation given in Table 3 provides vital information about the relationship between the dependent and independent variables. It can be observed that the dependent variables ROA and ROE are not having any significant correlation with the independent variables. Further, a significant correlation between the independent variable CR and QR indicates the presence of multicollinearity. Therefore, in the regression model, only one variable out of the two prominent measures of liquidity i.e. CR and QR need to be used. Due to the robustness of the quick ratio as a measure of liquidity, it has been used in the final regression models.

Regression Model

Two different regression models were developed for each dependent variable. Table 4 presents the regression model for ROA with three regression outcomes; panel OLS, Random Effect and Fixed Effect model.

Table 4: Regression Model for Measures of Liquidity predicting ROA

Dependent Variable:	ROA			ROA			ROA		
Method:	Panel Least Squares			Panel EGLS (Cross-section random effects)			Cross-section Fixed Effects model		
Variable	β	t	p	β	t	p	β	T	p
QR	0.046	0.414	0.680	0.085	1.995	0.049	0.086	2.012	**0.048**
DTR	-0.033	-0.323	0.747	0.019	0.168	0.867	-0.051	-0.350	0.728
NDWC	-0.231	-1.936	0.056	0.007	0.149	0.882	0.023	0.488	0.627
ITR	0.107	0.996	0.322	-0.028	-0.437	0.663	-0.035	-0.512	0.610
LEV	-0.271	-1.204	0.232	0.016	0.182	0.856	0.035	0.387	0.700

	β	t	P	β	t	p	β	T	p
LSIZE	-1.158	-4.207	**0.000**	-0.094	-0.568	0.572	0.058	0.321	0.749
LAGE	1.189	2.263	**0.026**	0.875	0.981	0.329	0.336	0.170	0.866
PANDEMIC	-0.132	-0.659	0.512	0.008	0.098	0.922	0.056	0.509	0.613
C	-1.522	-1.964	0.053	-1.291	-0.981	0.330	-0.534	-0.184	0.854
R-squared	0.219			0.080			**0.929**		
Adj. R-squared	0.147			-0.006			**0.902**		
S.E. of regression	0.929			0.331			0.315		
F-statistic	3.019			0.933			34.163		
Prob(F-statistic)	0.005			0.494			0.000		
Durbin-Watson stat	0.260			0.941			1.329		

Correlated Random Effects - Hausman Test

Test Summary	Chi-Sq. Statistic	d.f.	Prob.	Fixed Effects model is preferred as Hausman Test is showing a p-value less than 0.05 (Rejected)		
Cross-section random	15.690	8.000	**0.047**			

Source: Authors own interpretation of secondary data

As per the panel OLS model, it can be observed that only the size of a firm and its age are significantly predicting ROA, whereas the other measures of liquidity are not significantly related to ROA of the Aluminium industries. Similar observations were also observed for the random-effects model where all the variables in the equation are not predicting the dependent variable. Hausman test results give the inference that the fixed effect regression model is appropriate for interpretation as the hypothesis underlying the Hausman test i.e. "Random effect model is appropriate" has been rejected with a p-value less than 0.05. Now as per the cross-section fixed effects model, it can be observed that quick ratio is significantly and positively predicting the ROA of the selected industries which allows us to reject the null hypothesis H01 to conclude that the measure of liquidity QR is significantly predicting the ROA of the selected industries. This observation is in confirmation with the earlier findings reported by several authors who stated that there exists a positive relationship between liquidity and profitability (Bagchi & Khamrui 2012; Kimondo et al. 2016; Mohd and Asif 2018; Swagatika & Ajaya 2018; Ali and Bilal 2018). On the contrary, the other measures like the ITR, DTR, NDWC are insignificant in predicting ROA which is in accordance with the findings of Ashutosh & Gurpreet (2018), Ayako et al. (2015) and Mohammed and Yusheng (2019). Moreover, the Pandemic proxy is also insignificant in explaining any change in ROA of the Aluminium sector.Thus, it can be concluded that there is no significant effect of the pandemic on the relationship between liquidity and profitability which rejects the hypothesis H04.

Table 5: Regression Model for Measures of Liquidity predicting ROCE

Dependent Variable:	ROCE			ROCE			ROCE		
Method:	Panel Least Squares			Panel EGLS (Cross-section random effects)			Cross-section Fixed Effects model		
Variable	β	t	P	β	t	p	β	T	p
QR	-0.098	-0.805	0.423	-0.098	-0.848	0.399	-0.104	-0.793	0.431
DTR	0.007	0.058	0.954	0.007	0.061	0.951	0.289	0.648	0.519
NDWC	-0.037	-0.284	0.777	-0.037	-0.299	0.766	-0.104	-0.733	0.466
ITR	0.104	0.887	0.378	0.104	0.934	0.353	0.159	0.771	0.443
LEV	0.523	2.117	0.037	0.523	2.228	0.029	0.917	3.335	**0.001**
LSIZE	-0.157	-0.522	0.603	-0.157	-0.549	0.584	-1.229	-2.225	0.029
LAGE	-0.305	-0.529	0.598	-0.305	-0.557	0.579	1.285	0.212	0.833
PANDEMIC	-0.027	-0.123	0.902	-0.027	-0.130	0.897	-0.207	-0.609	0.544
C	0.385	0.453	0.652	0.385	0.477	0.635	-1.843	-0.208	0.836

R-squared	0.0635		0.064		0.331
Adj. R-squared	-0.0236		-0.024		0.076
S.E. of regression	1.0171		1.017		0.966
F-statistic	0.7291		0.729		1.297
Prob(F-statistic)	0.6654		0.665		0.196
Durbin-Watson stat	2.6647		2.665		3.355

Correlated Random Effects - Hausman Test

Test Summary	Chi-Sq. Statistic	d.f.	Prob.	Fixed Effects model is preferred as Hausman Test is showing a p-value less than 0.05 (Rejected)
Cross-section random	17.970	8.000	**0.022**	

Source: Authors own interpretation of secondary data

On the other hand, the regression model predicting the ROCE of the Aluminium industries given in Table 5 also provides a significant p-value for the Hausman test confirming the appropriateness of the fixed-effects model. It can be observed that only the leverage of the selected industries is positively and significantly predicting ROCE. This means an increase in the leverage can favour the ROCE of the Aluminium sector. In contrast, the measures of liquidity are not significant at all to infer that there is no relationship between liquidity and ROCE of the selected industries. As such, there is no significant effect of the pandemic situation has been observed on the profitability parameter ROCE. This observation is in line with the earlier findings that claimed an insignificant relationship between liquidity and ROCE (Ashutosh & Gurpreet 2018; Ayako et al. 2015; Mohammed and Yusheng 2019)

Further, an independent samples t-test given in Table 6, gives an insignificant outcome for the difference between the mean values of the measures of profitability. Besides, it has been observed that there is no significant effect of pandemic on the liquidity and the profitability of the selected industries. This observation accepts the null hypothesis H02 and H03 indicating an insignificant impact of the pandemic on the liquidity and profitability position.

Table 6: Independent Samples t-test for Equality of Means

Variables	Levene's Test for Equality of Variances	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
ROCE	Assumed	1.246	0.267	0.415	93	0.679	0.088
	Not assumed			0.479	80.841	0.633	0.088
ROA	Assumed	0.751	0.388	-0.276	93	0.783	-0.058
	Not assumed			-0.260	63.527	0.796	-0.058
CR	Assumed	0.537	0.465	0.447	93	0.656	0.095
	Not assumed			0.491	92.310	0.624	0.095
QR	Assumed	0.056	0.813	0.169	93	0.866	0.036
	Not assumed			0.182	92.999	0.856	0.036
ITR	Assumed	1.458	0.230	1.004	93	0.318	0.211
	Not assumed			1.095	92.808	0.276	0.211
DTR	Assumed	0.730	0.395	-0.492	93	0.624	-0.104
	Not assumed			-0.467	65.201	0.642	-0.104
NDWC	Assumed	1.483	0.226	-0.123	93	0.902	-0.026
	Not assumed			-0.109	49.058	0.914	-0.026

Source: Authors own interpretation of secondary data

Recommendations and Conclusion

The findings of the study can be summarised that there is no significant relationship between liquidity and profitability of the Aluminium manufacturing industries in India. However, a significantly positive relationship was observed between QR and ROA. This observation may not be a chance happening yet the industries need to keep an eye on the liquidity position as it affects the ROA. Whereas, ROCE is not at

all affected by the liquidity position of the selected industries but the leverage of the industries has the potential of improving the ROCE as it exhibited a significantly positive relationship. Moreover, the pandemic situation has not at all affected the liquidity and profitability position.

The findings of the study are not only useful to the selected industries but also to the investors for effective investment decisions. As the pandemic situation and the liquidity measures have no impact on the profitability of the Aluminiummanufacturing sector, investment in this industry would be profitable during such adverse economic situations. The study also providesthe academicians and analysts with precise information regarding the nexus

between liquidity and profitability. The study can be further extended to other sectors like steel, and other metal manufacturing industries to find out whether a similar relationship exists between profitability and liquidity. As such a comparative study is also possible by including different manufacturing sectors with extended years of financial data.

Finally, the study has certain limitations like the analysis of data only for five financial years and the limited number of Aluminium manufacturing industries in India further lowered the total number of observations which may affect the results. However, the inclusion of only a five-years' data is appropriate to analyse the effect of the pandemic year 2019 and 2020.

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FROM LIFE TO LITERATURE: THE IDENTITY OF WOMEN IN JONATHAN SWIFT

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ABSTRACT

Jonathan Swift, the representative satirist of eighteenth century British literature, was both religiously institutionalized and a worldly wise man. Being the Dean of St Patrick's Church Dublin did not stop him from recognizing and looking deep into the lives of the women in his contemporary social setting. The eighteenth century woman, devoid of a formal education and confined to helpless coquetry, was largely dependent upon the admiration of men and a proper marriage, which were her only means to secure an acceptable social life. However, when we come to Swift and look closely at his life and works, we get to observe a starkly unique attitude that the author bears towards women. This paper concerns itself with the distinct approach that Swift exhibits in the context of the identity and intellectual capacity of the female, and how it is informed by Swift's own sense of identity. While on one hand there are generalizations about the usually conceived idea of the woman who was primarily a physical presence than a knowledgeable or spiritual one, what we also see in Swift is an attempt in constructing the identity of women as being intelligent and politically wise. Through some interesting pieces of texts, readers see how on one hand he sought to control the lives of women who belonged to his personal and social spheres, and ventured to alter their minds towards increased credibility on the other.

Keywords: Swift, women, identity, contempt, control, emancipation, fidelity etc.

It was in 1726, three years after Mrs Hester Vanhomrigh had died when Jonathan Swift's *Cadennus and Vanessa*, the poem she had long preserved, was published. He had named her Vanessa, but never intended to publicise their relationship when he had penned it in 1712. Claiming that Vanessa would be created by the Roman Goddess Venus with the attributes of wit, strength and intellect, Swift makes his attempt to pave a path through which men and women could be put upon an equal pedestal-

> Since men allege, they ne'er can find
> Those beauties in a female mind
> Which raise a flame that will endure
> For ever, uncorrupt and pure...
> I'll search where every virtue dwells,
> From courts inclusive down to cells.
> What preachers talk, or sages write,
> These I will gather and unite...
> Then sows within her tender mind
> Seeds long unknown to womankind...
> Her soul was suddenly endued
> With justice, truth, and fortitude; (Lines 143- 208).

As frivolous and coquettish as eighteenth century women might appear in contemporary literature in general, Swift on the accountability of his biography and surviving letters had tried to mould the women in his life with a sense of intelligence and a reasonable

thought process. The above lines deliberately work as a foil to defy contemporary definitions of feminine existence in creating the identity of a woman who would possess the helmed manly virtues of fortitude, wit, judgment and knowledge. While Pope had treated his heroine with a sylph stricken divine sublimity, Swift was far away from bestowing any such fantasy. Instead in *The Progress of Beauty*, he projects the uncomliness associated with an ever transitory and withering human form that lies underneath costumes and perfumes- "*Cracked lips, foul teeth, and gummy eyes*" (Line 15). In *Cadennus and Vanessa*, Swift ridicules women who have accepted the conditions that serve as a false elevation to a mindless state. Later in the poem he goes on to create a parallel of Belinda's toilette scene from Pope's *Rape of The Lock* : "*From every trifle that employs/ The out or inside of their heads,/ Between their toilets and the beds.*(ll. 27-50)" But Swift laments the scene and puts across the hint that through centuries men have subjected the fairer sex to conditions and habits that they blame women for, whereupon a painful and ignorant internalization has happened; a deviation from the regular image of the foppish woman that his friend Pope had reiterated in his works:

> She's not so handsome, in my eyes:
> For wit, I wonder where it lies...
> 'A baby face, no life, no airs,
> But what she learnt at country fairs...
> The girl might pass, if we could get her
> To know the world a little better.
> (TO KNOW THE WORLD! a modern phrase
> For visits, ombre, balls, and plays.)

<div align="center">(Lines 404-32).</div>

Swift's realisation reverberates with reason, echoing the famous influential statement made by Simone de Beauvais a double century later – "One is not born, but rather becomes, a woman" (Beauvais 1949). Swift was evidently a watcher of the identity of women.

Seemingly a proud and judgmental man on both professional and personal fronts, Swift along the length of his works had established a clear demarcation of sensibilities between the women he held close in life and the ones he watched from a distance. Needless to say, the women who had been able to achieve his attention had been offered to attain a higher level of intellectual existence. After all, he believed to have and must have played a most crucial role in forming their sensibilities. As David Nokes observes in a biography of Swift –

> It was to be a familiar feature of all Swift's relationships with women that they should be not only frail and fatherless, but should be prepared to give up any remaining family ties and rely entirely upon him... They must also be prepared to be moulded and educated by him (Nokes 40).

Thus, women served him as his subconscious fodder. For a man who held unreciprocated wishes in worldly affairs and was torn in disillusionment being subjected to the ugly recesses of human perfidy, we see him longing for a sense of supremacy while dealing with people. This might have been a part of his suffering, an exasperation to maintain superiority that made him go from one woman to another in quest of it. While we cannot claim fidelity from him towards one single lady, it is evident that he sought for women who had the capacity to soften and console his mind which had always been subjected to an agony of turmoil in his unfulfilled social, political and economic desires. Since the time he was young and dependent on a disinterested uncle, his approach towards the feminine was shrouded in dubiety. Swift's biographer Irvin Ehrenpreis records- "Swift would probably have found the remote femininity of his mother and sister to be a deepening enigma, with associations of danger, allurement and jealousy" (Ehrenpreis 42). Erikson's theory of psychosocial development talks about a stage of finding fidelity[1], and it corresponds to family, relationships, society and politics. In Swift, we see a disturbance in this stage, a confusion in fixing this fidelity stemming from the upheavals in his personal and social life, as well as the Anglo Irish religio political strife. This being a crucial stage of identity formation, critically informs Swift's subjectivity about the human condition and the deferrence of that significance into the identity of women he had been close with. He renamed these women after Roman Goddesses which provided him with the chance of escaping relationships with them as earthly creatures of expectations and also to use them in his literature as he wished to. This resounds his desire of control, an element that he found lacking in his real world. Be it Jane, Hester or Esther, he preferred correspondence with ladies who were lonely much like himself, and found comfort in their dependability upon him. His life being clouded with neglect from his earliest years, this might have served as a catharsis for him, a psychological orgasm in his otherwise unsettled mind, that came from the realisation that he played the master with his women, controlled and tossed their minds.

Wherein lies the enigma of his secret marriage that concerns the most important woman in his life Esther Johnson whom he had named Stella, Swift has described her in his memoirs as "the truest, most virtuous and valuable friend that I, or perhaps any other person, was ever blessed with... the usual topic of ladies' discourse being such as she had little knowledge of and less relish... Honour, truth, liberality, good nature, and modesty were the virtues she chiefly possessed, and most valued in her

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[1] Erik Erikson describes eight stages of psychosocial development in an individual's identity formation.

acquaintance".[2] He had guided her intellect, channelled her mind to form opinions and a better judgment so that she stood apart from rest of the womanhood of her society. David Nokes has been quoted in his book saying that Swift tried to reduce Stella's esteem by conspicuously projecting her physical flaws in an attempt to de-sexualize her. But while he was a man who seemed to let no woman get the better of his emotions and chastised Stella whenever she made an attempt to spurn him, the above statement could have also been a misreading of the author's character. It appears Swift to having ensured that Stella could successfully steel herself against futile praises and frivolous judgments that accompanied women, and instead develop an illuminated mind which was at par with her times; that she could form a politically, socially and culturally charged intellect. "Swift was her writing master, and as A. C. Elias has shown, and Swift himself observes, his tutorship influenced Johnson's own hand to the degree that her handwriting was confused with his" (Williams 114).

Stella had also been the caring nurse to him when he was ill, but he did not leave it at that. In his 1721 birthday poem to her, Swift conjures the character of 'Chloe', a girl with a perfect skin, to extend the contrast of importance between the body and the mind. Stella's gratitude has also been recorded – "You taught how I might youth prolong/ By knowing what was right and wrong;/ How from my heart to bring supplies/ Of lustre to my fading eyes;/ How soon a beauteous mind repairs/ The loss of changed or falling hairs;/ How wit and virtue from within/ Send out a smoothness o'er the skin/ Your lectures could my fancy fix/ And I can please at thirty-six".[3] The series of letters that Swift had written to Stella from England throughout his stay there from 1712 to 1713 and which has been collected as his *Journal to Stella* bears testimonial to the fact that Swift had kept her informed and updated about political and social life in England; genuinely believing her to be capable of understanding the facts and be 'always teaching something to Mrs Johnson, because she is good at comprehending, remembering and retaining'.[4] The accounts accommodate prominent political figures of contemporary interchanging regimes, their digressions and accomplishments, Swift's personal quips on them, descriptions of unsettling voyages to and from Ireland, and most importantly his own political dreams in which Stella served as his confidante. From the witty conversationist Whig supporter Lady Betty Germaine whom he had a rapport with (to account for his comfort among women who entertained his knowledge) to the daughters of the Duke of Ormond whom he calls 'insolent drabs', from the drawing room idiosyncrasies reflecting the interests of Lord Bollingbroke ('a thorough rake') and his likes to the prudent Lord Dartmouth and ingenious philosopher Berkeley of Trinity, the journal contains it all. He had decided that he had made a political and rational creature out of Stella.

He wrote *The Windsor Prophecy* to attack the Duchess of Somerset in an ill judged desperate motivation as he was convinced that the lady was a malign influence upon the Queen. And in the same Christmas, he was very much saddened by the death of Anne Long, a woman of the province with whom he had developed a lively correspondence. Swift wrote her obituary, describing him as a 'person' instead of calling her a woman, thus *ungendering* virtue- "She was the most beautiful person of the age she lived in, of great virtue, infinite sweetness and generosity of temper and true good sense" (Nokes 142). He would talk about the callousness of reactions of Lady Suffolk and Mrs Howard who demonstrated an indifference towards his works, which eventually spiralled into a deep dislike for her spleen in *Verses on the Death of Dr. Swift* – "Kind Lady Suffolk in the spleen/ Runs laughing up to tell the Queen/ . . . He's dead you say; why let him rot . . ." (par. 29). In the line of his young women admirers were also Laetitia Pilkington and the poetess Mary Barber, whom he described as the best poetess

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[2] Swift's description of Stella, as recorded in *The Works of the Rev. Jonathan Swift, D.D: with Notes, Historical and Critical* (1803), Volume 14, U of Michigan, 2009, pp. 244-253.

[3] Stella's Letter to Swift, as recorded in Nokes, pp. 255.

[4] Swift's exchange with Reverend William Tisdall regarding Stella, as recorded in the introduction to *Journal to Stella* by George A. Aitken, U of Adelaide, 2014.

in England and Ireland. Lady Pilkington proved to be a considerable admirer in her *Memoirs* where she has recounted her physical and emotional encounters with Swift, his dead pan nature during his declining years, and his somatic grip over her as he would pinch her hard for her mistakes.

On the other hand, Hester Vanhomrigh was a loner whom he had met at Dunstable and readily grew affection for, seemingly physical, which needless to say was short lived. For what the surviving letters say, Hester steadily degenerated from being the attractive 'other woman' in his life with whom he had shared moments of carpe diem to the nagging exasperated widow whose company and correspondence Swift had increasingly avoided during the later part of their relationship – "O - - -- -- how have you forgot me you endeavour by severities to force me from you...for heaven's sake tell me what has caused this prodigious change in you...".[5] He was a man who let no woman get on his nerves and resorted to art for his evasion –

> But what success Vanessa met
> Is to the world a secret yet.
> Whether the nymph to please her swain
> Talks in a high romantic strain;
> Or whether he at last descends
> To act with less seraphic ends;
> Or, to compound the business, whether
> They temper love and books together,
> Must never to mankind be told,
> Nor shall the conscious Muse unfold (Lines 819-828).

Cadennus had only intended to cultivate Vanessa's mind and her expectations only filled him with shame and disappointment. But this did not cease him from already having preoccupied Hester's mind and instil in it a stern sense of judgment and cynicism that, just like Stella, made it difficult for her to mix with her immediate crowd, even when Swift insisted her upon socialising to calm her longing for him. Hester in her letters compare men to animals whom she finds uncivilized and grotesque, thus establishing a parallel sensibility with Swift as David Nokes observes

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[5] David Nokes, *Jonathan Swift: A Hypocrite Reversed*, 1985, pp. 259.

that she might have read an early draft of *Gulliver's Travels* and seems to have been the first proselyte of Swift's protagonist's view of the world.

For a book like *Gulliver's Travels* where there are almost no female characters crucially determining the plot, we have Alexander Pope's imaginary verses written in alignment with the tale that includes an argument by Mary Gulliver directed towards her husband. It is formed more like a complaint, replete with pleadings and exasperation that only reflect the helplessness and subjection of the woman to her husband's whims:

> Not touch me! Never Neighbour call'd me Slut!
> Was Flimnap's Dame more sweet in Lilliput?
> I've no red Hair to breathe an odious Fume;
> At least thy Consort's cleaner than thy Groom.
> Why then that dirty Stable-boy thy Care?
> What mean those Visits to the Sorrel Mare?
> Say, by what Witchcraft, or what Daemon led,
> Preferr'st thou Litter to the Marriage Bed?
> (Swift 281).

While this was the image of the vexed eighteenth century woman in a fit of pique, Swift's depiction of the female in his text, even with their meagre roles and passing references, is virtually in sync with the prevailing methods of his time. Terms like 'lewd', 'quarrelsome', 'overbearing', 'noisy', and 'empty' are literally used to describe them more than once and the unconstrained use of these words makes it look like an accepted practice of the time. But when one reads between the lines, it can be observed that there is a brilliant non-typical treatment followed in their representation. If we claim that Swift was one of the most brutal satirist of all times, and he had the most contrary opinions of the discourse that apparently constituted his text in matters of politics, state and society, we may very well conclude that he adhered to the same while he projected the state of women. While Swift was aware that they undoubtedly led a much lower existence than men, he had not denied the reasons for it. Gulliver, a character that belongs to the contemporary cultural structure should only have knowledge enough that is restricted within his social limitations; and he reflects with sorrow that coquetry, censure and scandal

are instinctually placed in the female. Now what is instinct if not the performative end of amalgamation of centuries of practice? While women suffered from limitations in every aspect of living, men too were limited in understanding the path of it. There is a reiteration of the passivity of the female and active role of the male in creating the ugly situations for which the latter blames the former. A man may rise to be a chief minister if he has the ability to prudently dispose a wife, a daughter or a sister; a nobleman is depicted as one who is idle, he gambles, makes frequent visits to prostitutes and finally marries a wealthy woman just to restore his monetary status thus sinking into a loveless hateful life thereby producing sick children. Both the socially outcast whore and the socially recognised wife are at receiving ends, and the man plays the execution card to complete the circle. Jane Austen writes in *Sense and Sensibility* that women always have to wait for things to happen to them;[6] with no real authority or power they only remain to be used, exploited and disposed off according to the needs of man. Without education and independence, they had been forced to accept this life since ages which had led them to resort to the ways of coquetry, seduction, overbearance and deceit. At this point, on a highly interesting note, readers should find Swift to have foreseen Mary Wollstonecraft's *Vindication of the Rights of Woman*. In Book four Chapter eight, we come across Gulliver expanding upon the life style, virtues and education of the Houyhnhnms, considering the last of which the horses have a quite different opinion compared to English men –

> Temperance, Industry, Exercise and Cleanliness, are the Lessons equally enjoyed to the young ones of both Sexes: And my Master thought it monstrous in us to give Females a different Kind of Education from the Males, except in some Articles of Domestick Management; whereby, as he truly observed one Half of our

Nation were good for nothing but bringing Children into the World: And to trust the Care of their Children to such useless Animals, he said was yet a greater Instance of Brutality (Swift 235).

There is a sublime resemblance to Wollstonecraft's vision about the rights and importance of education for women that would serve as a necessity to turn them into rightful compatible companions of men. She has stated in her essay that uneducated shallow women were bound to be failures as mothers and wives; that they would spoil children out of sentimentality leading to spiritual degradation inside the house. And so is she disdainful of women who revel in the celebration of their frailty - "Pleasure is the business of woman's life, according to present modification of society, and while it continues to be so, little can be expected from such weak being... Exalted by their inferiority...they constantly demand homage as women, though experience should teach them that the men who pride themselves upon paying this arbitrary insolent respect to the sex... are most inclined to tyrannize over, and despise, the very weakness they cherish" (ch. 4, par. 10). Swift in his tale of his voyage to Lilliput had laid the repetition of a similar account which vouches for a proof that he blamed the patriarchal structure that channelled male ethics into woman's social behaviourism and the way they were shaped to follow them from birth. Men control women, which is why they fail to develop reason, self governance and the sense of an identity, thus becoming feeble and irrational in the process. As a result, they become capricious and callous coquettes, seeking to indulge in overt emotions and fail to adjust to the friendship and equanimity that are needed once passion and beauty begins to wane. Against this evil, Swift has a remedy for the English society from the land of Lilliputians –

> [...] the young Girls of Quality are educated much like the Males [...] And if it be found that these Nurses ever presume to entertain the Girls with frightful or foolish Stories, or the common Follies practised by Chamber-Maids among us; they are

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[6] Margaret Dashwood grumbles to her mother that men can go around the world and do things while women have no power to act and have to eternally depend on men for happiness.

publickly whipped thrice about the City [...] neither did I perceive any Difference in their Education, made by their Difference of Sex [...] For, their Maxim is, that among People of Quality, a Wife should always be a reasonable and agreeable Companion, because she cannot always be young (Swift 43).

The author never tried his hand in euphemism even if he sounded scathingly political; his satire meant that civilisations in far-off unknown lands were much advanced in many terms than the English who claimed themselves to be only falsely superior. Quite surprisingly, a man from the eighteenth century who condemned the frivolity of women and could not be respectfully loyal to any of his own had found proper reasons for their flattering fascinations; and takes his stand along with the mother of modern feminism as he voices the need of education for *one half of the human race*[7]. While on one hand, Swift is conventional in portraying Glumdalclitch as the caring, nurturing woman who nurses him to health (reflective of Stella), on the other hand he deconstructs the idea of beauty associated with the body of a woman. In Brobdingnag, Gulliver is put into the baths of aristocratic fair skinned ladies, but he relates with horror that their unclothed bodies were a disgusting sight for him and they appeared far from welcoming. Being multiple times larger their skin appeared coarse and unevenly coloured, and the mention of conspicuous pores, moles, hair, freckles, pimples and spots on the woman's body deliberates a grotesque image as opposed to the exquisitely descriptive wonders generally attached to her physical form. Two more namely 'excremental poems' by Swift include *A Beautiful Nymph Going to Bed* and *Strephon and Chloe*; in both of these poems, the poet attempts a similar decentring of the notions of sophisticacy and studied decency that are comfortably constructed for delusional contentment, replacing them with coarse yet practical rituals of a lady striped off her

artificial ornamentations before she goes to sleep. A woman had always been an earthly creature as much as the man had been, and her polarisation either into a Goddess like perfection or into an ugly whore was unlikely to find worldly parallels. An article that looks at this process of Swift's as misogynistic says – "Swift, on the other hand, like the preachers, often shifted his attack from the superficial make-up to what lies beneath... he described in detail was wrong with it at present... Other typical Swiftian allusions to the female body are his reminder that Queen Caroline's "royal Carcase must / Squeez'd in a Coffin turn to dust" (Rogers 367-8). It is a truth accepted by all that Swift was obsessed with the human body, but his sheer distrust and contempt of it also point towards a cathartic saturation that pines for a world preoccupied with carnality and corporeality to be replaced by the spirituality of the transcendent soul. This might also spring from his Christian wisdom influenced by Aquinas that held the human body as a fallen site of pollution waiting to be purged.

Swift identifies as one who was dubious and elusive about his relationship with women, but underlying his sensibilities had been a vision for their educational and intellectual rights. With a natural inclination towards befriending women who could talk sense to him like Lady Betty Germaine and creating knowledgeable social misfits out of the women in his life as he himself was, he was one of the few male writers who might have actually realised that the idea of the female should be rebuilt. As the character of Vanessa indicates, both men and women stand equal chances of his admiration and contempt founded upon their disposition and singularities. Like his contemporary writers, he too abhorred the ostentatious attacks of spleen and agreed that there is no charm in ignorance, but unlike them he did not end up solely scorning and blaming women of their conduct. The fact that he had reason enough to understand that the state of womanhood was a culmination of centuries of conditioning in ill practices and was in need of change probably made him one of the true members of Enlightenment modernity.

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[7] Mary Wollstonecraft in her seminal work *A Vindication of the Rights of Woman* famously stated that she was asking for the natural rights of one half of the world's total population (the female half).

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TEACHER EFFECTIVENESS AND JOB SATISFACTION OF HIGH SCHOOL TEACHERS OF KASHMIR VALLEY

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ABSTRACT

The present study aims at finding out the Teachers' Effectiveness and Job Satisfaction high school teachers of district Shopian (Kashmir Valley). Two scales were adopted and applied in the study namely (i) Teacher Effectiveness Scale (KTES) developed by the investigator (2021) and (ii) the Job Satisfaction Scale (JSST) developed by Dr. Meera Dixit (2011) for collection of the required data 330 high school teachers were randomly selected as the sample of the study. The study reveals that Teacher effectiveness of female teachers was found to be significantly higher as compared to the male teachers. Also, Teachers having higher levels of job satisfaction were found to be more effective than those having low levels of job satisfaction.

Keywords: Gender, Job Satisfaction, High School Teachers, Teacher Effectiveness.

I. Introduction

The teachers play the most crucial and essential role in the development of the whole educational system. There are many qualities, duties and responsibility of teachers for the development of society. There exists no society without student or man or teacher. In other sense educational development means society development also. Teachers have to teach effectively and motivate their students in the field of education. In the words of Mathur (2002),"No system of education, no syllabus, methodology, no text books can rise above the level of its teachers. If a country wants to have quality education, it must have quality teachers". Due to the help of the quality of a teacher, they were kept proper balance in educational process and their mind and life also. Without the balance they can't get any kind of pleasure or satisfaction in job."

1.1 Teacher Effectiveness

Classroom teaching to be more effective demands a high degree of rapport and good relationship between the teacher and the taught. It also demands an efficient and result oriented instructional strategy along with systematic assessment techniques in order to facilitate maximum learning opportunities for the students. Teaching to be valuable and significant demands that teachers be creators of miracles every day in the classroom, where the most unwilling of the students also feel like participating actively in the regular opportunities of classroom learning. Effective teachers are said to be the pillars of any nation as it is these teachers who shape the destiny of a country in the long run." Teacher effectiveness refers to "the impact of classroom factors, such as pupil teacher relationship, use of instructional resources, teaching methods, classroom organization and the degree of facilitation in learning." Gage (1962) described teacher effectiveness in terms of teacher effects on the realization of some value, where value takes the form of some educational objectives identified in terms of pupil behaviour, ability or characteristics. "The teacher effectiveness is, in fact, a matter of degree to which a teacher achieves the desired effects upon students (Medley & Shannon, 1994). The term 'teacher effectiveness' has also been defined by scholars in various ways. It is the relationship between the characteristics of teachers, teaching act and their effects on the educational outcome of classroom teaching (Flanders & Simon, 1969) and the power to realize socially valued objectives agreed for teachers; work especially but not exclusively, the work concerned with enabling students to learn (Jim Campbell, 2004). Gupta (1976) described the term teacher effectiveness as a repertoire of efficacy exhibited by a teacher in instructional strategies, classroom management, personal disposition, temperament and tendencies, evaluation and feedback, interpersonal relations, job involvement, initiative and enthusiasm, professional values and

innovativeness in everyday teaching learning situation."

1.2 Job Satisfaction

Every individual tries to give their best performance in their job. When they get success, they also get a mental and emotional pleasure, which is called satisfaction. Without satisfaction, it is very difficult for a person to runs his/her duties smoothly and efficiently. Job satisfaction is a positive attitude of a person. It is an emotional and mental pleasure. If a teacher can't get satisfaction on his/her job the whole educational system can falls down. "According to R. Hop pock (1935), "Any combination of psychological, physiological and environmental circumstances that cause a person truthfully to say: I am satisfied with my job." In the word of Feldman and Arnold, (1983 "all positive effect or feelings that individuals have towards their job". According to Weiss (2002), Job-satisfaction is an attitude but points out that researches should clearly distinguish the objects of cognitive evaluation which are affect, beliefs and behaviors. Thus, he suggests that we form attitudes towards our jobs by considering our feelings, our beliefs and our behaviors. According to Dixit 2013), job satisfaction is the result of various aspects of attitude of an employee towards his/ her job. These are related with some significant factors like salary, service conditions, promotional avenues and other social support benefits like gratuity, pension, medical and group insurance etc. Job satisfaction is determined by the ratio between what we have and what we want (Hop pock, 1967; Kolte, 1978). Dissatisfaction of the teachers is the result of crowed classes and heavy workload of teachers (Lakadwala, 1977; Conley, Bacharach and Bauer ,1989; Camp, 1994; Kim and Loadman,1994; Ngidi and Sibaya, 2002)."

II. Review of Related Literature

Review of related literature is an important pre-requisite to actual planning and then to the execution of any research work. It enables the researcher to define the limit of his field. Through the review of related literature, the researcher can avoid the unfruitful and useless problem area.

Mishra (2011) "studied the teacher effectiveness, job satisfaction and organizational commitment among secondary school teachers. The results indicated that teacher effectiveness, job satisfaction and organizational commitment were positively correlated with each other. No significant differences were found between the male and female teachers with respect to teacher effectiveness while on job satisfaction and organizational commitment they differed significantly."

Goel (2013) studied teacher effectiveness of school teachers in relation to their job satisfaction, personality and mental health. The findings of the study revealed that "teacher effectiveness, job satisfaction, personality dimensions and mental health were found positively correlated and job satisfaction and mental health was found positively correlated."

Tomar, S. K. (2015) A Study of Teachers' Effectiveness and Job Satisfaction in Secondary Schools. The study reveals that there is no significant difference between teacher effectiveness of male and female teachers. Also, the result indicates that there is no significant difference between job-satisfaction of male and female secondary school teachers."

Boruah, M. and Tok, B. R. (2017) conducted study on Job Satisfaction and Teacher Effectiveness of Secondary School Teachers of Assam. The study reveals that the secondary school teachers of Assam are not extremely satisfied with their job. It is also observed that the teachers of secondary schools of Assam found average in effectiveness."

Lata, S. and Sharma, S. K. (2017) conducted study on Teacher effectiveness of elementary school teachers in relation to work motivation and job satisfaction. The study reveals that the Teacher effectiveness and work motivation of elementary school teachers correlated significantly irrespective of their level of job satisfaction. Also, an insignificant correlation was found between teacher effectiveness and job satisfaction of elementary school teachers irrespective of their level of work motivation. Work motivation and job satisfaction did not contribute significantly to the teacher effectiveness of elementary school teachers."

Halder, U. K. and Roy, R. R. (2018) conducted study on Job Satisfaction and Teacher Effectiveness of Secondary School Teachers. The study reveals that there was positive co-relation (.50) between job satisfaction and teacher effectiveness. The review of the related literatures indicates the inconsistencies in the findings of the earlier researches. This compels the present researcher to carry this investigation to ascertain the relationships and differences between the variables in hand. The present investigation will fill the void of knowledge"

III. Objectives of the Study

The study has been conducted to achieve the following objectives:
- To study the level teacher effectiveness of high school teachers.
- To study the level job satisfaction of high school teachers.
- To study the teacher effectiveness of high school teachers in terms of gender.
- To study the job satisfaction of high school teachers in terms of gender."

IV. Hypotheses of the Study

The following are the hypotheses of the study.

- The level of Teacher Effectiveness of high school teachers is low.
- The level of Job Satisfaction of high school teachers low.
- There is no significant difference between Teacher effectiveness of high school teachers in respect of gender.
- There is no significant difference between Job Satisfaction of high school teachers in respect gender."

V. Method of the Study

In the present study the investigator used Descriptive Survey Method to gather information and analyses the data.

5. 1 Sample of the study Sampling is the process by which a relatively small number of individuals or measures of individuals, or events are selected and analyzed in order to find out something about the entire population from which it was selected. It is often desirable in order to reduce expenditure, save time and energy, permit measurement of greater scope, or produce greater precision and accuracy. A sample of 330 high school teachers were selected from district Shopian of Kashmir valley through stratifiedrandom sampling technique."

5.2 Statistical Techniques used in the Study
1. Mean 2. S.D 3. t-test

Teacher Effectiveness total score

S. No.	Class Interval	Mid-Point	Frequency
1	21-40	30.5	14
2	41-60	50.5	30
3	61-80	70.7	39
4	81-100	90.5	48
5	**101-120**	110.5	70
6	121-140	130.5	51
7	141-160	150.5	39
8	161-180	170.5	27
9	181-200	190.5	12
Total			**330**
Mean			**109.60**
S. D			**40**

From the above table, it is found that the mean and standard deviation of the entire Sample are 109.66 and '40.00 respectively. Further this table also depicts that 51.21% of the secondary school teachers have their scores up to the range 81-140 falls in the average category. So, the null hypothesis has been rejected.

Job Satisfaction total score

S. No.	Class Interval	Mid-Point	Frequency
1	101-120	110.5	20
2	121-140	130.5	40
3	141-160	150.5	52
4	**161-180**	170.5	78
5	181-200	190.5	55
6	201-220	210.5	39
7	221-240	230.5	30
8	241-260	250.5	16
Total			**330**
Mean			**175.28**
S. D			**35.60**

From the above table 4.1, it is found that the mean and standard deviation of the entire Sample are 175.28 and 35.60 respectively. Further this table also depicts that 56.06% of the secondary school teachers have their scores up to the range141-200 falls in the average category. So, the null hypothesis has been rejected.

Mean difference between Male and Female High School Teachers in Teacher Effectiveness

Variables	Gender	N	Mean	SD	't' Value	Level of Significance
Teacher Effectiveness	Male	190	105.44	40.00	2.00	Significant at 0.05 level
	Female	140	114.50	41.20		

It is found from the table 4.4, that the calculated 't' value 2.00 of teacher effectiveness is found to be significant at the 0.05 level. Hence the above Stated null hypothesis is rejected at 5% level of Significance and it is concluded that male and female high school teachers differ significantly in their teacher effectiveness.

Mean difference between Male and Female High School Teachers in Job Satisfaction

Variables	Gender	N	Mean	SD	't' Value	Level of Significance
Job satisfaction	Male	190	168.60	34.80	5.32	Significant at 0.05 level
	Female	140	186.64	26.80		

It is found from the table 4.13, that the calculated 't' value 5.32 of job satisfaction is found to be significant at the 0.05 level. Hence the above stated null hypothesis is rejected at 5% 1evel of significance and it is concluded that male and female high school teachers differ significantly in their Job satisfaction.

VI. Discussion

1. The level of Teacher effectiveness of high school teachers is average.

2.The level of Job Satisfaction of high school teachers is average.

3.The effectiveness of male high school teachers is lower than that of female high school teachers.

4.The Job Satisfaction of male high school teachers is lower than thatof female high school teachers.

VII. Delimitations of the Study

"The study was delimited with respect to the following:

• The study was conducted only on 330 high school Teachers of Shopian District of Kashmir Valley.

• The study was confined only two variables, Teacher Effectiveness and job satisfaction.

VIII. Conclusion

"To conclude for school teachers, we cannot rule out the vital link of his/ her effectiveness

with his/her level of satisfaction. Hence, it is imperative to empower and motivate the school teachers on all these fronts so as to make them more effective in deciding the destiny of the country in words of the Indian Education. It is obvious that job satisfaction promotes teacher's efficiency and productivity and transformation. Therefore, teachers' job satisfaction will bring transformation and quality secondary education in Kashmir Valley. Vroom & Deci as cited in Okonkwo (1997) posited that workers will be motivated to perform their jobs effectively to an extent to which they are satisfied with those jobs. The more workers' rewards are, the harder they would work. Similarly, the greater the extent in which an employee's needs are satisfied in his job, the greater the extent to which he would respond, presumably with gratitude or loyalty. So, when teachers are satisfied with their jobs, they will give their students the best and they will be willing to transform education at the high school level. In addition, they will be willing to transform and prepare the student for higher studies or to perform societal roles."

Appendix

1. Teacher Effectiveness Scale developed by investigator, 2021.
2. Job Satisfaction Scale developed by Meera Dixit, 2011.

Author Contributions

"The research has been conducted by Gulzar Ahmad Dar during the year 2021 in the Indian state Jammu and Kashmir presently the union territory in the Kashmir valley division in district Shopian. Also, the analyses of data are done by the Dar. The review of related literature work is done by Dr. G. P.Ponraj Both the authors have approved the final version of the paper."

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WOMEN EMPOWERMENT AND MORBIDITY LEVEL: EVIDENCE FROM MANIPUR

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ABSTRACT

This study examines the role of women empowerment in determining the morbidity level among women in Manipur. The analysis is based on a primary survey conducted among 300 married women having children with less than 5 years of age, in two districts of Manipur. Proxy indicators of women empowerment and socio-demographic characteristics of the respondents were collected. The study measures a composite women empowerment index (WEI) as a simple average of standardized scores of the indicators which were identified based on five dimensions of women empowerment. Bivariate analyses show a negative association between women empowerment and education but there no particular pattern observes among women with different occupations. Women in urban areas are found to have more illness in urban areas, with illness rate of 36 percent in urban areas and 34 percent in rural areas. A model estimated using a multivariate logistic regression shows negative relationship between WEI and illness rate. WEI is found to be the only statistically significant factor (OR=0.001, p< 0.001) for illness among women, the rest of the other variables which include women's work status, age at marriage, household's size, husband occupation and place of residence are all found to be insignificant at α=5% confidence level. These findings highlight the instrumental functions of women empowerment in determining the illness level among women.

Introduction

There has been growing recognition that women empowerment is an essential policy goal for economic development [MDGs (2000), World Development Report (2012) and SDGs (2015)]. Word Bank`s the World Development Report (2012) argues that women`s empowerment is both a development objective in its own right as well as an instrument for economic development. United Nation`s development SDG calls for urgent needs to end all forms of gender injustice and eliminate all forms of violence against women by 2030 (Goal No.5). Women's role in improving the well being of her and their children, especially in health, has been established by many authors (Bloom et al 2001; Rekha Mehra 1997; WDR 2012, Naila Kabeer 2005). As the primary caretakers of the family, women spend more time in taking care of the family and are more likely to influence the health outcomes of their families and children. Research conducted in South Asia and African countries also provided evidence that women`s empowerment is positively associated with range of health outcomes (Jejeebhoy 1991; Murthi and Dreze 1995; Das Gupta 1990). Varkey et al (2010) in their studies across 75 countries finds positive

evidence: gender empowerment has reduced fertility rate, maternal mortality rate, infant mortality rate and under-five mortality rate; increases both male and female life expectancy rate; child being is worse in US states where women have lower political and economic status.

However, there are very few studies which tried to explore the relationship between women empowerment and illness/morbidity rate. Most of the studies had focused on the impact of women empowerment on health outcomes and health care utilization. This study aims to fill this void in the literature by investigating the role of women empowerment in determining the illness rate among women.

Materials and Methods

The study is based on the primary data which was collected by this author in May/June 2019 in two districts of Manipur: Kakching and Chandel. Manipur is one of the eight Indian states which together constitute the North-East Region. The state is largely hilly and mountainous although most of the population and economic activities are confined to the small plain areas. The household's based survey was conducted among 300 randomly selected married women in their reproductive age (15-49). Households were the primary

units for the survey and the youngest eligible married women in the households were interviewed. All the interviews were conducted in Manipuri language in both the districts. Data on basic socio demographic characteristics, health data and women empowerment data were collected from the respondents. Respondents were asked if they had any illness in the last the three months prior to the day of survey. A score of 1 was given if the respondent answered 'Yes' otherwise 0 was given for 'No'.

Composite women empowerment index (WEI) is calculated based on five dimensions of women empowerment: women's household decision making, women's participation in economic decision making, freedom of movement, women's autonomy and attitude towards gender relation. Thus, Empowerment index (E_{ij}) based on each dimension is first calculated based on the methodology used by Biswas and Kabir (2004) as follows:

$$E_{ij} = \frac{x1 + x2 + x3 + \dots + xn}{M}$$

Where, E_{ij}= Empowerment Index for i^{th} individual for j^{th} dimension,

x1, x2, x3,...xn = actual score for each indicator used in each dimension

n= Numbers of indicators for each dimension

M= Maximum possible score for each dimension

Then the composite Women Empowerment Index (WEI) is calculated as the simple unweighted average of standardized scores of the five Eij as follows:

$$WEI = \frac{E1 + E2 + E3 + E4 + E5}{5}$$

E1, E2, E3, E4 and E5 represent the women empowerment index based on household decision making, economic decision making, freedoms of movement, women's autonomy and attitude towards gender relation respectively. The details on indicators used to capture these five dimensions are given in Table A1 (Appendix).

Since the dependable variable is categorical variable, this study uses logistic regression to examine the association between WEI and Illness rate. The logistic regression solution to this problem is to transform the odds using the natural logarithm. Therefore, after the transformation

$$\text{Logit}(y) = \ln(odds) = \ln\left(\frac{p}{1-p}\right) = \alpha + \beta x$$

Where p is the probability of the event (illness) and x is the explanatory variable. Using the multivariate logistic regression the following model is estimated:

Table 1.1: Models Details		
Dependable variables	**Independent predictors**	**Estimation Method**
Women's reported Illness	Composite Women Empowerment Index (WEI), Age at marriage, women's work status, Husband's education, Household's size, Region	Multivariate logistic Regression

The model estimates the relationship between WEI and women's reported illness by controlling other socio demographic variables like women's age at marriage, household's size, husband's education, women's work status, region and district.

Results and Discussions

From Table 1.2, it is clearly visible that there is inverse relationship between the chances of illness and education level. About three-fourths of those with below primary and upper primary education have reported to have some form of illness in the last three months prior to the day of survey. But only 11% of those with graduate and 9% of those with PG have some form of illness in the last three months. Chi square test also shows a p value (.000) which is less than α=0.5 confidence level, so null hypothesis is rejected which asserts that there is variation in women's illness rate in relation to their education level.

Table 1.2: Women's reported illness by Socio-demographic indicators (n=300)			
	Any reported illness in the last 3 months		
Variables	Yes	No	Percentage
Education			
Below primary	14	5	73.68
Upper primary	22	9	70.08
Secondary	59	42	58.42
Higher secondary	22	69	24
Graduate	5	42	11
PG and Above	1	10	9.09
Respondent Occcupation			
Housewife	43	43	50
Seasonal Agricultural wage labourer	25	46	35.21
Market vendor/Vegetables sellers	24	26	48
Weavers/Artisans/Selfemployed	7	26	21.21
Small business/petty shops	3	20	15
Govt. Salaried Employee	3	28	9.78
Professional/ Managerial Job	1	8	11.11
Work Status			
No Work	68	89	43.31
Work	38	105	26.57
Region			
Rural	39	76	33.91
Urban	67	118	36.21
District			
Kakching	79	121	39.5
Chandel	27	73	27
Education in Years			
1-5 years	14	5	73.68
6-10 years	64	68	48.48
11-12 years	22	69	24.18
Above 13 years	6	52	10.34

The reason for such trend could be because more elite and educated individuals have more health concerns, more awareness about illness and they are more likely to take preventive measures. Several studies in India find such inverse relationship (Duraisamy 2000; Sunder 1995; Duraiswamy 1995). Similarly, distribution of illness is found to be negatively associated with the education of years women attended. Though there is no particular pattern, variation in reported illness is also seen among women with different occupation. Half of the housewives, 35 % of the agricultural labors, 48 % of vegetables sellers, a fifth of the weavers (21%), 15 % of those in small business, roughly a tenth of government employee (9.8%) and 11 % of those in professional job have reported to suffer from some illness in the last three months. With a statistically significant p value (<0.01) from chi square test, there is significant association between women's occupation and reported illness. Further, women with work are found to have less illness rate (26%) as compared with those with no work (43%).

Women in urban areas are observed to have little more illness than those in rural areas, with illness rate of 36 percent in urban areas and 34 percent in rural areas. However, this variation is found to be not statistically significant with χ^2 (0.165) and p value (0.685) which is more than α=5% confidence level. In comparison between the two districts, women in Kakching district are found to have more illness rate (39%) than those live in Chandel district (27%). Thus, women in hill areas (Chandel) reported less illness as compared to those in valley. Chi square test also shows a χ^2 (4.56) with p value (0.033) indicating a significant association at 5% level of confidence.

Since Chi square only identifies the association and does not infer anything on the causal relationship, a multivariate logistic regression estimates a controlled model which tries to find out the factors for women's illness rate. Table 4.8 shows that WEI is a statistically significant predictor (p<0.01) for women's reported illness in the last three months prior to the survey. Since odds ratio is less than 1, the nature of association is negative, indicating a lower illness among the more empowered women. With the odds ratio of 0.001, it can be inferred that women with one additional unit of WEI score will have approximately 99 percent less chances of having any illness.

Table 4.8: Results of multivariate logistic regression analysis			
		Dependable Variables	
		women's reported illness rate in the last three months preceding the survey	
Independent variables		**Odds Ratio**	**p value**
Composite Empowerment Index (WEI)		0.001**	.000
Household Size		.905	.528
Respondent's age at Marriage			
	Below 19	1	.000
	Above 19	1.123	.726
Respondent's work status			
	No work	1	.000
	Work	1.088	.788
Husband education			
	Secondary	1	.000
	Higher Secondary	.748	.402
	Graduate	1.070	.892
	PG & above	3.813	.218
Region			
	Rural	1	.000
	Urban	1.162	.617
District			
	Kakching	1	.000
	Chandel	.667	.223
Adjusted R^2		.341	
**indicates statistically significant at 5% confidence level			

This negative association of women empowerment and women's illness rate is consistent with the evidence established in the literature. For instance, Begum S and Sen B (2005) in their findings from Bangladesh shows positive impacts of women's education, exposure to media and decision making on the nutritional status of women.

The adjusted R^2 value of 0.341 indicates that the model predicted approximately 34 percent variation in the morbidity level among women. All other predictors included in the model are

found as non-significant variables in predicting the women's illness rate. Except household size and region, all the other non-significant predictors have positive association with the women's illness rate. Women's place of residence, husband education level, women's work status and women's age at marriage are found to be insignificant predictor for her illness rate. Thus, the model shows that women empowerment (WEI) is the single important factor determining women's illness rate.

Conclusion

In exploring the relationship between women empowerment and women's morbidity rate, the regression analysis sheds light on the importance women empowerment in determining women's health, particularly morbidity rate among women. The calculated WEI (women empowerment index) was found to be highly significant factor for women's illness rate. However, other socio demographic variables included in the model are not found to be significant factors. Household's size, women's age at marriage, women's work status, husband's education, region and district are all turn out to be insignificant factors. Though regression results could not find any significant impact of these characteristics on morbidity level, Chi square test observe variation in morbidity level in relation to these socio-demographic characteristics. These findings stress the need for recognizing gender equality as a development objective.

Acknowledgement

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Appendix

Table A1: Details of variables used to capture Five dimensions of Women Empowerment

Dimensions	Indicator variables	Scores assigned
a) HH Decision Making		A score of 1 if Yes otherwise 0
	i) about her own health	
	ii) about child health	
	iii) about child education	
	iv) visiting/staying with Parents	
	v) Decision about family planning	
b) Economic Decision making		A score of 1 if Yes otherwise 0
	i)Control over household income, saving and resource allocation	
	ii)Freedom to participate in micro credit programme such as marup and tender	
	iii)Control over daily HH basic needs	
	iv)Ability in participate in important househod expenditure on assets	
c) Freedom of mobility		A score of 1 if Yes otherwise 0
	i) to visit market alone	
	ii)to outside the village	
	iii) to visit friends and relatives	
	iv)Freedom to visit Hospitals alone	

Table A1: Details of variables used to capture five dimensions of Women Empowerment

d)Women's Autonomy		A score of 1 if Yes otherwise 0
	i) If she could own land in her name	
	ii)Freedom to vote in election independently	
	iii)Freedom to participate in women`s agency, NGOs, SHG.	
	iv)Freedom to participate in local poliitical activities	
e) Women's attitude towards gender relation		A score of 0 is assigned if Yes or 1 for No.
	i) Whether Domestic Violence can be justified?	
	ii)Whether Preference of Boys to Girls is justified?	
	iii)Acceptance of higher status of men than women	
	iv)Whether you agree with unequal inheritance rights?	

INFLUENCE AND IMPLICATIONS OF GENDER STEREOTYPES AT WORKPLACE

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ABSTRACT

The research includes the investigation of the factors that have created pressure on the workplaces due to gender stereotypes. Raised challenges have been analyzed in research that can open up channels to review and consider the issues of the employees in the workplaces. The collection of the data has been made on the basis of the survey consisting of 50 participants and the recorded data has been analyzed in the Excel sheet. The survey has been conducted in the Google form by preparing questionnaires. The findings suggest that there are several implications that have been raised because of gender stereotypes and finally a conscience has been drawn.

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Keywords: Gender, stereotype, workplaces

Introduction

Gender roles are influenced by many factors such as the media, family and society background and the peers along with workplaces. The perspectives of the person in terms of gender role, it impacts on the mindset and behavioral approaches on how to get treated by the society. People in terms of gender inequality have faced several challenges in society and the workplaces. As stated by Balachandra *et al.* (2019), sex-based biases might lead to the loss of ventures from the organization. As per the view of Mirza and Jabeen (2020), despite the increasing number of women employees in the workplaces, they suffer from discrimination in any hard jobs requiring physical activities.

However, not only women and even the men in some workplaces suffer from gender discrimination and give rise to stereotyping behavior in the workplaces. The research is based on the identification of such challenges and influences of gender stereotyping in workplaces, and the results will be discussed with the help of survey records in later sections. This research thus aims to identify the implication and influences that are being created by the stereotyping behavior in the workplaces. The objective of this research is

research is based in identification of the factors that are responsible for giving rise to gender stereotypes. Another objective of this research is based on the determination of the impact of gender stereotypes in workplaces. Apart from this, another objective of this research is to analyse the positive influencers and implications of the gender stereotypes in the workplaces.

Background

Gender stereotypes are transmitted through recreational socialization of the society. However, improper management of the workplaces has given rise to patriarchal expectations. Apart from this the gender stereotypes have been found to be influencing positive aspects in the career of both men and women as well. As per the view of Rasool*et al*. (2020), workplace violence's might disrupt the balance of sustainability performances of the employees. In some of the organizations, there have been found to be very minimal participation of the women in the hierarchical position. It might be because of the fact that women are considered to be weaker than that to target men in the workplaces.

Rasool *et al*. (2020) has also cited that stressful events in terms of gender stereotype might disrupt the mental state of the employee in the

workplaces that would, in turn, negativity and reduce the performances of the employees. In some countries it has been found that homosexuality is known as a criminal offence.

Most of the countries that consist of approx 71 countries are located in the Middle East, Asia and Africa has raised questions on the homosexuals (Statista.com, 2021).
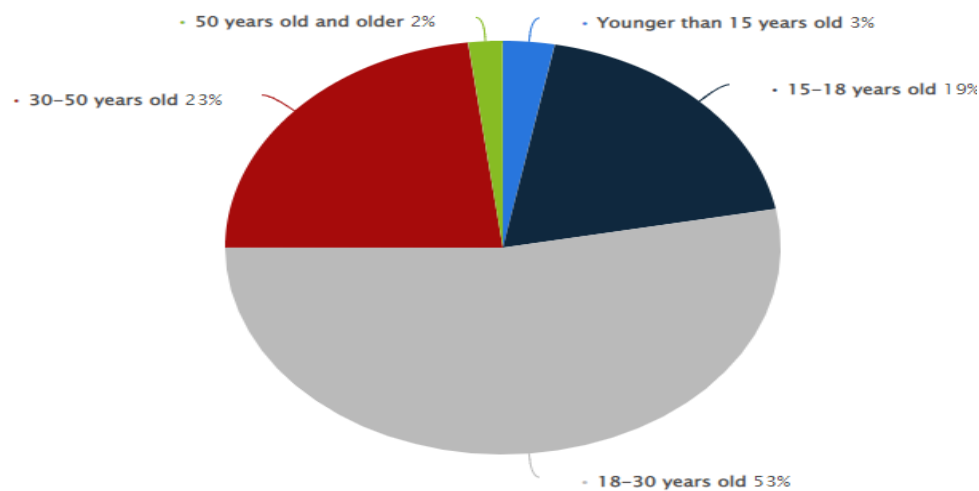

Figure 1:Homophobic, transphobic and biphobic physical assaults

Figure justifies that there homophobic, transphobic and biphobic physical assaults that happens to the employees and does not allow them to stay in society. However, every individual possesses the right to lead in their own way; this sort of discrimination might influence them to perform criminal activities. Moreover, these factors can induce several challenges in between the employees and reduce collaboration.

As per the view of Thébaud and Charles (2018), it has been noted that in most of the organizations the gender segregation is the most popularly resonance that influences the employees. It is necessary to look after all the laws and jurisdiction that can reduce the burden of gender stereotyping in the workplaces. Surprisingly, even in the advanced technological era, there are no such places that can provide proper satisfaction in terms of working environment. As demonstrated by Eaton *et al*. (2020), it has been noted that despite the increasing number of females in every work place, be it in the educational sectors or the corporate sector, they remain under-represented by society. The figure 1 justifies that mostly the aged people who are more than 50 years of old are more prone to physical assault rather than that of the younger ones (Statista.com, 2021). This research would thus determine all the possible consequences

that can influence the impact of gender stereotypes in the workplaces with proper responses of the people. The ideas of negative attitudes have reduced workflow in many organizations and are being evaluated in this research article.

Methodology

a. Data collection

The collection of the data for this research article is based on the primary quantitative method. A survey has been conducted on this earth with the help of a questionnaire and has been sent to the employees of different organizations through Google form. As per the view of Snyder (2019), building of research with the help of analysis of the current challenges and being evaluated as strategies in future perspectives. The primary data collection method would help to identify the current challenges that are being faced by the employees due to gender stereotypes. The collected data sets from the survey have been analyzed in the excel sheet and the responses are being discussed below. However, the rising challenges for the chosen topic have been analyzed with the help of collected secondary sources from the past research. The proper maintenance of the ethics has been done while collecting the data and it has been ensured that

no individuals are being harmed with the research [**Refer to appendix**].

b. Data sampling

The sampling technique that has been used in the research is random sampling technique. It has enabled picking up the participants from different organizations and has been asked to respond to the survey. A total sample of 50 participants has been chosen who are currently working in different workplaces. The identity of the participant has been kept hidden due to security concerns.

c. Data analysis

The Analysis of the data is based on the extracted records of the survey. The collected data have been analyzed in the Excel sheet. The statistical records of the responses from the participants have been done in the later sections. As demonstrated by Snyder (2019), the analysis of the data must be based on the logical approaches and techniques that are necessary to be included in the research. As mentioned in the earlier section, the identity of the participants is not being revealed due to security issues and the maintenance of anonymity has been done. Before conducting the survey, the information about the research has been given to the participants, and also consent of the participant has been taken accordingly.

Findings and discussion

As mentioned in the earlier section, analysis of the data is based on the records that have been collected from the survey.

Analysis 1

Count of 1. Do you work in an organization that comprises gender stereotypes?
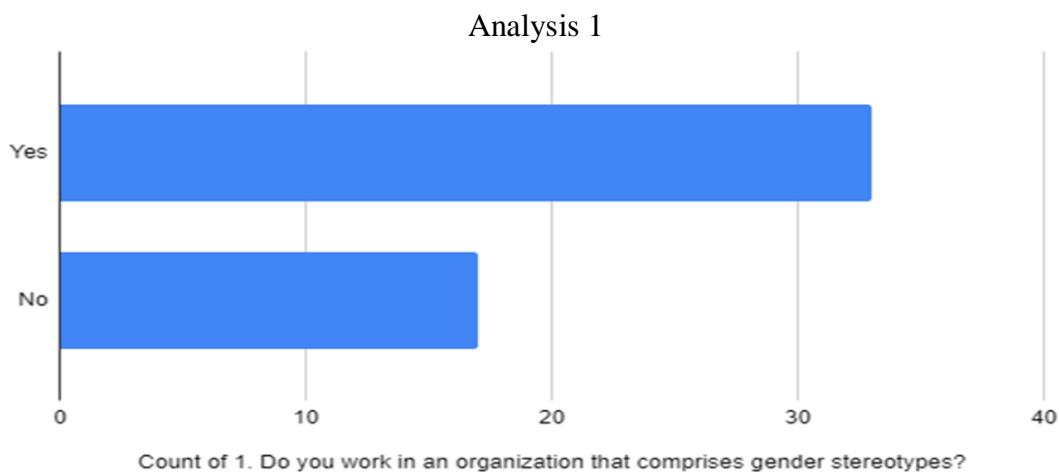
Figure 2: Responses of the employees who works under those workplaces that deals with gender stereotype factors

Figure 2 justifies that approximately 66% of the employees that bear the challenges of gender stereotypes in the workplaces. On the other hand, approximately 34% of the employees are not working under such workplaces or organizations.

2.

Count of 2. Does racism get influenced because of stereotypes?
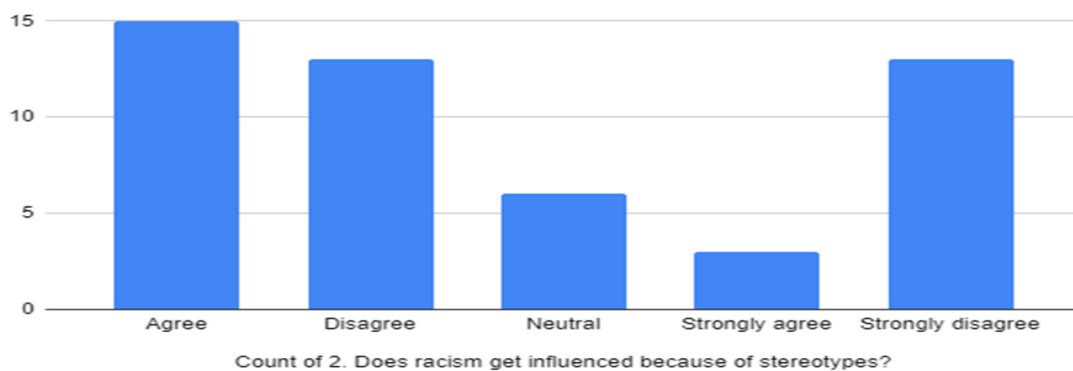
Figure 3: The influence of racism gets rises because of gender stereotypes in the workplaces

The figure 3 states that the factor of racism might get influenced because of the gender stereotypes issues in the workplaces. In the mentioned figure, it can be noticed that 36% of the total responses are favoring the fact of facing the racism challenges in the workplaces on the other hand; approximately 52% of the responses disagree with the facts. Additionally, 12% of the totals of 50 participants are giving their neutral responses.

3.
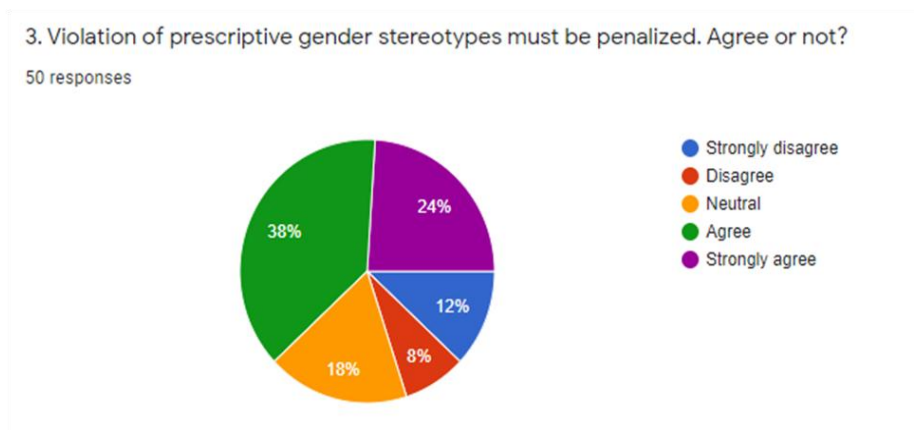
Figure 4: The rule of penalizing the violation of the prescriptive stereotypes must be introduced in the workplaces

As per figure 4 penalizing the person who is violating the work environment and sustainable flow of the workplaces, must be adopted by the organization. However, in most of the workplaces, there is no such rule that can help to reduce the issue. In the above-mentioned figure, it can be observed that 62% of the employees are agreeing with the fact that the penalization must be imposed on the employee who is creating violence in the workplaces in terms of gender stereotypes.

As per the view of Rivera and Tilcsik (2019), internal committees of the workplaces are solely responsible for giving rise to such factors. The figure also justifies 20% of the total responses in terms of disagreeing with the fact of raising racism in the workplaces. Additionally, 18% of the employees have given their neutral views.

4
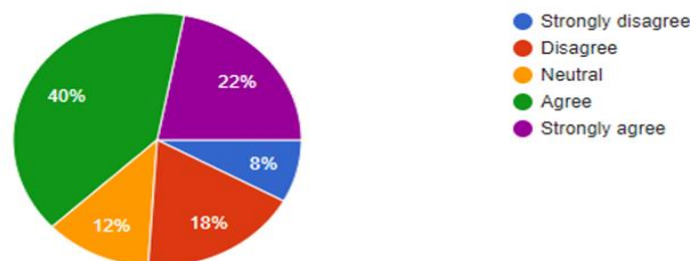
Figure 5: Gender stereotypes can impact as positivity in some workplaces

Gender stereotypes can even put adventurous factors in the workplaces. For example, listening to the stories of experiences among the employees who have been through their situation might act as motivations for the normal ones. In the above given figure 5, it can

be noted that approximately 62% of the participants agree with the fact. On the contrary, approximately 26% of the responses are against the fact. Furthermore, 12% have been responded as neutral. As demonstrated by Triana *et al.* (2019), psychological health is

responsible for giving rise to either positive or negative workflow. It is thus necessary to maintain collaboration in the workplaces by removing the discriminating factors between both the male and female employees.

5.
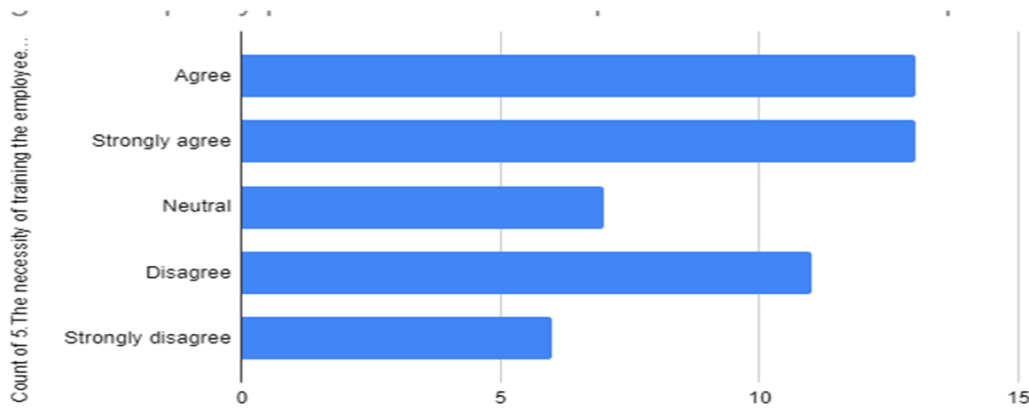
Figure 6: Importance of training given to the employees to reduce the discrimination and induce gender equality practices in the workplaces

The above-mentioned figure 6 justifies the 52% responses who agree with the fact of implementing training in the workplaces. On the other hand, 34% of the total responses are not agreeing with this fact. Additionally, 14% of the respondents have given their neutral views. As illustrated by Parker and Funk (2017), it has been noticed that gender discrimination has become a key factor for

giving rise to stereotyping. Especially the women working in a typical environment is suffering from gender stereotyping in terms of behavioral issues. The biggest gap rises between the income that is being achieved by men and women in the workplaces. It is thus necessary to introduce training sessions in the workplaces to reduce the gender inequalities.
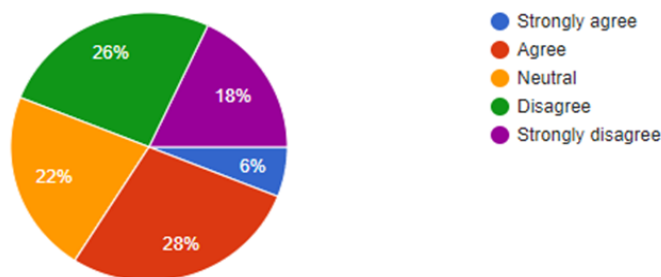
Figure 7: Typical characteristics that has created differences among men and women in terms of gender stereotyping in the workplaces

It has been noted that in most of the cheese, the women and men are being judged by different modes of behavior changes. In this aspect, the anger, outspoken as well assertion must not be

dealing with women characteristics even when she is suffering from violence's in workplaces. As per the view of Krishna *et al.* (2021), it has been noted that judging men and women by

analyzing these factors can also impact on the consumer perspectives related to that organization. In this figure 7, a total 34% of the total responses are agreeing with the fact of getting judged by observing comparing

characteristics that are mentioned above. On the contrary, 44% of the respondents are against the fact. Additionally, 22% of the responses are neutral.
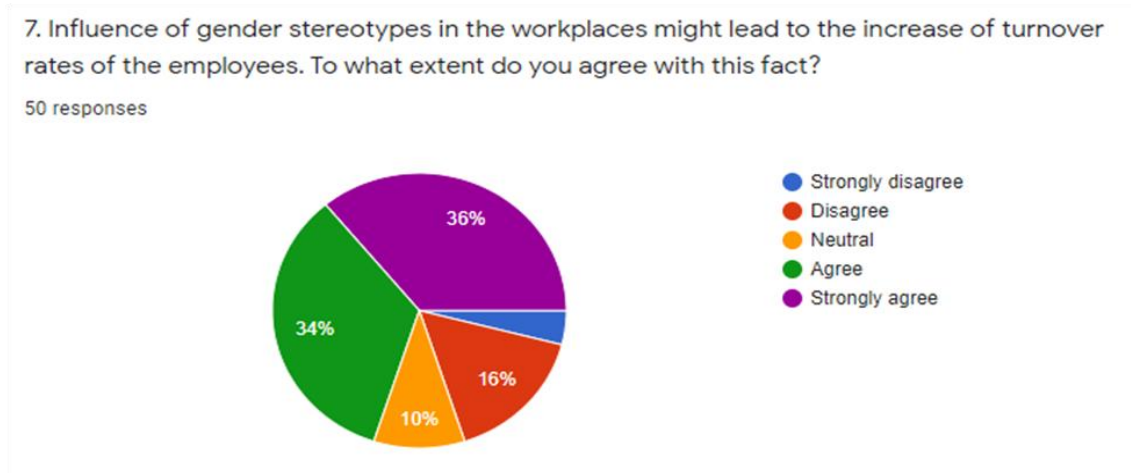
7.

Figure 8: Increase of employee turnover rates due to gender stereotyping in the workplaces

The above mentioned figure 8 justifies that 70% of the responders are agreeing with the fact that gender stereotypes might reduce productivity and increase employee turnover

rates. On the other hand, 18% of the total responders are not agreeing with the facts. 10% of the total responses have given their neutral reviews.

8.
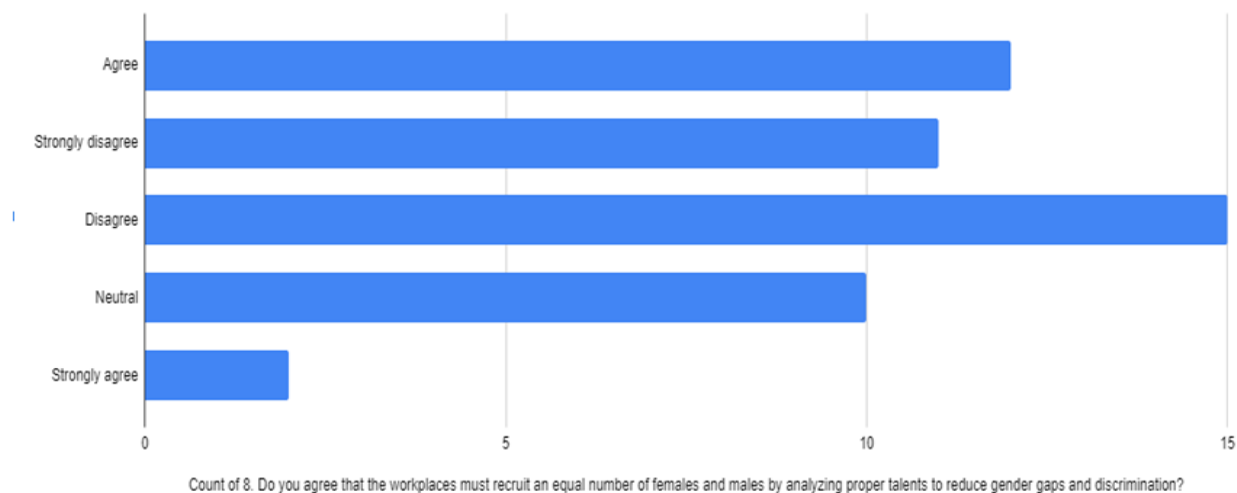
Figure 9: Equal number of employee recruitment is necessary to reduce gender gaps in the workplaces

The above-mentioned figure 9 justifies that 28% of the total responses agree with the fact of recruiting an equal number of employees to reduce gender discrimination in the
.

workplaces. On the other hand, 52% of t tidal responses have disagreed with this fact. Additionally, 20% of the responses have been found to be neutral.

9.

9.Failing to investigate, prosecute and violence against women in the workplaces might disrupt the culture of the workplaces?

50 responses

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree
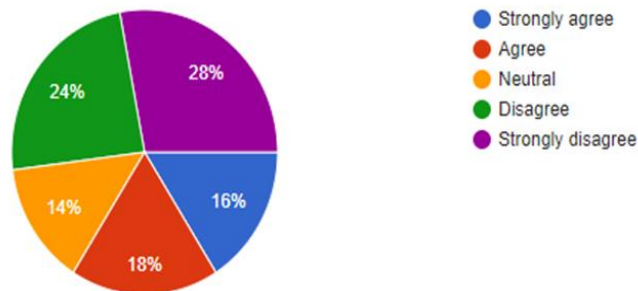
Figure 10: Violence occurs to women in the workplaces are not being revealed

As per the view of Pap (2019), organizational phenomena of rising gender stereotypes have become a difficult part to deal with. Especially the violent activities suffered by the women are not being even considered in the workplaces.

The figure 10 suggests that 34% of the total responses are agreeing with this fact. 52% of the responses are disagreeing and 14% of the responses are neutral.

10.

10. Prohibition on gender discrimination must be adopted with proper laws and regulations in the workplaces. Agree or not?

50 responses

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree
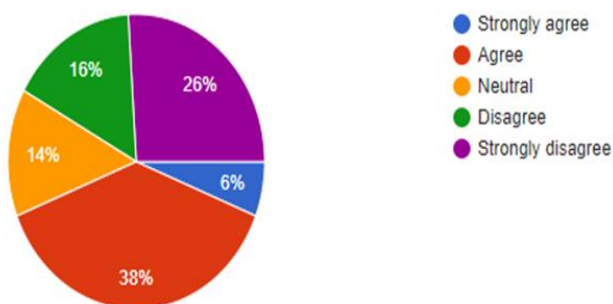
Figure 11: Prohibition in gender discrimination must be reduced by adopting proper laws

Prohibition on gender discrimination can be stopped by implementing rules and judicial activities in the organization. 44% of the responses are agreeing with the fact, and 14% of the total responses have given neutral responses. 42% of the responses disagree with the views as per figure 11.

Conclusion

The research shows an enlightened structure of the issues and impacts of gender stereotypes in the workplaces faced by the employees due to the severity of discrimination related to different factors. The research thus concludes

that gender inequality and challenges are faced being racing day by day in different zones of the workplaces. The research concludes that there is not much consideration being done that can reduce the gender stereotyping factors in the workplaces. It has also been concluded that the aged people are more prone to suffer from gender physical assaults than the younger ones in the society.

Some changes that can evaluate universalities of the workplaces must be implemented in order to make a safe and secure environment for the employees. The necessity of implementing advanced regulations and

jurisdiction against women violence must be introduced in the workplaces. The women and men both need to be reported equally with equal essence in the workplace. In short, it can be concluded that the workplaces must adopt the security and safety concerns and trends to the employees that can educate them about gender equality and can make a sustainable environment of the workplace.

Limitation of the study

The limitation of the study is time-bound when the time of the study increases then it will be better to collect more data and information regarding the selected topic. As viewed by Ilin *et al*. (2017), every study has some limitations while conducting; however, the other limitation of the study is budget. Additionally, an adequate budget for the study will help to collect data through secondary resources to form paid websites.

On the contrary, if the budget of the study is not adequate then it will be quite difficult to proceed with the conduction process. As for analyzing the data many software's can be used when the budget is high in the study. As commented by Ilin *et al*. (2017), the time-bound of a study is another limitation and a significant limitation in the research. As if the data of the study is not collected in proper time, then the study will not be conducted on the appropriate time schedule. It can be said that, in this particular study the major limitations are identified which is time and budget of the study.

Future scope

The research would enlighten the path of revealing the perspective of the employees regarding gender stereotypes in the workplaces. This research would also help to implement strategies that can rescue the impact of gender stereotypes in the workplaces.

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BIOLOGICAL STUDIES AND CHARACTERIZATION OF BIMETALLIC COMPLEXES OF Ni (II), Cd (II) and Hg (II) CONTAINING SCHIFF BASE {N,N,'-Bis-(Benzylidene)-1,3, Phenylenediamine} in 1:2 ratio

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ABSTRACT

*The bimetallic complexes of Ni (II), Cd (II) and Hg (II) with Schiff base ligand, {N,N',- bis (Benzylidene)-1,3– Phenylenediamine (BENDAMB1,3)} in 1:2 ratio were synthesized by Template method. The structural aspects of these transition metal complexes were determined by elemental analysis, molar conductance, magnetic moment measurements. The Spectral characterization done by using IR, Electronic and ^{1}H NMR spectral studies, which shows that Schiff base ligand is linked with comparatively harder metal Ni^{2+}. The softness parameter **TEn$^{\neq}$** of complexes have also been calculated to derive the binding side of the ligand, the softness parameter suggest cationic-anionic structure for these complexes. Newly synthesized bimetallic complexes have been evaluated for their Biological activities and was compared with solvent, screening results indicates that the metal complexes are moderately active compared to solvents.*

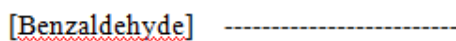*Keywords: Schiff base, Bimetallic, Softness Parameter, Biological activity*

Introduction

Coordination chemistry is undoubtedly the most active research area in inorganic chemistry Lot of metal containing complexes have been synthesized and studied, these transition metal complexes shows the therapeutic and diagnostic properties as well as catalytic property and versatile activities including antifungal and insecticidal activities[1-2]. Bidentate Schiff bases are well known to co-ordinate with various metal ions and have attracted a great deal of interest in recent years due to their rich co-ordination chemis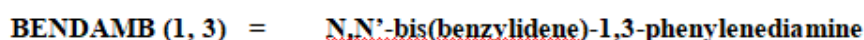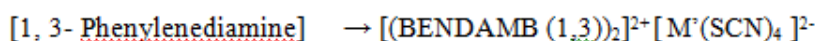try of -C=N group (azomethine), they are used as chelating ligand in coordination chemistry of transition metals,[3-4]. The importance of Schiff base complexes for bioinorganic chemistry, biomedical applications, supra molecular chemistry has been well recognized and reviewed, they show antibacterial, antifungal and herbicidal activity [5-6]. The diversified application of the transition metal complexes of Schiff bases leads us to design Schiff base ligand and their transition metal complexes. In this paper we have reported synthesis characterization and biological screening of bimetallic complexes of the fallowing type.

$$[MM'(SCN)_4] \rightarrow [(BENDAMB\,(1,3))_2M(NCS)_2M'(SCN)_4]$$

$$+ \qquad 1:4:2$$

$$[Benzaldehyde] \quad ------------------------$$

$$+$$

$$[1,3\text{- Phenylenediamine}] \rightarrow [(BENDAMB\,(1,3))_2]^{2+}[M'(SCN)_4]^{2-}$$

BENDAMB (1, 3) = N,N'-bis(benzylidene)-1,3-phenylenediamine
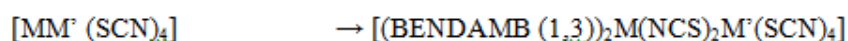
Materials and methods

Solvents were dried and distilled in usual manner Nickel (II), Cadmium(II), and Mercury(II) nitrate (all BDH) were used as received without further purification. Potassium thiocyanate (Sarabhai M. Chemicals) was used after drying in vacuum. Phenylenediamine and Benzaldehyde (both CDH) were used as received.

FTIR spectra were measured on a Perkin-Elmer spectrometer RXI, using KBr pellets. The Electronic spectra were recorded on a Perkin-Elmer LAMBDA-15 UV/VIS spectrophotometer in acetone/DMSO. ^{1}H – NMR spectra was recorded on Burker DRX-300 in DMSO.

Molar conductance were measured in acetone and DMSO with the help of Century CK-704 Conductivity bridge (Type digital portable kit) using a dipping type of cell at 298 ± 2^0K. Gouy's method was employed for the measurement of Magnetic Susceptibility.

Diamagnetic Correction were also made using Pascall's constant. The metal and sulphur content were analyzed using standard methods[7].

Preparation of Bimetallic Complexes

Bimetallic complexes of N,N'-bis(benzylidene)-1,3-phenylenediamine [BENDAMB(1,3)] Schiff base were synthesized by template method[8]. Metal dithiocyanate were prepared by fallowing literature procedure[9], both M(SCN)$_2$ and M'(SCN)$_2$ were mixed in 1:1 ratio for the preparation of bimetallic Lewis acid MM'(SCN)$_4$, the calculated amount of benzaldehyde (4mol) was added into the solution of MM'(SCN)$_4$ and stirred for 5 minutes and then 2 mol of 1,3-phenylenediamine was added and whole reaction mixture was stirred for 6-8 hr, after constant stirring of reaction mixture, in each case a solid was separated which was filtered off and washed with methanol, dried in vacuum and recrystallized from Acetone/Chloroform. All bimetallic complexes were partially/completely soluble in DMSO.

Result and Discussion

The stoichiometry of the complexes are in agreement with elemental analyses given in **Table-1** The lower value of conductance in DMSO is indicative of non-electrolytic behavior of complexes.

Table -1: Elemental analyses, color, yield & melting point of the complexes

S.N.	Complexes	Color	Yield	M.P.	M Ni	M' Cd/Hg	S
1	[(BENDAMB(1,3))$_2$Ni(NCS)$_2$Cd(SCN)$_2$]	Light Grey	48	167^d	5.80 (6.03)	11.40 (11.56)	12.90 (13.19)
2	[(BENDAMB(1,3))$_2$Ni(NCS)$_2$Hg(SCN)$_2$]	Green	63	179	5.30 (5.53)	18.60 (18.91)	11.80 (16.52)

Satisfactory C, H, N analyses have been obtained for all complexes; **d-**decompose

1.1. Electronic spectra and Magnetic moments

The bimetallic Complexes are diamagnetic in nature, electronic spectra of the complexes viz.- 1 & 2 show a band between 24930-24960cm^{-1} which can be assigned for the transition ^{1}A$_1$(g)→^{1}B$_1$(g) (ν_2) and another band between 30915-32950cm^{-1} may be attributed for the transition ^{1}A$_1$(g)→^{1}B$_3$(g) (ν_3). The electronic spectra of these complexes also exhibit a charge transfer band.

Electronic spectral assignments of the complexes viz. -1 & 2 suggest Square Planar environment around Nickel ion[10], while tetrahedral environment around mercury ion.

1.2. IR spectra analyses

The infrared spectra of these complexes (presented in **Table-2**) exhibit two bands in –C-N stretching region, in between 2071-2105 cm^{-1} clearly indicates the presence of only S-bonded terminal SCN groups. Other bands like δ(NCS), ν(C-S), ν(M-N) and ν(M'-S) also appeared at their own position and evident for cationic-anionic structure for these complexes.

A strong band in the region 1633cm^{-1} appears in Schiff base characteristic of azomethine (>C=N) group[11-12]. This band is shifted towards the lower frequency region (~28-33cm^{-1}) in the bimetallic complexes indicative of Schiff base azomethine nitrogen atoms.

Table - 2

S.N.	Complexes	C-N (Str)	C-S (Str)	δNCS (bend)	>C=N(Str) azomethine	ν(M-N)	ν(M'-S)	Structure
1	[(BENDAMB(1,3))$_2$Ni(NCS)$_2$Cd(SCN)$_2$]	2074(w) 2105(s)	753 785	483(w) 423(m)	1605(s)	306(m)	234(w)	C.A.
2	[(BENDAMB(1,3))$_2$Ni(NCS)$_2$Hg(SCN)$_2$]	2071(s) 2089(m)	750 781	484(w) 410(m)	1600(s)	302(m)	226(w)	C.A.

1.3. ^{1}H-NMR spectra

The ^{1}H-NMR spectra of the complexes recoded in DMSO given in **Table-3**,

The fallowing conclusion can be derived.

(1) The ^{1}H NMR spectrum shows a signal between δ7.18-7.61 due to aromatic ring in all complexes.

(2) A proton signal due to -CH=N group appears in between δ8.48-8.67 in the complexes due to lone pair donation to metal from nitrogen.

Therefore on the basis of Electronic spectra, IR spectra and ^{1}H NMR spectra we suggest cationic-anionic structure for the complexes, in which SCN present as terminal, and Schiff base ligand is linked with comparatively harder metal like Ni^{2+}

Table 3 - ^{1}H NMR data (scale ppm) of the complex

S.N	Complexes	Aromatic ring	-CH=N
1	[(BENDAMB(1,3))$_2$Ni(NCS)$_2$Cd(SCN)$_2$]	7.18(s) 7.60(m)	8.67(s)
2	[(BENDAMB(1,3))$_2$Ni(NCS)$_2$Hg(SCN)$_2$]	7.19(s) 7.61(m)	8.48(s)

Cationic - anionic structure (A) for the complexes 1, 2 also supported by the fallowing ground.

(a) The Nickel complexes are low spin, it is not surrounded by four NCS group because the [Ni(NCS)$_4$]$^{2-}$ ion is high spin.

(b) HSAB theory[13] also support the binding possibility of thiocyanate ion in metal complexes where nitrogen of thiocyanate was well linked with comparatively harder Nickel.
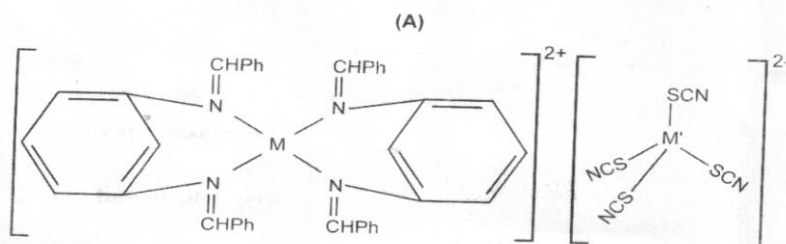
1.4. Application of softness parameter to the nature of bridge

Quantitative softness value of M and M' (M=Ni; M' =Cd, Hg) and thiocyanate ion are related with nature of the complexes i.e. Cationic-anionic, these softness values are derived by quantum mechanical procedure pioneered by Klopman[14].

The total softness values of M and M' have been derived by adding the softness values of ligand to the reported values of M and M'. The obtained values of softness parameter TEn$^{\neq}$(M-M') for complexes 1, 2, are in between 40.89-42.12 which can be accounted for cationic-anionic structure. The TEn$^{\neq}$ (M-M') values and predictions are presented in Table-**4**

Table – 4

S.N	Complexes	TEn$^{\neq}$ (M-M')	Nature of Bridge
1	[(BENDAMB(1,3))$_2$Ni(NCS)$_2$Cd(SCN)$_2$]	42.12	C.A.
2	[(BENDAMB(1,3))$_2$Ni(NCS)$_2$Hg(SCN)$_2$]	40.89	C.A.

Biological Studies

(a) Antibacterial activity

Complexes were screened to evaluate their antibacterial activity against bacteria (*E.coli*, *P.aurginisa*). All the complexes shows superior activity compared to solvent, which can be explained on the basis of Tweedy theory[15]. The Schiff base can penetrate the bacterial cell membrane by coordination of metal ion. Screening results are tabled in, Table **5a**

(b) Antifungal Screening

The fungicidal activity of the complexes was evaluated against *A.flavus* and *F.solani* by Agar plate technique. At the three concentration 1000 ppm, 100 ppm and 10 ppm. The average percentage inhibition after 96 hr by various compound was calculated from the given expression **-**

(%) inhibition = 10 (C-T) /C

Where C = diameter of fungus colony in control plates after 96 hr, and T = diameter of fungus colony in tested plated after 96hr. The results compiled in Table -5b, all the complexes show significant toxicity at 1000 ppm and 100 ppm but toxicity decreases rapidly at 10 ppm.

Table- 5a

S.N	Sample	E.coli	P.aurginisa
1	DMSO	-	-
2	[(BENDAMB(1,3))$_2$ Ni(NCS)$_2$Cd(SCN)$_2$]	+	+
3	[(BENDAMB(1,3))$_2$ Ni(NCS)$_2$Hg(SCN)$_2$]	++	+++

(-) zero activity, (+) less active, (++) moderately active, (+++) highly active.

Table- 5b

S.N	Complexes/Schiff Base	(%) inhibition after 96 hrs					
		A.flavus			*F.solani*		
		1000 ppm	100 ppm	10 ppm	1000 ppm	100 ppm	10 ppm
1	[(BENDAMB(1,3))$_2$Ni(NCS)$_2$Cd(SCN)$_2$]	63.7	55.9	40.4	71.7	59.2	46.2
2	[(BENDAMB(1,3))$_2$Ni(NCS)$_2$Hg(SCN)$_2$]	80.6	77.3	62.1	81.3	74.5	46

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HISTORY, PRESENT 2021 AND FUTURE OF CYBER ATTACKS

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ABSTRACT

Cyber-attacks are the attacks that target organizations and individuals either as a tool for other activities like identity theft, stalking, etc. or with a computer as a crime object like phishing, hacking, and spamming. Cyber-attacks are rapidly increasing and making cyber security a major concern in this day and age. When launched successfully, cyber-attacks can cause massive damage to individuals and businesses. Hence, immediate response is mandatory to contain the situation in case cyber-attacks occur. In this paper, we will discuss the history, present and future of cyber-attacks and measures for organizations to prevent those attacks in future. The ever illusive strategies and suspicious nature of criminals should also be identified. We have outlined some of the practices to prevent those attacks while recommending incidence response measures and updates in enterprises.

Keywords: cyber security, cyber-attacks, cyber criminals, cyber security practices, incidence response

Introduction

Cyber-attacks have been ranked 5[th] among top rated security risks in the year 2020 and became the new normal in private and public sectors. Cyber-attacks in IoT alone are projected to rise up by 200% by 2025 and this risky business is going to grow in the year 2021. In addition, Global Risk report 2020 released by World Economic Forum (2020) claimed that there is only 0.05% of detection in the US. The landscape of cyber security is changing rapidly and several changes have been made in 2020 alone. Almost all kinds of businesses, whether small or large, had been affected by global pandemic, which amplified cybercrime because of uncertainties related to business security and remote working.

From data theft to data breach and ransomware, there is around 600% rise in cybercrime due to COVID-19 pandemic. Almost every industry needs to look for new solutions and adapt faster. Considering these threats, this article will help businesses to explore the types of security threats and cyber-attacks that have ever happened, present trends, and might happen in future and scholars to look for the ways to ensure cyber security in future.

1.1 Background

COVID-19 took the healthcare system by storm but 2020 also brought a cyber pandemic (Lohrmann, 2021). Later on, top experts in the cyber security industry predicted 2021 to be even worse in terms of cyber security outcomes in comparison to 2020 (Lohrmann, 2021). The Orion vulnerability in SolarWinds was one of the worst data breaches ever made in December 2020 and it is still affecting over 18000 companies (Vaughan-Nichols, 2021). Microsoft recently reported vulnerabilities in its Calendar program and Exchange Server mail for government and corporate data centers. Chinese hackers were involved in causing vulnerabilities since January 2021, as per the reports of CNBC (Novet, 2021).

These are a few examples of modern cyber-attacks that have increased recently. In this article, we are going to discuss the genesis of cyber-attacks and their evolution to the present day as well as future trends of these attacks to be aware of. This research will open further research paths for academicians to explore more in this area and find more security vulnerabilities which should be addressed.

1.2 Literature Reviews

Irrespective of the impulsive changes which have taken place in the international politics, North Korea never stops posing threat to global stability by constantly advancing its "long-range ballistic missiles" and nukes. North Korea wants to make huge impact with cyber terrorism at relatively low costs of cyber offenses. **Hwang & Choi (2021)** shares the perspectives of explicit experts in cyber terrorism ever happened in South Korea to focus attention to these scenarios. At the same time, the authors claim to put emphasis on cybercrime and cyber terrorism practices and

current academic trend. They adopt criminological theories and perspectives as well as network frameworks of asymmetrical and multifaceted cyber terrorism in post-modern global politics. To do this, they conducted a qualitative analysis of existing trends, forms, objectives, and characteristics of cyber-attacks by North Korea and suggest how to progress for global policy response successfully.

A huge range of cyber-attacks have been observed since the 1980s on "Industrial Control Systems" and some of them affected "critical national infrastructure". There are limitations to access data about industrial communication networks related to cyber-attacks, especially in the context of national security, Miller et al (2021) explains the publicly reported cyber-attacks despite the limitations on accessing details about cyber-attacks targeting industrial communication systems. They analysed and identified earlier cyber-attacks targeted those systems and documented their evolution. They provide great understanding to cyber-security experts about threat actors, attack vectors, targeted locations and sectors, and impact, etc. for the constant improvements in cyber security risk management plans.

COVID-19 was an unexpected and a huge event which changed the lives of billions of people across the world and changed societal norms and the way people used to live and work. Apart from the unprecedented impact on businesses and society as a whole, COVID-19 pandemic has caused a set of unique situations related to cybercrime which affected both businesses and society. The pandemic has already caused a heightened fear with the risks of cyber-attacks along with the rise in range and number of cyber-attacks. **Lallie et al (2021)**analyse the effect of pandemic in the context of cyber-attacks which have happened across the world during COVID-19. They considered and analysedcyber-attacks in major global events to explore the modus operandi of attackers. They explored the gaps between the initial COVID-19 outbreak from China and the first cyber-attack followed by a pandemic. They used the case study of the UK to show how those crooks make the most of

government announcements and major events to design and execute their activities carefully. Currently, the majority of commercial, economic, social and government interactions of different countries are conducted in cyberspace. A lot of government organizations and private players worldwide are suffering the risks of cyber-attacks on their wireless networks. Modern world relies heavily on digital technology and it is still challenging to protect data from cyber-attacks. Cyber-attacks are basically aimed to cause financial harm to the companies. Some of the common attack vectors are malware, DoS, viruses, etc. Organizations use different techniques to avoid cyber-attacks. Researchers across the world have proposed a lot of methods to avoid cyber-attacks and control the damage. **Li and Liu (2021)** conducted a comprehensive review and survey on latest advances in cyber security and investigated the strengths, weaknesses, and challenges of methods proposed. They also discussed usual security practices with the early-generation methods and history of cyber security. They also explored the latest advancements and trends in cyber threats and security along with presenting challenges.

Since the late 1960s, research on cyber security has constantly evolved as information security or computer security. **McShane et al (2021)** briefly discuss the history while focusing on latest cyber risk management strategies including both economic and technical dimensions. They are aimed to discuss major steps involved in the cyber risk control process to focus on the gaps and determine research paths. Cyber risk is not easy to be covered in the overall process of risk management on enterprise level and it is important to approach cyber resilience.

1.3 Research Gap

Cyber-attacks have been more prevalent especially since 2020. In order to deal with those attacks, it has become more important than ever to understand the root cause behind those attacks. There are so many studies related to different kinds of cyber-attacks and policy recommendations. But there is still a lack of study regarding the past, present and future of cyber-attacks. This study is aimed to fill this gap and find out the right solutions to prevent

those attacks in future and financial and other losses to companies and governments.

1.4 Research Question

- What is the history of cyber-attacks?
- What are the cyber-attack trends in 2021?
- How are cyber-attacks going to be in future?

1.5 Importance of the Study

Considering the increasing instances of cyber-attacks, it becomes very important to understand how cyber attackers work and how they target organizations and individuals for cyber-attacks. It is even more important to know the origin of cyber-attacks and present scenarios. This way, we can predict how intense cyber-attacks are going to be in the near future.

1.6 Research Objectives

- To know the evolution of cyber-attacks from 1990s to present
- To know the current cyber-attack trends and how to ensure cyber security
- To find out how intense cyber-attacks are going to be in future

Research Methodology

2.1 Research Method & Design

In order to address the above research questions and fulfil research objectives, we have adopted a secondary research method through desktop search and collected recent resources, when it comes to know about existing cyber-attack trends and future predictions. However, we also needed to use earlier studies to explore the history of cyber-attacks and how they evolved over time. We have found relevant evidence based on our research questions. This way, researchers can study and synthesize the results of this study to find out the right policy, practices, and future directions. We used literary studies for getting credible resources so that researchers can critically analyse limitations, assumptions and findings. Hence, this study is aimed to pay more scientific contributions to future studies in the field of cyber security.

2.2 Research Approach

We have drawn studies on cyber threats and attacks during the pandemic since December 2019, i.e., the onset of COVID-19 and various types of cyber-attacks to different organizations across the world. We considered cybercrimes, cyber security, cyber threats, and cyber-attacks as the inclusion criteria for this research during the COVID-19 outbreak. We conducted a comprehensive search on several online portals, literature, journals, and other databases to search the specific information. We searched for relevant studies through Google Scholar as per our research questions. We chose some of the best online databases like Science Direct, IEEE Xplore, Google Scholar, SpringerLink, ACM Digital Library, and other databases as they are centralized sources for studies based on cyber security and technology.

2.3 Research Limitation

Though we have found some data from credible sources on the internet, there are some limitations of systematic research study. It has captured trends and focus areas in the literature, but there is a need to dig deeper into details and primary studies are required in this topic to assure the quality of results. In addition, more focused review of studies is required so that we can get more detailed information so that policymakers can make more informed decisions in future towards mitigation of cyber-attacks.

Analysis of Data

Be it Yahoo data breach, Equifax hack, Ashley Madison incident, or Exatis data leak, Cyber-attacks are constantly evolving day by day and becoming even more sophisticated (Cook, 2000; The Wired, 2018; Mindsight, 2017; Hackett, 2021). When it comes to data breaches or hacking, shady figures under the hoods stealing data for profit are the first that come in mind. But governments are also involved in cyber warfare to spy on enemy nation states. Nations may sway ideology, discourse, or voters and hackers can have a huge sum for selling electronic records of people. We have always wondered how it all started at some point. Before going any further,

here are some of the most common cyber-attacks taking place these days –

- **Worms** – They simply copy themselves on other computers and deliver a payload of malicious virus or cause network overloads. Such viruses may steal valuable data like passwords, delete files, and encrypt files (in case of ransomware attack). They deliver a payload to put a backdoor, so that computers can be controlled as hackers' botnets. They remain hidden in a system and wreak havoc (Figure 1).

Figure 1 – A Diagram of Multi-step Worm Attack
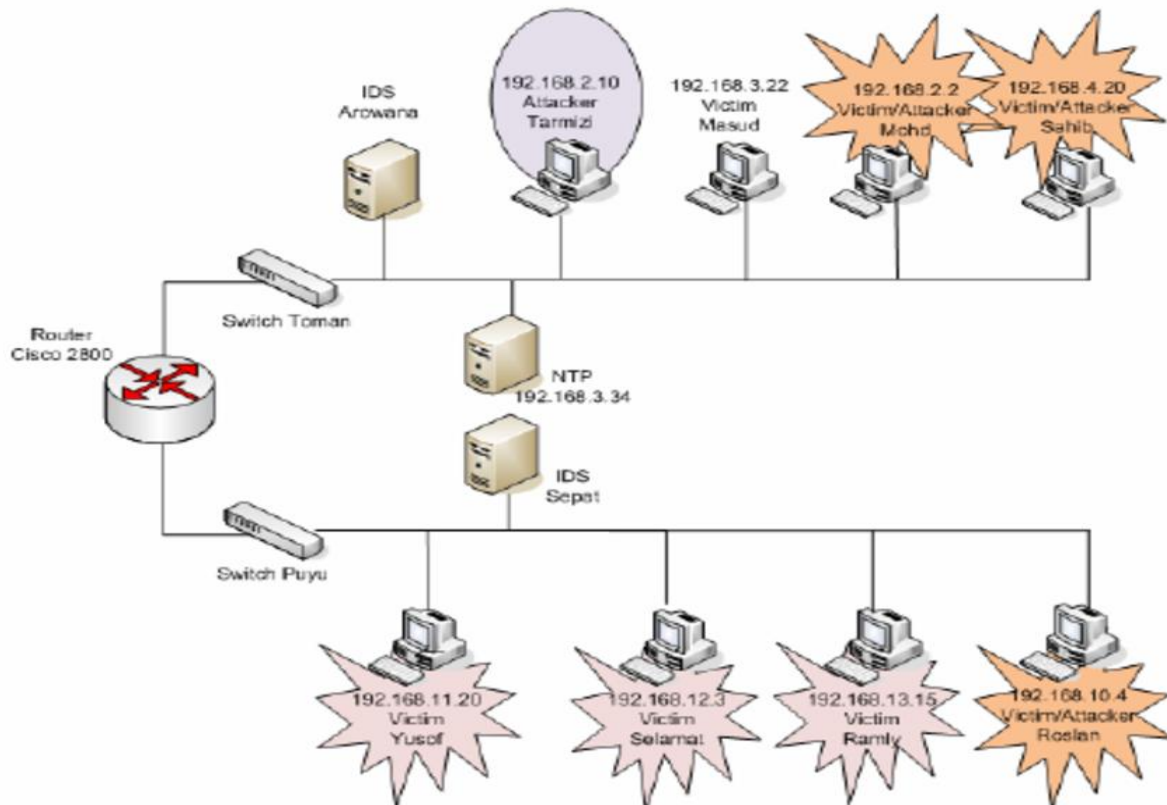
Source – Robiah et al (2010)

- **Botnet Attack** – A botnet is used to attempt a Distributed Denial of Service (DDoS) attack, conduct eavesdropping, and spread malware on a network or introduce a phishing attack. There is always a botmaster to control the botnets (Figure 2).

The DDoS attack vectors manipulate the networks being legitimate traffic coming through the servers and they cause major slowdowns and outages by overloading the system. These attacks target financial institutions or even businesses.
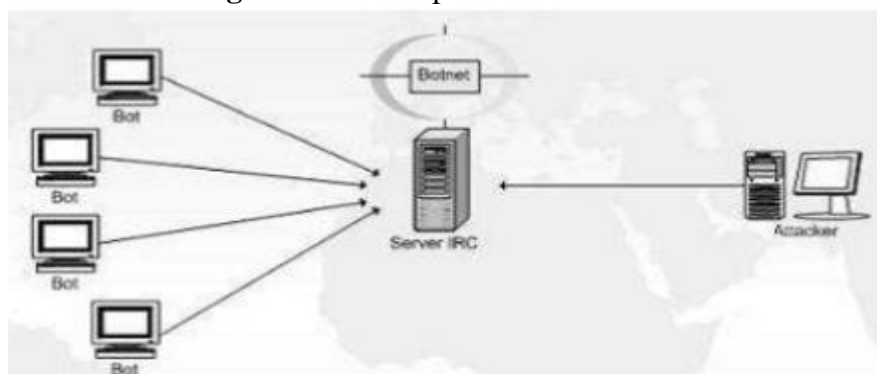
Figure 2 – A Sample of Botnet Attacks

Figure 2 – Botnet attack

● **Phishing** – As the name suggests, a hacker fishes mobile and internet users for data through email, text message, or even a letter sent from a source that seems too good to be true. A representative will either lure or scare the users to share their personal data like passwords, user names, account numbers, UPI pin code, ATM pin, and other sensitive information. They can retrieve all the details they need with this attempt.

● **Trojan Horses** – Once it enters the system, it downloads the threats from the internet secretly like malware, spyware, and other computer viruses, without letting the system know about the infection.

Q. What is the history of cyber-attacks?

Hundreds of thousands of cyber-attacks have been recorded in history over the years. Here's the brief overview of some of the major cyber-attacks ever happened–

Table 1 – History of Cyber Attacks

| Year	Cyber Attack Incident	Description
1988	The Morris Worm	It was done basically for good intent but it went wrong surprisingly. Robert Tappan Morris, a student in Cornell University developed a program to determine internet size. It used to crawl over the web, get installed on other systems, and count its copies. It was done to figure out the numbers of connected systems. The problem arose when it was installed on each computer multiple times. The infected computers crashed and deliberated with each attempt. It was the first ever DDoS attack, though it was done by accident. **Damage** – Over 6000 computers were damaged by the worm (i.e., 10% of the whole internet network of that time). Considering inflation, the damage cost from $100,000 to $1 million for restoration.
1995	Porsche Giveaway by LA KIIS FM	The 102th caller was supposed to win a Porsche by LA KIIS FM and Kevin Paulson definitely wanted to win. He used his hacking ability to block their calls and hacked the phone network to assure the slot of the 102nd caller. However, he got caught for this attempt and was booked for five years of imprisonment.
2002	DNS Attack	It was the first cyber-attack in history when the internet was targeted directly. The entire internet was assaulted by a DDoS attack for an hour by hitting 13 root servers of Domain Name System.
2008	DDoS Attack on "The Church of Scientology"	Anonymous, a famous hacker group, unleashed a DDoS Attack on "The Church of Scientology" as part of "Project Chaology" a political movement against them. Over 500 DoS attacks were made to get the Scientology website down. A teenager from New Jersey was involved who was charged heavy fines and sentenced to probation for two years.
2013	Yahoo	A state-sponsored attack was made in 2014 until Verizon declared its deal with Yahoo. It got worse because it led to compromising over 500 million accounts. Another breach took place in 2016 and over 1 billion accounts were compromised. **Damage** – According to Yahoo's valuations, the value of the company was down to around $300 million and over 3 billion accounts might be affected.
2014	JP Morgan Chase	During the summer of 2014, more than 7 million accounts of small businesses and 76 million households were hacked and hackers got their names, phone numbers, addresses, and emails.
2016	Adult Friend Finder	In October 2016, over 412.2 million account holders' names, passwords, and email accounts for over 20 years were leaked online. Poor SHA-1 hashing algorithm was used to protect the passwords.
2017	Equifax	One of the leading credit bureaus based in the US, Equifax exposes over 143 million accounts and the data was highly valuable and sensitive. For example, driver's license, birth dates, social security numbers, and even credit card details.
2018	Exactis	An unknown Florida-based marketing firm leaked over 340 million records. Some of the major parts of the leak include name, phone number, address, number of children (even their genders and ages), habits, interests, and even whether users follow a specific religion or smoke.

Source – Mindsight (Climer, 2018)

Q. What are the cyber-attack trends in 2021?

In this day and age, small and medium businesses are getting more targeted by cyber-attacks which are more frequent and complex. According to a study, small businesses are on the radar of 43% of cyber attackers and only 14% are prepared with proper cyber security measures (Accenture, 2019). Along with normal operations, cyber-attack disrupts major IT infrastructure and assets which cannot be recovered without proper resources or budget. Due to this reason, small businesses are unable to cope up with this. Here are some of the recent events happened to small and medium businesses worldwide, according to "State of Cyber Security Report" (Keeper Security, 2021) –

- 45% of small businesses are not prepared to mitigate security attacks due to insufficient measures.
- 66% of them had a cyber-attack over the past year.
- Cyber-attacks have been more targeted in 69% of cases.
- 57% of small businesses suffer phishing attacks, 30% face data theft, and 33% have stolen or compromised devices.

There are different ways cyber attackers can target an organization, i.e., by causing small disruptions to huge fiscal losses. There is some kind of cost involved in every consequence, be it monetary or otherwise, irrespective of cyber-attacks. Reputation damage, financial losses, declined productivity, legal trouble, and continuity issues are some of the consequences of cyber-attacks.

Figure 3 – Ransomware Attacks – Frequency of Cases
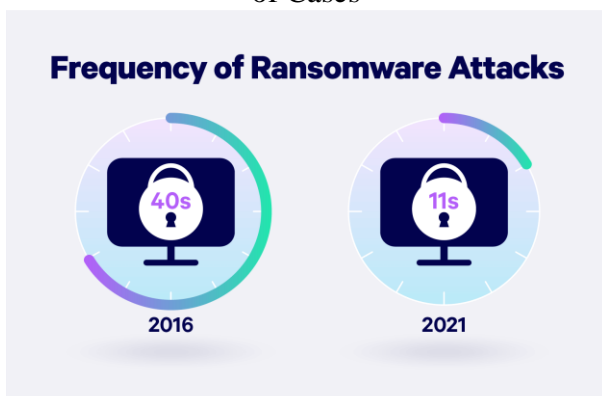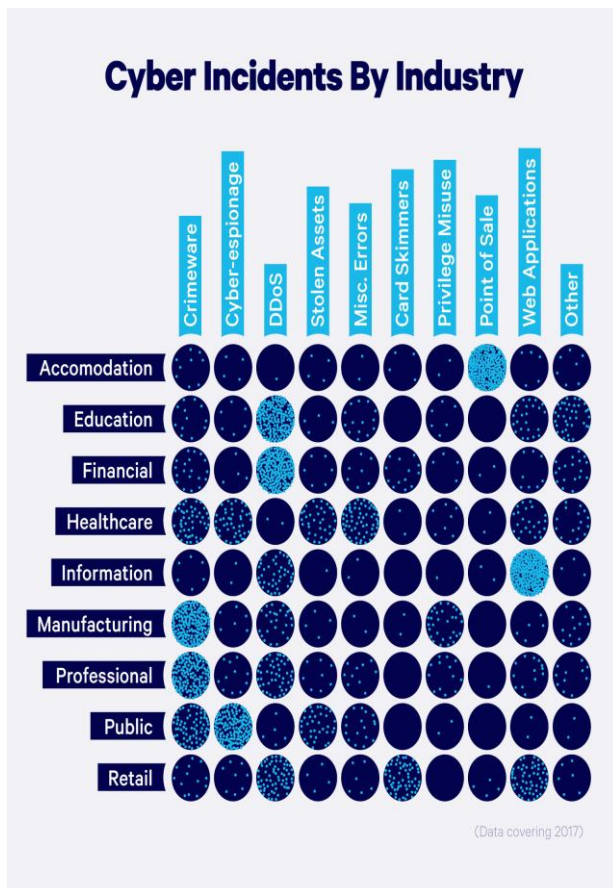

Source – Embroker (2021)

Ransomware attacks are becoming more frequent and a common security concern. Ransomware attacks used to target businesses every 40 seconds in 2016. In 2021, it rises up to every 11 seconds (Cybersecurity Ventures). A malicious program is used in this attack to encrypt important files in a computer system and a ransom amount is demanded from the victim to decrypt the same.

Q. How are cyber-attacks going to be in future?

Cyber-attacks target some industries even more, especially because of the kind of operations they perform. Though data breach could affect any industry, attackers usually target those who are closely related to the daily lives of people. They commonly target companies which hold personal information or sensitive data of clients. Here are some of the highly vulnerable organizations that should be very careful and be vigilant from future cyber-attacks –

- **FinTech and Banks** – They have bank details, card information, and personal data of clients or customers.

- **Healthcare** – They hold clinical research data, electronic health records (EHR), and patients' data, including billing information, social security numbers, and insurance claims.

- **Educational institutions** – They hold students' records, such as academic research, financial records, enrolment, and personal information like addresses, names, etc.

- **Companies** – They have inside information like trade secrets, product concepts, employee and client databases, intellectual property, contract deals, etc.

Figure 4 – Industries highly vulnerable to cyber attacks

Cyber Incidents By Industry

(Data covering 2017)

Source - Embroker (2021)

It is estimated that cybercrime had cost around $3 trillion to companies globally in 2015, which is projected to rise up by $10.5 trillion in 2025 annually (Intrusion Inc, 2020). According to Cybersecurity Ventures, cybercrime is increasing at around 15% per year of growth rate and greatest economic wealth transfer ever has been recorded in cybercrime.

Results & Findings

In a business or company, breach is discovered only when any major incident occurs. A breach is discovered after around 197 days on average in a company and it is usually contained around 69 days later, according to IBM. Companies which contained a breach after 30 days spent over $1 million as compared to those which took within 30 days. A company suffers even more trouble when they are slow to respond to a data breach. It can cause a lack of productivity, customer trust, or hefty fines.

One can be prepared in case of data breach with a proactive response plan. A risk management strategy is highly recommended to deal with incidents like breaches to mitigate the impact on the bottom line of the company.

For example, a response plan can guide the team in the stages of detection, investigation, containment, recovery, and remediation. Company database might be a bunch of boring files for an average individual, but it is a goldmine for hackers. They know what to do with those files and hard drives. Most of the cyber-attacks take place by insiders, outsiders, organized crime syndicates, company partners, and affiliated groups, according to a "Data Breach Investigations Report" by Verizon[1].

It is important to prevent data breaches after having a huge data breach event considering the increasing threats of mishandling information by hackers. There are various data breach laws in different countries. There are different factors to be considered as per the business location. Notifications regarding what are covered, breach, and penalties will look different as per the location and incidence. Even the most disciplined and careful organizations suffer data breaches at some point. The key here is to establish a proper disaster management plan to deal with potential risks to respond to attacks and contain the damage. It is evident that businesses are constantly under the risk of cybercrime and they should have proper steps to protect their data. They should take proper steps to avoid data breaches in future and following consequences.

Conclusion

All in all, both the cybercrime rate and frequency have increased and will rise up as a result of their past progress. In addition, ransomware is going through a great change as part of data breach incidents. Hackers just used to encrypt data and ask for ransom in the past. But it is recommended for companies to invest properly in their backup and restore plans with their IT team to avoid paying the ransom. These days, hackers are adding the element of data breach extortion as their next step and their ransom demand has been increased to "buy silence" and prevent the leak of sensitive data. The key here is to stay ahead with changing times and evolve data security plans.

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Future Scope

It is really hard to predict the future of cyber-attacks as confidence of cyber criminals is increasing to evade detection. They have permeated almost every part of large organizations and they might be very efficient to spread ransomware and expand their reach to small fishes and even people to their repertoire for their attack. They can easily spread their "small-dollar" attacks with rising automation to mobile and personal devices while being profitable.

In order to counter these attacks, companies should conduct cyber security risk assessment annually, either with third-party services or in-house IT staff. They can focus on the most prevalent types of cyber-attacks that could wreak havoc to their company and determine the risk levels. They can determine their acceptance levels to deal with existing levels of risk if they are willing to invest in further resources. In addition, anti-ransomware programs are also effective to thwart these attacks. These are relatively cheap and they can help save a lot of resources in an organization. Finally, organizations should also determine whether third-party vendors are prepared with their cyber security plans before contracting the services.

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CERA (CONSORTIUM FOR E-RESOURCES IN AGRICULTURE) ACCESS: A CASE STUDY OF A REMOTE RURAL INSTITUTE LIBRARY IN MAHARASHTRA

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ABSTRACT

Now-a-days almost all international journals are available in electronic format and are made available on Internet. Library co-operation, resource sharing is found among few libraries, from last two-three decades. Library e-resources consortium is a kind of library cooperation for e-resources sharing. Consortium for e-Resources in Agriculture (CeRA) is a project by Indian Council of Agricultural Research (ICAR), New Delhi. Approximately 152 consortia members, which include, all State and Central Agricultural Universities, ICAR institutes, Directorate, National Research Centres in India, are the beneficiaries of this consortium. CeRA access was provided at University library Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth in the year 2008, and fully started functioning in the year 2009. A case study of implementation of CeRA in a remotely situated Institute in Maharashtra, with special reference to Post Graduate Institute of Post Harvest Management, Killa, Tal. Roha, Dist. Raigad, Maharashtra is studied. This case study elaborates the procedures involved, along with generalized flowchart, which can be followed as a guideline / role model.

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Keywords: CeRA, Consortium, Agriculture consortium, ICAR, Jgate@CeRA, e-Journal access

Library Cooperation, Resource Sharing and Consortium

The idea that libraries should, in some way, find means to work cooperatively to provide people with access to books unavailable in nearby libraries is a deeply rooted concept in librarianship. A search for the origins of the concept leads one down intriguing trails, but the first exemplar is not likely to be found. Catalogs of manuscripts in more than one monastery library existed in thy first half of the thirteenth century. Kraus (1975).

Similarly in olden days, 'Library cooperation' concept was existing. Later on, the term, 'Resource sharing' was being coined. And now, hear about the term, 'Consortium'. These three concepts are not exactly one and the same, but are related with each other given in Fig. No. 1
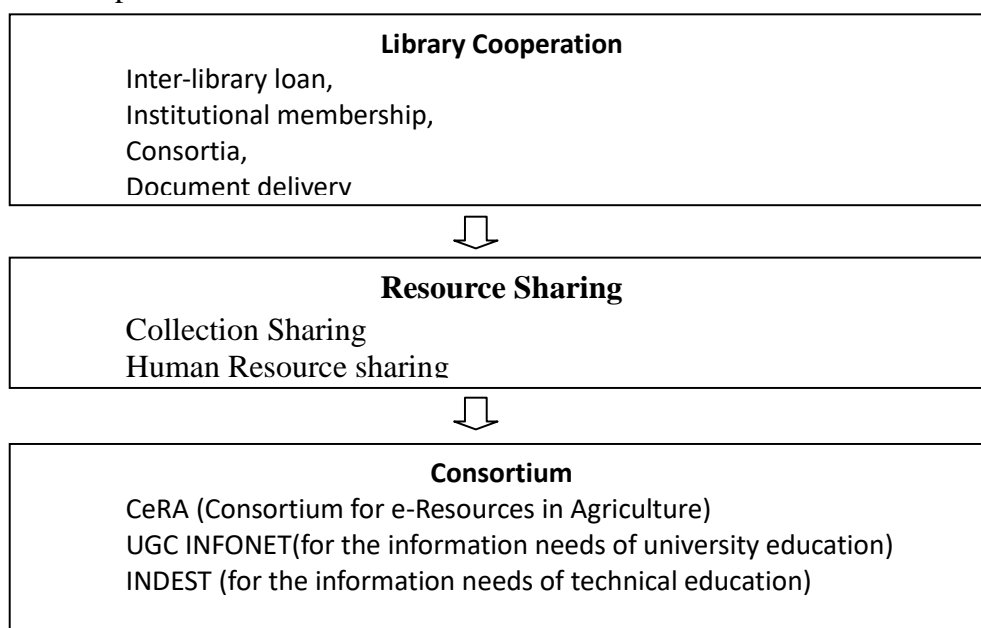
Fig. 1 : Library cooperation, Resource sharing and Consortium

In the research paper "Library cooperation: A Remedy but not a Panacea", Boissé Joseph A. (1995) highlighting the importance of Consortium comments, "The phrase 'Library cooperation' has become something like mantra in the library world of the late 20th century. Virtually every issue of every library publication mentions something about 'Library cooperation'. In our herculean efforts to overcome many of the enormous obstacles which we face, we look to 'Library cooperation' as a Panacea." In addition to this, Singh, K., & Rao, V. B. (2008) defined Consortia as, "A consortia is an association of two or more individuals, companies, organizations or governments (or any combination of these entities) with the objective of participating in a common activity or pooling their resources for achieving a common goal. Consortium is a Latin word, meaning 'partnership, association or society' and derives from consors 'partner', itself from con- 'together' and sors 'fate', meaning owner of means or comrade."

Stressing the need of Library Consortia, Uplaonkar Shilpa S and Kalikadevi G. Badiger (2017) mentioned, "Information explosion; Shrinking Budget; Diversity of user needs; Professionalization Of Library Services: Quick Access".

Exhaustive list of Consortia in India. Singh, K., & Rao, V. B. (2008)

Sr. No.	Consortium	Governing Body
1)	CSIR Library Consortia	**C**ouncil for **S**cientific and **I**ndustrial **R**esearch
2)	FORSA	**FO**rum for **R**esource **S**haring in **A**stronomy and Astrophysics)
3)	HELINET	**HE**alth Sciences **L**ibrary & **I**nformation **NET**work
4)	ICICI Knowledge Park	**I**ndustrial **C**redit and **I**nvestment **C**orporation of **I**ndia
5)	IIM's Library Consortia	The **I**ndian **I**nstitute of **M**anagement
6)	INDEST	**I**ndian **N**ational **D**igital Library in **E**ngineering **S**ciences and **T**echnology
7)	UGC-DAE	Consortium for Scientific Research DAE Library Consortia (**D**epartment of **A**tomic **E**nergy)
8)	UGC-Infonet	**U**niversity **G**rants **C**ommission
9)	ICAR - CeRA	**I**ndian **C**ouncil of **A**griculture **R**esearch Consortium for **e-R**esources in **A**griculture

Chauhan & Mahajan (2013) stated that, "Including scholarly contents has given right to the publishers of peer-reviewed journals to keep higher subscription rates. It always affects library budget to a great extent. Since long libraries have been experimenting different ways of library cooperation so that maximum benefit, especially economic benefit, could be extracted from their joint cooperation ventures. The term 'consortia' has been considered an advanced stage of library cooperation. Advent of electronic journals has given rise to homogonous libraries and national governments to cope with scarcity of funds and unavailability of internationally produced scholarly literature by means of establishing library consortia. Various library consortia have been mushroomed all across the world and India has also not been spared from it." (Chauhan & Mahajan, 2013)

According to Satija & Kaur (2009), "Resource sharing requires shared values and vision, as well as funding and commitment by stakeholders. Vital and well-run consortia are an important source of help for librarians. Consortial subscriptions are a common form of resource sharing. INDEST- AICTE and UGC-INFONET are open-ended consortia that have brought about a revolution in resource sharing." (Satija & Kaur, 2009)

Singh N. (2018) highlights that "Indian Agricultural Libraries are exploring new ways and collaborations to fulfil the information need of their patrons through resource sharing and delivering documents using online platform accessible 24X7. This system revealed that Inter Lending and Document Delivery Services (DDR) facilitated through a collaborative consortium Journal Gateway called CeRA under Indian National Agricultural Research System. CeRA the (Consortium for e-Resources in Agriculture) provides a platform for online acess to e-journals and inter lending. DDR Services has been established to share resources subscribed by individual libraries as well as consortium journals using the web portal. The article also discusses the use of DDR services by patrons

of the first Indian Agricultural University in the country. Reports that the student community were most active in using the platform for inter library loan and document request in comparison to the faculty researchers who were less dependent on document from other libraries." (N. Singh, 2018)
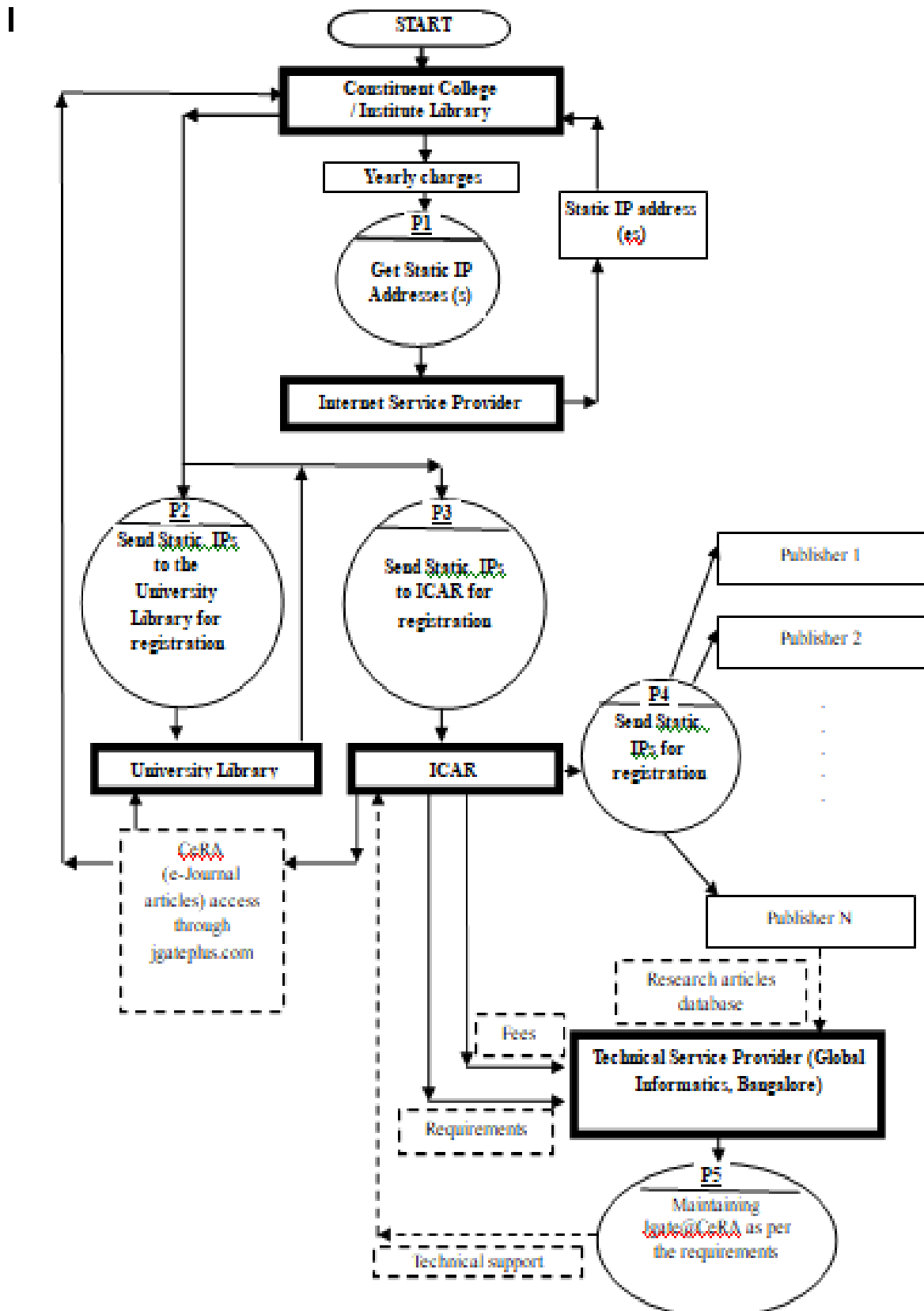

Fig. 2. Flowchart depicting CeRA access in a constituent College / Institute Library'

As per the Cera_leaflet-2012-FINAL.pdf (n.d.) it is understood that, "Consortium for e-Resources in Agriculture (CeRA) is one of the important sources of online journals in Indian agricultural universities and institutions. All the Indian agricultural libraries of State Agriculture Universities and ICAR Institutions have been accessing online national and international journals through CeRA. Since, ICAR is having network connectivity across institutes and state agricultural universities, select journals could be made available over the network for the use of scientific community. Accordingly, the Consortium for e-Resources in Agriculture (CeRA) was established in November 2007 for facilitating accessibility of scientific journals to all researchers / teachers in the National Agricultural Research System by providing access to information specially access to journals online which is crucial for having excellence in research and teaching."

Procedures involved in the access to CeRA (Consortium for e-Resources in Agriculture) (Ref. Fig. 2) followed in Post Graduate Institute of Post Harvest Management, Killa-Roha, Dist. Raigad. Maharashtra , a constituent college working under Dr. .Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra :

This Institute is located in remote area, and far away, at a longer distance from the University campus. Being a State Agricultural University, DBSKKV is part of ICAR's CeRA (Consortium for e-Resources in Agriculture). The patrons of PGI PHM Institute Library were in need of access to CeRA.

CeRA can be accessed in two ways:

1) Using credentials: In this method, the system will ask for Username and Password. (University Library is supposed to provide the credentials to the Institute library)

2) Registering Institute's Static IPs with University Library and ICAR, Publishers

Following method was adopted, while implementing CeRA at the PGI PHM Institute Library.

Flowchart depicting CeRA access in a constituent College / Institute Library' is a generalized flowchart given in Fig. 2. It is discussed, with special reference to Post Graduate Institute of Post Harvest Management, Killa-Roha, Dist. Raigad. M.S. 402116.

The first entity involved is, of course the Institute Library. The patrons of this library need access to CeRA. So, the Institute Library had asked for Static IPs from the Internet Service Provider (the 2nd entity involved in the picture). Please note that, some ISP (Internet Service Providers) ask for annual charges for Static IPs. Now, these Static IPs were provided to ICAR (Indian Council of Agriculture Research, New Delhi) and the DBSKKV University Library, for registration purpose.

The DBSKKV University Library, is being directly member of CeRA, is using Static IPs and already communicated to ICAR, New Delhi.

ICAR registered these Static IPs with various Publishers, and acknowledged the same to the PGI PHM Institute Library.

All the above procedures took longer time for communication and execution. But, once it is done, the patrons got access to CeRA. Now, the teething problems started, e.g., not getting access to some articles etc. Then Institute communicated the same to ICAR.

The user (Institute Library) is not directly related to one more entity shown in the picture, i.e., Technical Service Provider. Here, in this example it was, Global Informatics Pvt. Ltd., Bengaluru, who provide technical support to ICAR, in maintaining the JGate@CeRA, http://www.jgateplus.com website.

When, the Institute needs the CeRA usage statistics, it has to approach DBSKKV University Library (the CeRA Admin part is handled by it) and jcoordinator@informaticsglobal.com . The system provides CeRA usage statistics of a University and not that of a College / Institute Library.

Using Credentials is another way to access CeRA consortium. The credentials are provided by the University Library.

Constraints

1. Availability of Internet. In rural areas network availability is a big issue. Many a times, the network is not available.
2. For static IP, the Internet Service Provider, charges on the annual basis. If not paid the charges, the users get limited access to the consortium.
3. If the static IPs are changed, which are registered with the different publishers, again the institute needs to convery the new IPs to the University Library and ICAR, so that ICAR-DKMA conveys it to all the publishers. This is very time consuming process.
4. e-books covered under CeRA are not accessible. (https://www.icar.org.in/sites/default/files/Elsevier-eBooks-CeRA.pdf#overlay-context=content/consortium-e-resources-agriculture-cera accessed on 23.11.2020)
5. Copyright problems and misuse of research material; Absence of printed copies of journals; Internet access is necessary; Combination of essential and non-essential journals; Requires high initial investment in license and information and communication technology; (Sadu Ranganadham and Lokachari Lakshmipathi (2013).
6. Lack of infrastructure; .Not easy to use; Difficult to read; Lack of training; .Preference to paper journals. (https://naip.icar.gov.in/download/77209/final-cerareport.pdf/final-cerareport.pdf Accessed on 01.12.2020)

7. The CeRA Usage statistics reports can be generated only by Admin user i.e., University Library. There is no access to Institute Libraries to the CeRA usage statistics reports. Moreover, these reports can be generated for the whole university users and not only for the Institute/ IP based usage statistics. If the Institute/college wants to find out CeRA usage statistics for oneself, it is not available.
So, the data provided here is of the Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli.
(https://jgateplus.com/admin/faces/RMS/counterReport.xhtml Accessed on 01.12.2020)

Table 1. : JGate@CeRA Usage Statistics report Date: From 07/2018 to 06/2019

Sl. No.	Group Name	Total
1	TOTAL HITS	36840
2	Total Logins / Sessions	2472
3	Searches	20763
4	Full text / Abstract Views	5542
5	ILL Requests/Enquiries	362
6	TOC Browsing	3763
7	Profiles Created	143
8	E mail Alerts	2
9	RSS Feeds	2
10	Others	3791

(Source: Global Informatics, Bengaluru, Karnataka, India)

Table 2. : JGate@CeRA Usage Statistics report Date: From 07/2019 to 06/2020

Sl. No.	Group Name	Total
1	TOTAL HITS	21230
2	Total Logins / Sessions	1666
3	Searches	10867
4	Full text / Abstract Views	3256
5	ILL Requests/Enquiries	363
6	TOC Browsing	2754
7	Profiles Created	147
8	E mail Alerts	5
9	RSS Feeds	1
10	Others	2171

(Source: Global Informatics, Bengaluru, Karnataka, India)

Table 3. : JGate@CeRA Usage Statistics report Date: From 07/2020 to 12/2020

Sl. No.	Group Name	Total
1	TOTAL HITS	4852
2	Total Logins / Sessions	273
3	Searches	2899
4	Fulltext / Abstract Views	1064
5	ILL Requests/Enquiries	21
6	TOC Browsing	240
7	Profiles Created	1
8	E mail Alerts	1

| 9 | RSS Feeds | 0 |
| 10 | Others | 353 |

(Source: Global Informatics, Bengaluru, Karnataka, India)

Advantages

1. CeRA acts like a catalyst to enhance agricultural research, education and extension activities of NARS institution in achieving excellence and setting high standards in output and service to the society. (https://www.icar.org.in/content/consortium-e-resources-agriculture-cera Accessed on 25.11.2020)

2. Currently publishers like Springer, Wiley-Blackwell and Elsevier are providing their articles on-line before their print versions are made available. With respect to CeRA, vairous features like Simple Search, Advance Search, etc. Are provided through the Consortia. E-Publishing has increased the interactivity and customization for consortia users by providing alerting services like 'My Journals'. (Chandrasekharan, H. et. al. (2012)

3. Available 24&7 days; Search bibliography / full text of article; Avoids duplication of resources; Provides access to wider range of electronic resources at lower cost; Helps to develop common resources database; Optimum utilization of funds; Facilities to build up digital libraries. Sadu Ranganadham and Lokachari Lakshmipathi (2013).

4. It is available from desktop; Speed of publication; Easy search; Hyperlinks; Graphic capabilities; Onscreen reading; Access from different locations; .Downloading facility; Easy accessibility.
(https://naip.icar.gov.in/download/77209/final-cerareport.pdf/final-cerareport.pdf Accessed on 01.12.2020)

5. Information explosion; Shrinking Budget; Diversity of user needs; Professionalization Of Library Services: Quick Access:

Conclusion: Consortium is one of the examples of Library co-operation. CeRA (Consortium for e-Resources in Agriculture) can be accessed by Static IP method or Credentials method. PGI PHM Institute Library used Static IP s method for access to CeRA. Institute Library, University Library, Internet Service Provider, ICAR, Technical Service Provider and Publishers are the entities involved in it.

Way Forward: The users of the CeRA consortium are able to access the valuable, reputed journals and research articles therefrom in Full Text or able to Request Article from the consortia member library. They can integrate consortia with any standard Reference Management Software like Zotero / Mendeley for ease.

There are near about 7-8 active consortiums in Indian Government institute libraries like UGC-Infonet for (Non agricultural universities in India), INDEST for Engineering faculty, CeRA for Agricultural Universities etc. In future, all these consortiums may be merged together for better access to e-Resources available having one large domain.

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