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A Comparative Study and Visualization of Machine Learning Algorithms on Student Performance Prediction

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Abstract

Students' performance prediction is forecasting the academic performance of students which can help the educational institutions to provide timely actions like modification of classroom practices and introduction of remedial/coaching classes. Evaluating the performance of students and predicting their future academic performance is a challenging yet productive task for any educational institution. This research work predicts the grade of the students by considering their marks in the beginning of the course using machine learning algorithm using Python 3.7. Various machine learning algorithms like Naive-Bayes, KNN, Decision Tree, Random Forest, Gradient Boosting were used and their accuracies were compared by visualization. The effectiveness of student performance prediction depends on the accuracy of the algorithm used. It was found that the accuracy of Decision Tree algorithm was highest and the prediction model was built on it.

Keywords - Students' performance prediction, Machine Learning, Educational Data Mining.

I. Introduction

Assessment and evaluations are vital tools at all levels of education for developing appropriate curriculum, train students using various instructional methodologies and deciding the overall effectiveness of courses/programs. Students' academic performance is acquired from the data of a variety of assessments like tests, assignments, projects, etc. that accurately reflect students' preparation, capability, and interest. The early academic prediction helps the institution by identifying the students' strength and weaknesses which in turns helps in the excellence of institutions.

A. Educational Data Mining

Educational data mining (EDM) refers to techniques, tools, and research designed for automatically extracting meaning from large repositories of data generated by or related to people's learning activities in educational settings [1]. EDM is a combination of education, computer science and statistics. Performance prediction is forecasting the students' performance based on various factors such as academics, social-economic background, family status, scholarships, previous grade obtained, study time, etc. [2]. This research work focuses and considers only the academic performance of a student in the early period of their course and predicts the final grade which will be obtained at the end of the course.

B. Machine Learning Classification Algorithm

Machine learning enables the machines to learn from data and build predictions without being explicitly programmed for that task, automatically without human involvement [3] Machine learning algorithms can be classified into supervised and unsupervised leaning. In supervised learning, machines are trained with a known set of data that is, the input data are correctly tagged with its output data. When a new input data comes in, it is evaluated based on the existing trained data and predictions are made. In classification algorithm, the new input data is classified into the class it belongs to. Thus, the results in classification algorithm are categorical. In this research work, we have more than two classes of outcome and it comes under multi-class classification.

II. Methodology

This session explains about the process involved in this research work. Fig. 1 picturises the sequential flow of the process.

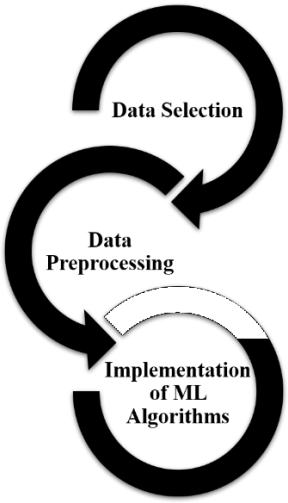

Fig. 1 Flow of Process

Data related to student performance prediction is selected and it is pre-processed to get it into the desired data for usage. The processed data is split into training data and target data. Machine learning model is built using the algorithms and the model is trained using the training data. Performance of the model is tested using the target data and different evaluation metrics are used to calculate the performance of the model. A prediction model is built based on the most accurate classifier.

A. Data Selection

A benchmark dataset is chosen from the internet. It contains the internal tests marks, assignment marks, score for attendance, external exam marks and the grade of a subject. Fig. 2 represents the student marks dataset.

	Student ID	Regular/Lateral	CIA-1	CIA-2	CIA-3	Assignment-1	Assignment-2	Assignment-3	Attendance (%)	Internal(50)	External(100)	Final Marks	Grade
0	1	Regular	2	22	8	8	10	8	100	20	49	44	F
1	2	Regular	2	10	18	10	10	9	90	20	45	42	F
2	3	Regular	8	20	40	8	10	8	79	32	94	79	B
3	4	Regular	31	29	40	10	9	8	90	37	47	60	D
4	5	Regular	26	16	30	9	9	8	96	31	50	56	D

Fig. 2 Student Marks Dataset

The description of the student marks dataset is given in the Table 1 along with its datatype. There are 13 attributes and 10000 records in the dataset which makes the prediction more accurate.

TABLE I. DESCRIPTION OF THE STUDENT MARKS DATASET

S. No	Attribute Name	Description	Datatype
1.	'Student ID'	Registration number of the students	numeric
2.	'Regular/Lateral'	Entry of the student to the institution – regular or lateral entry	categorical
3.	'CIA-1'	Continuous Internal Assessment – 1, Mark ranges from 0-40	numeric
4.	'CIA-2'	Continuous Internal Assessment – 2, Mark ranges from 0-40	numeric
5.	'CIA-3'	Continuous Internal Assessment – 3, Mark ranges from 0-40	numeric
6.	'Assignment-1'	Assignment, Mark ranges from 0-10	numeric
7.	'Assignment-2'	Assignment, Mark ranges from 0-10	numeric
8.	'Assignment-3'	Assignment, Mark ranges from 0-10	numeric
9.	'Attendance (%)'	Percentage of Attendance	numeric
10.	'Internal(50)'	Internal Marks – calculated based on CIAs, assignments, and attendance, ranges from 0-50	numeric
11.	'External(100)'	External Exam, mark ranges from 0-100	numeric
12.	'Final Marks'	Final marks calculated based on internal and external marks. It ranges from 0-100	numeric
13.	'Grade'	Grade calculated based on final marks. Various grades are S, A+, A, B, C, D, F	categorical

B. Data Pre-processing

```
#to find missing value
student_data.isnull().sum()

Student ID          0
Regular/Lateral     0
CIA-1               0
CIA-2               0
CIA-3               0
Assignment-1        0
Assignment-2        0
Assignment-3        0
Attendance (%)      0
Internal(50)        0
External(100)       0
Final Marks         0
Grade               0
dtype: int64
```

Fig. 3 Finding Missing Values

Data pre-processing is preparing the raw data suitable for the machine learning model. The first step in data pre-processing is to find out the missing values in the data set. Fig 3. shows the method to find the missing values in python 3.7. it is found that there are no missing values in the entire dataset.

The next step in data pre-processing is encoding the categorical datatype attributes to numeric. From the Table 1, there are two attributes, ‘Regular / Lateral' and ‘Grade’ which are of categorical datatype. In python, LabelEncoder() method encodes the categorical value and give a numeric value for the attributes.

Next step is the feature scaling. Here the features are the attributes in the dataset. In some cases, it is necessary to standardize the independent variables (attributes) of the dataset in a specific range. In this research work, mostly all variables are marks and it is already in the range of values so it was not needed to scale the features.

C. Implementation of Machine Learning Algorithms

The pre-processed data is split into two sets as training data and test data of 70% and 30% respectively. The student marks dataset contains 10000 records, it is split into 7000 training data and 3000 test data. Final marks and grade are the target variables and it is removed from the test data. Using this data, the machine learning models were built based on the following classification algorithms.

- Gaussian Naive-Bayes
- K-Nearest Neighbor (KNN)
- Decision Tree
- Random Forest
- Gradient Boosting

It is very important to choose the best machine learning classifier for a perfect prediction. There are different metrics to evaluate the efficiency of the models. In this research work, every classifier was evaluated based on

- Accuracy
- Precision
- Recall
- F1 score

The overall performance of the model can be evaluated using confusion matrix. Confusion matrix gives a comparison between actual and predicted values on the test data. The following terminologies are related to confusion matrix.

True Positive (TP) - Observations that were predicted YES and were actually YES. True Negative (TN) - Observations that were predicted NO and were actually NO. False Positive (FP) - Observations that were predicted YES but were actually NO. False Negative (FN) - Observations that were predicted NO but were actually YES.

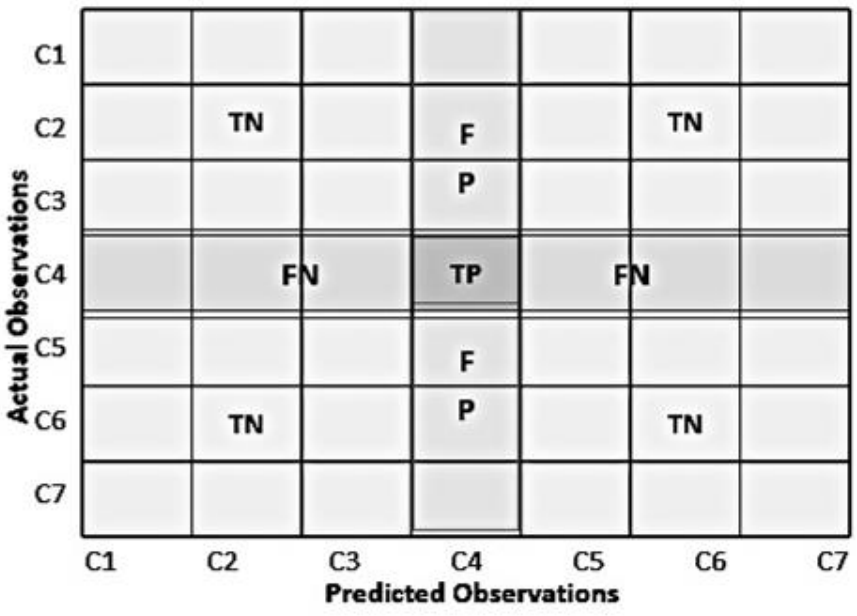

Fig. 4 Confusion Matrix

Fig. 4 gives the confusion matrix. In student dataset there are seven grades, ie the target variable, from F to S and is been considered as seven classes. The predicted observations fall in any of these classes. Accuracy of the classifier is calculated by

$$Accuracy = (TP + TN) / (TP+FP+TN+FN) \quad (1)$$

In the Fig. 4, class 4 is considered. In multi-class classification the sum of all individual TP, TN, FP, and FN are used to calculated the accuracy.

III. Results and Discussion

The machine learning classifiers are evaluated based on different evaluation metrics and confusion matrices.

A. Confusion Matrices

Confusion matrix gives the performance of the classifier based on the classes. Fig.5 picturizes the confusion matrix of all the ML algorithms. Decision tree classifier gives the best accuracy when compared the other classifiers.

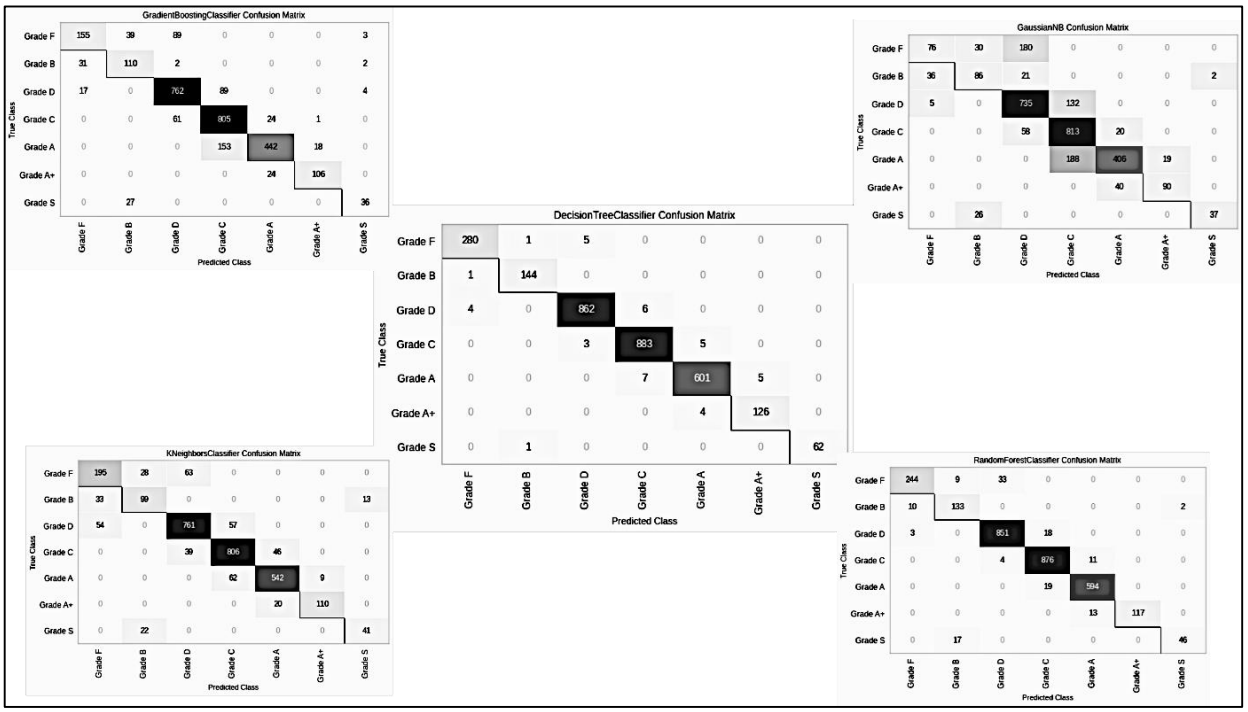

Fig. 5 Confusion Matrices of Classifiers

B. Accuracy

Accuracy of an algorithm is its correctness of predicting the result based on already trained data. Equation (1) gives the formula for calculating the accuracy.

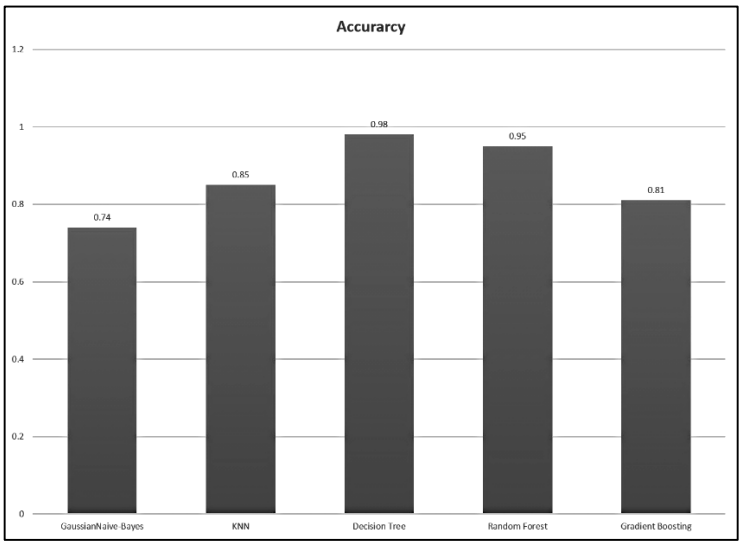

Fig. 6 A Comparison of Accuracy of Classifiers

The accuracy of the Decision Tree classifier is the highest and it is 98%. Hence this classifier is chosen among all other classifiers.

C. Precision

Precision is defined as the ratio of correctly predicted positive observations (True Positive) to a total number of predicted positive observations (either correctly or incorrectly).

$$Precision = TP/(TP+FP) \quad (2)$$

Precision helps us to visualize the reliability of the machine learning model in classifying the model as positive. Fig. 6 shows the comparison of precision of the different classifiers.

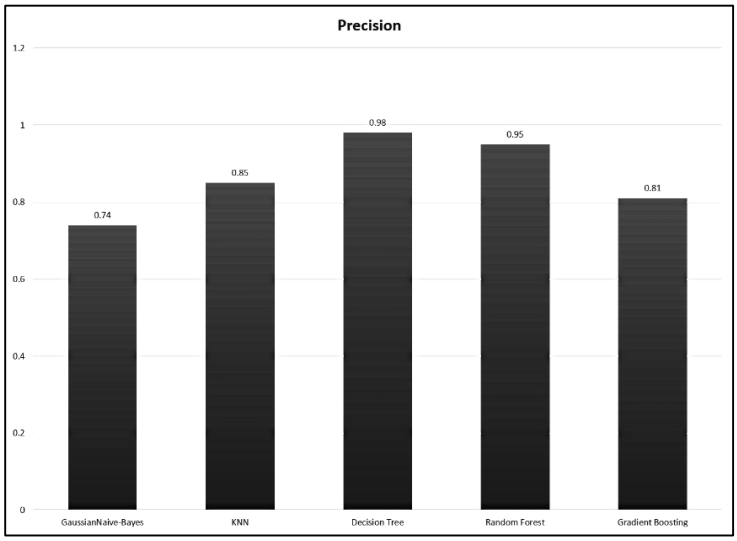

Fig. 7 A Comparison of Precision of Classifiers

D. Recall

The recall is calculated as the ratio of correctly predicted positive observations (True Positive) to the total number of positive observations. The recall measures the model's ability to detect positive observations. The higher the recall, the more positive samples detected.

$$Recall = TP/(TP+FN) \quad (3)$$

Recall is independent of the number of negative sample classifications. Fig. 8 shows the comparison of recall value of the different classifiers.

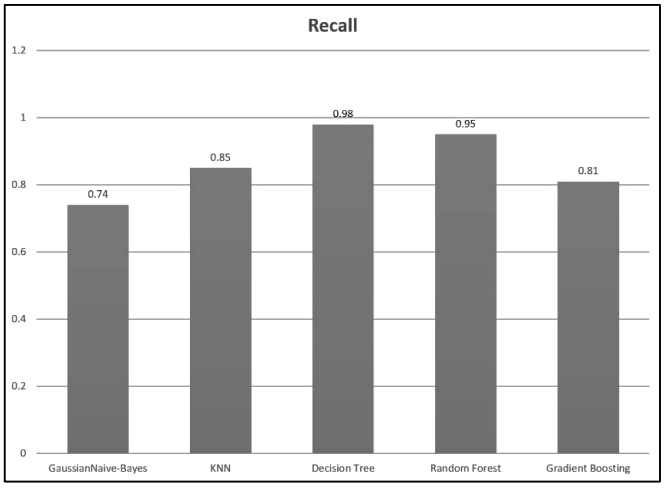

Fig. 8 A Comparison of Recall of Classifiers

E. F1 Score

The F1 score is to combine the precision and recall metrics into a single metric. F1 score is useful when the dataset is highly imbalanced. By definition, it is the harmonic mean of precision and recall.

$$F1\ score = 2*((Precision*Recall) / (Precision+Recall)) \quad (4)$$

Since the F1 score is an average of Precision and Recall, it means that the F1 score gives equal weight to Precision and Recall. In some cases, instead of having as two different metrics, F1 score is useful. Fig. 9 shows the comparison of F1 score of the different classifiers.

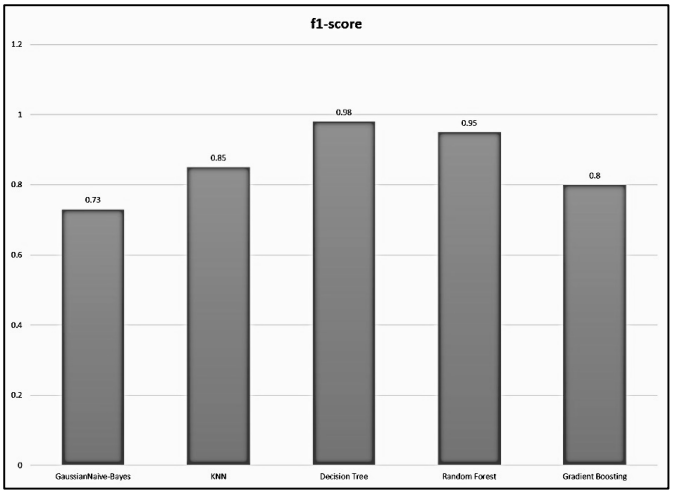

Fig. 9 A Comparison of F1 score of Classifiers

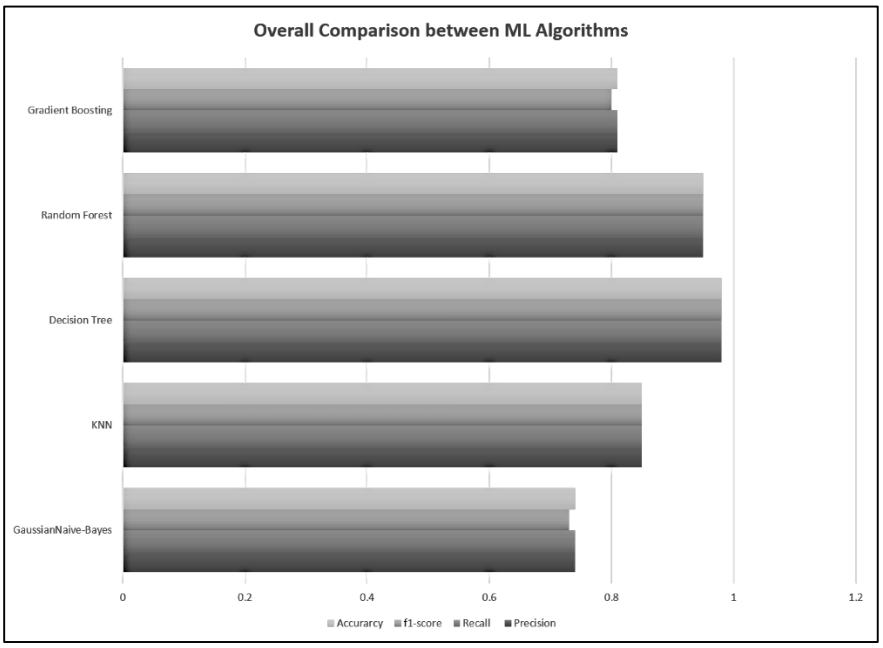

Fig. 10 Overall comparison of Classifiers

Fig. 10 shows the overall performance of all the ML algorithms. And its clearly seen that the decision tree classifiers precede all other algorithms such as KNN, Gaussian Nave Bayes, Random Forest and Gradient Boosting algorithm.

IV. Conclusion

This research work implemented different machine learning algorithm on students' database and evaluated the performance of the classifiers based on different metrics. It is found that the decision tree classifier performed best when compared to KNN, Gaussian Nave Bayes, Random Forest and Gradient Boosting algorithms. The accuracy of the classifier is 98%. Hence a ML model is built on it. The limitation of this research work is, only academic features of the students' performance are considered while there are non-academic features too which plays a vital role in students' performance. The future work of this research is to convert this model into a web application and to deploy in websites for the institutions to make use of the student performance predictive application.

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Financial support for this study was provided by the Faculty Research Seed Grant from the Women's Christian College through the Centre of Research and Development. The author wish to thank Dr. Lilian I. Jasper, Principal, the Deans of Research, and the Management of Women's Christian College for encouraging the interest of the author in research and granting funds to carry it out successfully.

References

[1] A. Algarni, “Data Mining in Education,” *Int. J. Adv. Comput. Sci. Appl.*, vol. 7, no. 6, 2016, doi: 10.14569/IJACSA.2016.070659.

[2] E. Osmanbegović, M. Suljić, and H. Agić, “DETERMINING DOMINANT FACTOR FOR STUDENTS PERFORMANCE PREDICTION BY USING DATA MINING CLASSIFICATION ALGORITHMS,” *Broj*, vol. 34, no. 34, 2014.

[3] P. C. Sen, M. Hajra, and M. Ghosh, “Supervised Classification Algorithms in Machine Learning: A Survey and Review,” *Adv. Intell. Syst. Comput.*, vol. 937, pp. 99–111, 2020, doi: 10.1007/978-981-13-7403-6_11/COVER.

A STUDY ON PERCEPTION AND AWARENESS OF KAVALAN SOS APP AMONG COLLEGE STUDENTS IN CHENNAI

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ABSTRACT

This paper studies the perception and awareness of the Kavalan SOS mobile application among college students in Chennai. The government has introduced various security measures to protect women, including the development of security applications. Although there are many security apps for women, this research focuses on the Kavalan app which was launched by Tamil Nadu Police in 2018 to keep women safe. The result of the study shows that only about 50% of the respondents have used the Kavalan SOS App.

INTRODUCTION

Threats to women's safety have become the norm today, and research around the world has identified various causes for the increase in crimes against women, including women being exposed to all walks of life. Women now work on a par with men in all fields, even late into the night. In such a scenario, the safety of women is a major concern given the increasing number of crimes against women.

Although the patriarchal thinking of society has changed a lot in the last decade, it has not helped to treat women equally. Women's safety is still threatened in a variety of ways, including night abuse, sexual harassment, rape, and domestic violence. Most crimes against women are unexplained due to family and social pressures. Therefore, the number of registered cases against women is significantly lower than the number of crimes committed in the country. Given the trauma that sexual violence can inflict on a woman and the slow pace of India's justice system, prevention is often considered better than cure. Women's safety has always been a problem even in this modern age with such technological advancements.

Technology has been practiced as an effective solution to this problem and to inspire women's confidence by promising freedom and security. Many companies have developed various mobile applications that promise security for women. This mobile app was designed to give women a sense of empowerment and ensure their safety by telling their close contacts about them with the click of a button. Although there are many security apps for women, this research focuses on the Kavalan app which was launched by Tamil Nadu Police in 2018 to keep women safe, to study the perception and awareness of the Kavalan SOS mobile application among college students in Chennai.

PURPOSE OF RESEARCH

The purpose of this research is to study the perception and awareness of the Kavalan SOS app among college students in Chennai. The results of this study will help the government to put up awareness camps and add many features in the app.

RESEARCH OBJECTIVES

The research objectives of this study are developed as follows:

- To explore and reach the usage of the Kavalan mobile application as an effective tool for the safety of college students.
- To analyse whether there is relationship between Awareness and Perception on Usage of Kavalan Safety App.
- To study the relationship between the awareness of the app and attitude toward technology for women's safety
- To study the demographic profile of the respondents.

LITERATURE REVIEW

According to **Westmarland et.al (2013)** the safety of women through mobile applications in their book Protecting Women's Safety, examined the use of smartphone applications in the context of domestic and sexual violence.

Mason C. et.al (2012) in their book studies on Surveillance and violence against Women, discuss surveillance technology, where they discuss a theoretical framework that highlights the challenges that new technologies pose to violent movements against women. (Mason, 2012).

(Vodafone's, 2014) on Connected Women talks about how smartphones can contribute to women's economic and social empowerment. The study reports that mobile phone use has empowered women in many ways, including exposure to literacy, banking, and health. It also makes them discover new business opportunities.

There are extensive studies conducted of safety apps among women in general concentrating on technological aspects. Therefore this study concentrates on studying mainly the awareness and perception of the Kavalan SOS app among college students in Chennai.

OVERVIEW OF KAVALAN SOS APP

Source:https://tamil.gizbot.com/news/tamil-nadu-police-introduces-kavalan-sos-app-for-ladies-031377.html

The Kavalan mobile app was initiated by the Government of Tamil Nadu as an SOS app under the Mobile Control Room initiative. Kavalan (meaning Police in Tamil) is an SOS app developed by the Tamil Nadu Police as part of the Tamil Nadu State Police Master Control Room initiative. The app is for the people of Tamil Nadu to seek police assistance instantly in emergency situations such as physical emergencies, eve teasing, kidnapping or natural disasters such as floods, earthquake, etc. (Vikaspedia) This mobile app is developed by Amtex Systems and with the help of this mobile app, the people of Tamil Nadu can get the help of the Tamil Nadu Police in case of an emergency. The app can be easily downloaded from the Google play store for Android users and from the Apple store for the IOS platform, allowing users of both platforms to ask for help during difficult times.

Awareness

Within one minute, the Kavalan team contacts the person in need to clarify the type of emergency, simultaneously person's location is shared with preregistered emergency contacts as an SMS alert. Unfortunately, the cons seem to outweigh the pros with the SOS app. In four years, the app has attracted only about 1 million subscribers but population in Tamil Nadu is 68 million. The awareness of the app hasn't been made to the fullest. Also, the transparency or statistics of how this app is benefitting users is unobtainable .Another point to ponder on, there are some miscommunications that the app works even when the phone is switched off or has no data connectivity, but the terms and conditions of the app clearly states that data and network connectivity is very much a requirement, as it is valid for any app. (Chanakyaa, April 2022).

Therefore this research attempts to explore the awareness level of Kavalan App among college students and extent of usage mong them.

Perception

While the police tout the app as a must-have for women, privacy concerns persist over its demands for information on using Kavalan App. Some people have expressed apprehensions over the need to give the app access to personal details on the phone, and have even complained of difficulties in downloading the app/ accessing services. Mobile numbers of close relatives or friends and email IDs are collected while registering. (The Hindu, Jan 2020). Therefore people expect much more than Safety Apps from Police and some added features to improve its effectiveness. Thus it can be Hypothesized that

H1: There is significant relationship between Awareness and Perception on Usage of Kavalan Safety App.

Attitude

Government is expecting that crime against women will reduce when women use this App. This App also helps women to cope up with mental pressure by complaining

immediately when they face adverse situation. So this paper investigates, whether awareness and usage of Kavalan App, instils positive attitude towards it.

Thus we can hypothesize that

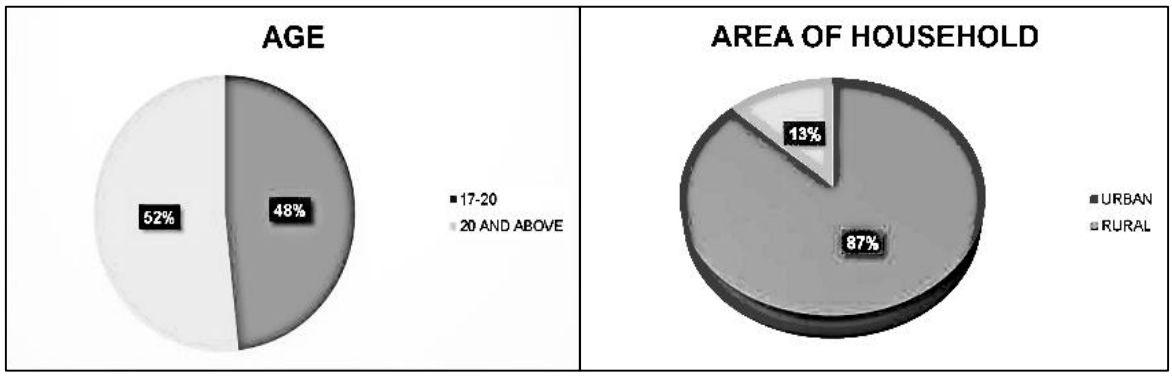
H2: There is significant relationship between the Awareness of the app and Attitude toward technology for women's safety

RESEARCH METHODOLOGY

A structured questionnaire was used to collect primary data. The questionnaire contained multiple-choice and five-point Likert-scale questions on Awareness, Perception and Attitude towards usage of Kavalan App. A convenient sample of 300 women college students in Chennai was collected.. SPSS 21.0 was used to analyse the descriptive statistics and regression of the measures.

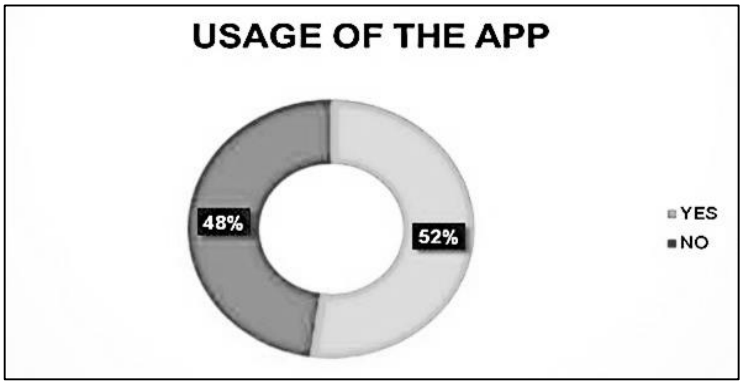
DATA ANALYSIS

Demographic Profile



From the above chart, it is evident that 48% of the respondents were 17 – 20 years of age and 52% of the respondents belonged to the age group 20 and above. And majority of respondents reside in urban area which constitute 87%.

Classification based on Usage of Kavalan App



From the table, it can be concluded that 52% of the respondents have used the Kavalan SOS App and 48% of the respondents have not used the Kavalan SOS App.

HYPOTHESIS TESTING

H1: There is significant relationship between Awareness and Perception on Usage of Kavalan Safety App.

- **Regression analysis explaining relationship between awareness and perception on usage the Kavalan SOS app.**

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.731[a]	.534	.533	.37337

a. Predictors: (Constant), aw

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.454	.133		10.893	.000
	aw	.635	.034	.731	18.457	.000

a. Dependent Variable: powsa

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	47.493	1	47.493	340.673	.000[b]
	Residual	41.404	297	.139		
	Total	88.897	298			

a. Dependent Variable: powsa

b. Predictors: (Constant), aw

The above table shows that the hypothesis was tested under the linear regression method, and it was significant at p = 0.000, the first table shows R = 0.720 which is the correlation between the perception of the app and awareness of the app. In model summary table, R2 = 0.518. So there is significant relationship between Awareness and perception on Usage showing that people expect much more than Safety Apps from Police and some added features to improve its effectiveness.

H2: There is significant relationship between the Awareness of the app and Attitude toward technology for women's safety

- **Regression analysis explaining the relationship between awareness of the app and attitude toward technology for women's safety**

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.724	.120		14.415	.000
	aw	.551	.031	.720	17.863	.000

a. Dependent Variable: TOWS

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.731[a]	.534	.533	.37337

a. Predictors: (Constant), aw

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	47.493	1	47.493	340.673	.000[b]
	Residual	41.404	297	.139		
	Total	88.897	298			

a. Dependent Variable: powsa

b. Predictors: (Constant), aw

The above chart shows that the hypothesis was significant at p = 0.000, the first table shows R = 0.731 which is the correlation between the perception of the app and awareness of the app. In model summary table, R2 = 0.534.Therefore there is significant relationship between Awareness of the app and Attitude toward technology for women's safety proving that usage of Kavalan App had instilled positive attitude towards it.

CONCLUSION

The study shows that that approximately only half of the respondents were using Kavalan Apps, implying that many of the college students are not aware of the value of these Apps. Therefore Government must take steps to reach out to more schools and colleges to create awareness among girl students. Also the study proved that Awareness of the Kavalan APP had a significant impact on their Perception and Attitude of Usage of Safety Apps.

Confidentiality and data security are the major weakness of Kavalan SOS as the tech experts working behind the app explain that data breaches are possible, and data of that size can be misused in many ways if leaked to the outside. So technical glitches and data security issues in Kavalan App, will have an impact on women's' trust on technology for safety. To keep women safe through technology, it is sad to realize that the huge funds available to women are not being used to bring these SOS apps more effective. Apart from raising public awareness and creating more effective Safety Apps it is also important to sensitize women at the highest levels to understand the nature of crime and act quickly to reach those in need.

REFERENCE

1. Mason, Corinne & Magnet, Shoshana. (2012). Surveillance Studies and Violence Against Women. Surveillance and Society. 10. 105-118. 10.24908/ss.v10i2.4094.

2. Vodafone. 2014. "Connected Women: How Mobile Can Support Women's Economic andSocialEmpowerment." https://www.vodafone.com/content/dam/connectedwomen/pdf/VF_WomensReport_V12%20Final.pdf [Google Scholar].

3. Westmarland, N., Hardey, M., Bows, H., Branley, D., Chowdhury, M., Wheatley, K., & Wistow, R. (2013). Protecting women's safety. *The use of smartphone 'apps' in relation to domestic and sexual violence. Durham University, Durham centre for research into violence and abuse*.

4. https://tamil.gizbot.com/news/tamil-nadu-police-introduces-kavalan-sos-app-for-ladies-031377.html

5. https://vikaspedia.in/e-governance/women-and-e-governance/kavalansos-mobile-app#:~:text=The%20app%20is%20for%20the,as%20floods%2C%20earthquake%2C%20etc.

6. https://chanakyaa.in/what-happened-to-kavalan-so app/#:~:text=Within%20one%20minute%2C%20the%20Kavalan,contacts%20as%20an%20SMS%20alert.

7. https://www.thehindu.com/news/cities/chennai/kavalan-app-personal-safety-at-a-click-but-what-about-data/article30464558.ece

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SOCIAL MEDIA MARKETING ON BODY POSITIVITY IN MILLENNIALS AND GEN Z

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ABSTRACT

This paper investigates Millennials' and Generation Z's attitudes toward body positivity on social media. The study established a significant impact on the mental health of the consumers/users. The research suggested that marketers should create effective body positivity campaigns.

INTRODUCTION

'Body positivity is believing that we all deserve to have a positive body image regardless of the unrealistic standards set by society. It is not anti-health or fitness, it's not "giving up on yourself and it's not only for larger bodies. It encourages all people to love their bodies. Body positivity is a worldwide social movement that accepts all body types irrespective of their size. In recent years, the body-positive movement has grown on social media, gaining both acclaim and condemnation from the public. We investigate the possible advantages and downsides of 'body positivity on social media in light of theory and existing facts. Body dissatisfaction, weight concern, thin-ideal internalization, and disordered eating behaviors in women have all been linked to exposure to culturally driven beauty ideals in the media. People are increasingly using social media as a primary source of information regarding social norms and beauty standards in recent years. 59% of the world's population uses social media. The average daily usage is 2 hours and 29 minutes (July 2022) (Smart Insights, 2022).

PURPOSE OF RESEARCH

The purpose of this research is to study the attitude of social media users toward body positivity and address some ways that body image influences mental health and well-being. The results of this study will help marketers to identify the areas to be concentrated on to develop an effective body positivity campaign.

RESEARCH OBJECTIVES

The research objectives of this study are developed as follows:

- To analyze consumers' perception, of the subject's body positivity on social media.
- To measure brands' incorporation of body positivity in their social media.

- To study the demographic profile of the respondents.
- To study the opinion of consumers on their self-image.

LITERATURE REVIEW

A study by **Salomon, I., & Brown, C. S. (2019),** suggest that individual differences will play an important role in understanding the consequences of early adolescent social media use and represents an important area for future research (Salomon, 2019).

According to a study by **Vendemia, M. A., DeAndrea, D. C., & Brathwaite, K. N. (2021),** more viewers believed that the images were digitally modified, the more negatively they rated the photos, and the more they believed the images were for self-serving reasons and, as expected, the approval of traditional beauty concepts. higher (Vendemia, 2021).

In the study by **Milatishofa, M., Kusrin, K., & Arindawati, W. A. (2021)**, the informants interpreted the body positivity of the body carried out through her Instagram upload in the form of self-appreciation and gave her followers an understanding that everything that is owned by the body must be accepted as it is with gratitude (Milatishofa, 2021).

In the study by **Legault, L., & Sago, A. (2022),** the researcher has highlighted the important difference between need-supportive and need-undermining body positivity (Legault, 2022).

As there are no extant studies on the impact of social media on body positivity in millennials and Gen Z. Research has been conducted only on female consumers' opinions and experiences about body positivity in social media marketing. This study will fill the gap and will also include both male and female perspectives on the subject of body positivity. This study will help marketers to design appropriate advertisements to attract and influence millennials and Gen Z on the subject of body positivity.

CONCEPTUAL DEVELOPMENT

Consumers' Perceptions and Brands' Incorporation of Body Positivity

Winfield and Richardson (2016) reported that when companies and social media campaigns focused on being diverse and having representations of all shapes, sizes, ethnicities, ages, and disabilities, women were able to find someone they identified with. Further, women had more confidence in themselves and had a more positive body image when represented through strong, powerful women in the media (Winfield & Richardson, 2016). D'Alessandro and Chitty (2011) discovered that consumer perception of the brand and overall feeling of body image is impacted by the body types used in advertising. Therefore it can be hypothesized that:

Hypothesis 1: There is a significant relationship between consumers' perceptions and brands' incorporation of body positivity in social media

Consumers' Opinions on Their Self-Image and Their Mental Health

Comparisons with idealized female body images, typically highly thin and attractive, can lead to anxiety about the self or social evaluations as well as depression (Cash & Pruzinsky, 2002). Thus it can be proposed that there is a relationship between consumers' opinions on their self-image and their mental health.

Hypothesis 2: There is a significant relationship between consumers' opinions on their self-image and their mental health.

Brands' Incorporation of Body Positivity and Consumers' Mental Health

Lazuka et al. discussed how Instagram contained a lot of posts tying body positivity to products that promote weight loss or fitness. The tactic can make women more dissatisfied with their bodies rather than promoting self-love and positive body image. The researchers also discussed how posts about women's bodies and their functionality can lead to body dissatisfaction in women with disabilities (Lazuka et al., 2020). Thus there is a significant difference in brands' incorporation of body positivity based on the most used social media platform. Thus it can be proposed that there is a relationship between brands' incorporation of body positivity and consumers' mental health.

Hypothesis 3: There is a significant relationship between brands' incorporation of body positivity and consumers' mental health.

RESEARCH METHODOLOGY

A structured questionnaire was used to collect primary data. The questionnaire contained multiple-choice and five-point Likert-scale questions on antecedents of attitudes, mental health, self-image and opinions. A convenient sample of 300 respondents in Chennai was collected for they come under the category of Millennials and Gen Z. Attitude and Purchase Decisions are measured through a single dimension. SPSS 21.0 was used to analyse the descriptive statistics and regression of the measures.

DATA ANALYSIS

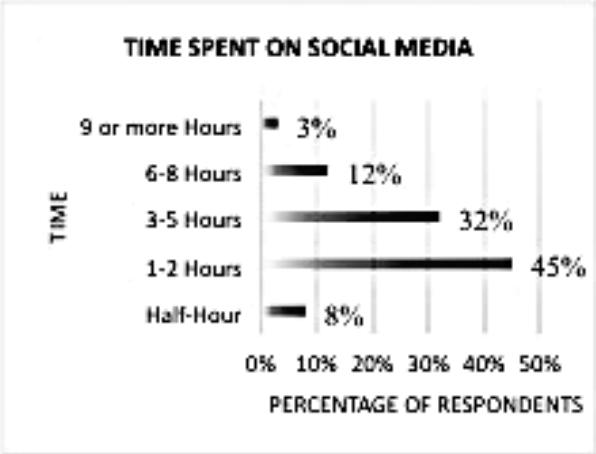
Reliability Testing

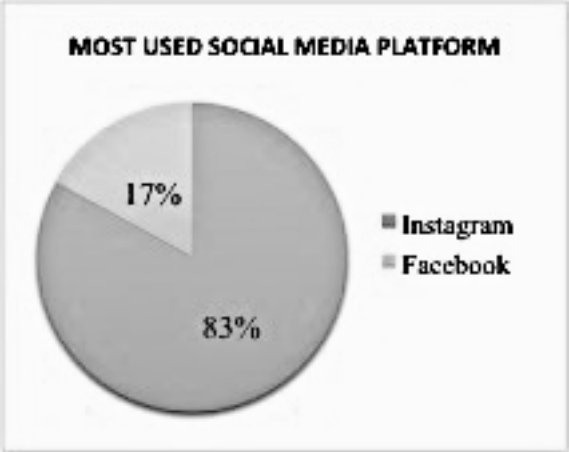
VARIABLE	NO. OF ITEMS	CRONBACH'S ALPHA
The mental health of the consumers	5	0.942
Consumers' opinions on their self-image	5	0.907

Consumers' perception of the subject body positivity	5	0.929
Brands' incorporation of body positivity	5	0.931

The items were considered to represent an acceptable level of internal consistency if Cronbach's alpha value was within 0.5 to 0.7 and a good level of Cronbach's alpha value was more than 0.7. The result showed that all variables obtained good level reliabilities of Cronbach's alpha larger than 0.8. Therefore, all measures used in this study were reliable.

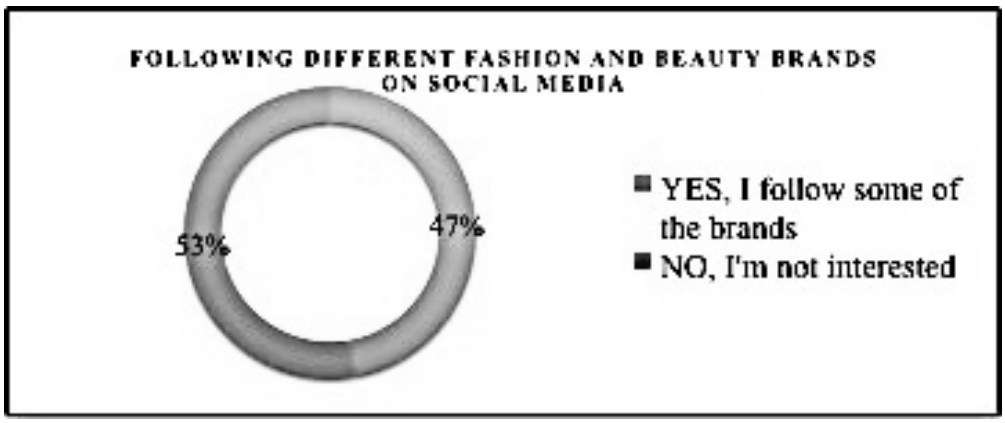
TIME SPENT ON SOCIAL MEDIA





Results show that the majority of the respondents spend about one to two hours on social media, and the most used site is Instagram.

FOLLOWING DIFFERENT FASHION AND BEAUTY BRANDS ON SOCIAL MEDIA



From the above chart, it can be understood that 47% of the respondents are interested to follow different fashion and beauty brands on social media

HYPOTHESIS TESTING

Regression analysis explains the relationship between consumers' perceptions and brands' incorporation of body positivity in social media

Coefficients						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	0.887	0.155		5.739	0.000
	BRANDS INCORPORATION	0.526	0.046	0.552	11.433	0.000
a) Dependent Variable: CONSUMERS PERCEPTION						

The result from the above table states that **there is a significant relationship** between consumers' perceptions and brands' incorporation of body positivity in social media at **p<0.05.** The second table shows **R = 0.552** which is the correlation between consumers' perceptions and brands' incorporation of body positivity in social media. In the model summary **R^2 = 0.305,** there is an effect on consumers' perceptions and brands' incorporation of body positivity in social media. The ANOVA table shows the **F** value as **130.712**. Therefore, the findings support the hypothesis that there is a significant relationship between consumers' perceptions and brands' incorporation of body positivity in social media.

Regression analysis explains the relationship between consumers' opinions on their self-image and their mental health

Coefficients						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	4.010	0.197		20.373	0.000
	OPINION ON SELF-IMAGE	-0.206	0.080	-0.148	-2.579	-0.010
a) Dependent Variable: MENTAL HEALTH						

The result from the above table states that **there is significant relationship** between consumers' opinions on their self-image and their mental health at **p < 0.05.** The second table shows **R = 0.148** which is the correlation between consumers' opinions on their self-image and their mental health. In the model summary **R^2 = 0.022,** there is significant effect on

consumers' opinions on their self-image and their mental health. The ANOVA table shows the **F** value as **6.653**. Therefore, the findings support the hypothesis that there is significant relationship between consumers' opinions on their self-image and their mental health.

Regression analysis explains the relationship between brands' incorporation of body positivity and consumers' mental health

Coefficients[a]						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	2.186	0.183		11.926	0.000
	BRAND	0.427	0.055	0.413	7.825	0.000
a) Dependent Variable: MENTAL HEALTH						

The result from the above table states that **there is a significant relationship** between brands' incorporation of body positivity and consumers' mental health at **$p < 0.05$.** The second table shows **$R = 0.413$** which is the correlation between brands' incorporation of body positivity and consumers' mental health. In the model summary **$R^2 = 0.170$,** there is an effect on brands' incorporation of body positivity and consumers' mental health. The ANOVA table shows the **F** value as **61.232**. Therefore, the findings support the hypothesis that there is a significant relationship between brands' incorporation of body positivity and consumers' mental health.

CONCLUSION

Thus this study established a significant impact on the mental health of the consumers/users. Body positivity should be integrated into the brand identity of fashion and beauty businesses, ensuring consistency and authenticity. As the consumers' concerns about body positivity influence their purchasing decisions, top brands can focus more on promoting body-positive content on social media. Brands should take measures toward empowerment through body positivity marketing instead of focusing on how the body appears in commercials; marketers may focus on how customers can enjoy their bodies and what they can accomplish with them. This research lays the groundwork for future research into the value of a positive brand image in developing and maintaining online brand-customer interactions, as well as the depth of body-positive material in social media marketing.

References

1. Cash, T. F., & Pruzinsky, T. (2002). Future challenges for body image theory, research, and clinical, practice. In T. F. Cash & T. Pruzinsky (Eds.), *Body images: A handbook of theory, research, and clinical practice* (pp. 509–516). New York: Guilford Press

2. Cox, Toby 2019. How Different Generations Use Social Media. *The Manifest.* Https://themanifest.com/social-media/how-different-generations-use-social-media. Read 1.10.2020.

3. D'Alessandro, S., & Chitty, B. (2011). Real or relevant beauty? Body shape and endorser effects on brand attitude and body image. *Psychology & Marketing*, 28(8), 843-878. DOI: 10.1002/mar.20415

4. Hargreaves, D. A., & Tiggemann, M. (2003). The effect of ''thin-ideal'' television commercials on body dissatisfaction and schema activation during early adolescence. *Journal of Youth and Adolescence*, 32, 367–373

5. Lazuka, R., Wick, M., Keel, P. & Harriger, J. (2020). Are we there yet? Progress in depicting diverse images of beauty in Instagram's body positivity movement. *Body Image*, 34, 85- 93.

6. Legault, L. &. (2022). When body positivity falls flat: Divergent effects of body acceptance messages that support vs. undermine basic psychological needs. doi:http://dx.doi.org/10.1016/j.bodyim.2022.02.013

7. Milatishofa, M. K. (2021). Analisis Resepsi Khalayak Terhadap Makna Body Positivity Pada Instagram Tara Basro. doi:http://dx.doi.org/10.23969/linimasa.v4i2.4136

8. Oinonen, T. (2021). Body positivity in social media marketing. Retrieved from https://www.theseus.fi/bitstream/handle/10024/496921/Oinonen_Tinja.pdf?sequence=2&isAllowed=y

9. Salomon, I., & Brown, C. S. (2019). The selfie generation: Examining the relationship between social media use and early adolescent body image. *The Journal of Early Adolescence*, *39*(4), 539-560.

10. Vendemia, M. A., DeAndrea, D. C., & Brathwaite, K. N. (2021). Objectifying the body positive movement: The effects of sexualizing and digitally modifying body-positive images on Instagram. *Body Image*, *38*, 137-147.

11. Winfield, S. & Richardson, Y. (2016). Designing-in consumer identity and experience via social media representation and engagement effects: Contesting female body image and branding. In C McIntyre, T.C. Melewar & C. Dennis (Eds.), Multi-Channel Marketing, Branding and Retail Design (pp. 51-72).

12. ://www.smartinsights.com/social-media-marketing/social-media-strategy/new-global-social-media-research/

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A STUDY ON CONSUMER PERCEPTION TOWARDS FEMVERTISING

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ABSTRACT

This study investigates consumer perception towards femvertising. The study established that consumers view femvertising as a harbinger of change in society despite their skepticism about purplewashing by companies to attract customers. This study identified a positive relationship between consumer attitude and their purchase intention towards brands that employ femvertising.

INTRODUCTION

According to SheKnows Media, Women currently comprise a $ 14 trillion market, and their purchasing power is expected to grow significantly over the coming years. They not only make up the majority of consumers of companies but are also usually in charge of purchasing decisions in households. As a result, companies are now seeking ways to attract female consumers via advertising, specifically through a marketing strategy called Femvertising. Femvertising is "advertising that employs pro-female talents, messages, and imagery to empower women and girls" (SheKnows, 2014).

On one hand, many companies have been praised for employing Femvertising in their advertisement campaigns and for advocating feminist tropes through such campaigns. However, on the other hand, many consumers have been skeptical about the companies' authenticity in supporting and promoting the campaigns and are criticized for using feminist sentiments to sell their products and generate more significant brand engagements. Such a practice is called purplewashing, a marketing strategy that uses women empowerment and feminism as a strategy to attract female consumers. Therefore, this paper aims to study consumer perception towards femvertising ads.

PURPOSE OF RESEARCH

The purpose of this research is to study consumer awareness, perception, and expected outcome towards femvertising ads, consumer attitude and purchase intention towards brands that employ femvertising in their ad campaigns, and consumer perception towards purplewashing. This study will help brands understand how consumer perception towards femvertising will impact their purchase intention and brand loyalty.

RESEARCH OBJECTIVES

- Assess the level of awareness of consumers toward femvertising ads.
- Analyze consumer perception towards femvertising ads and their expected outcome from such ads.
- Determine consumer attitude towards brands that employ femvertising in their ad campaigns.
- Analyze consumer purchase intention towards brands that employ femvertising in their ad campaigns.
- Discern consumer opinions on femvertising and purplewashing.
- Study the demographic profile of the respondents.

LITERATURE REVIEW

A study conducted by Pillay, S. (2020) found that femvertising positively impacts the attitude, feelings, and judgments of women belonging to both Generation Y and Generation Z. The positive impact on women's attitudes and feelings again has a positive influence on women's attitude towards beauty advertisements and their beauty brands.

The research conducted by Drake, V. E. (2017) found that female respondents have a significantly higher positive attitude and purchase intention towards products and brands that employs femvertising. It is also noted that femvertising produces a more robust emotional response to brands among millennial women due to strong empowering messages that resonate with them. It is further mentioned that women now are less offended by female portrayal in advertisements than the previous generation.

According to Hsu, C. K. J. (2018)**,** femvertising gained divided opinions on whether it empowered females or not. Such advertisements can certainly raise cultural awareness and start conversations about pro-female issues. It would benefit society if the brand's femvertising messages could bring a society-wide change.

In a study to investigate the attitude of Generation Y toward femvertising in the cosmetic industry, Descouens, M., & Gerbault, V. (2021) found that the representations are received positively by the millennials as it breaks stereotypes and offers a more inclusive representation. As millennials are rather committed to social causes, they are skeptical and cautious about the honesty of the brands, but they still seem to hold a positive purchase intention towards cosmetic brands using femvertising claims.

The above collection of literature reviews provides knowledge on women’s perceptions and attitudes towards femvertising but disregards the opinions of men who also consume these ads. Similarly, pre-existing literature centers only on the cosmetics, fashion, and menstrual products industries. This study aims to fill the above-mentioned gaps by including both male and female respondents and by extending the study across all companies

and industries. This study will help brands and marketers to understand how consumer perception towards femvertising will impact their purchase intention and brand loyalty.

CONCEPTUAL DEVELOPMENT

Level of Awareness and Perception

This study proposes that the level of consumer awareness significantly influences consumer perception towards femvertising.

H1: The level of consumer awareness significantly influences consumer perception.

Perception and Expected Outcome

In this research, it is proposed that the expected outcome is significantly influenced by consumer perception towards femvertising.

H2: Consumer perception significantly influences expected outcome.

Attitude and Purchase intention

Descouens, M., & Gerbault, V. (2021) found that despite being skeptical Generation Y held a positive purchase intention towards cosmetic brands using femvertising claims. Thus, it can be hypothesized that

H3: Consumer attitude significantly influences their purchase decision.

Perception on femvertising and purplewashing

In this research, it is proposed that consumer perception towards femvertising significantly influences consumer perception of purplewashing.

H4: Consumer perception towards femvertising significantly influences consumer perception of purplewashing.

RESEARCH METHODOLOGY

A structured questionnaire was used to collect primary data. The questionnaire contained multiple choice and five-point Likert scale questions on consumer awareness, perception, and expected outcome towards femvertising ads, consumer attitude and purchase intention towards brands that employ femvertising in their ad campaigns, and consumer perception towards purplewashing. Convenient sample of 340 consumers from different age groups and various cultural atmospheres was collected. SPSS 26.0 was used to analyze the descriptive statistics and regression of the measures.

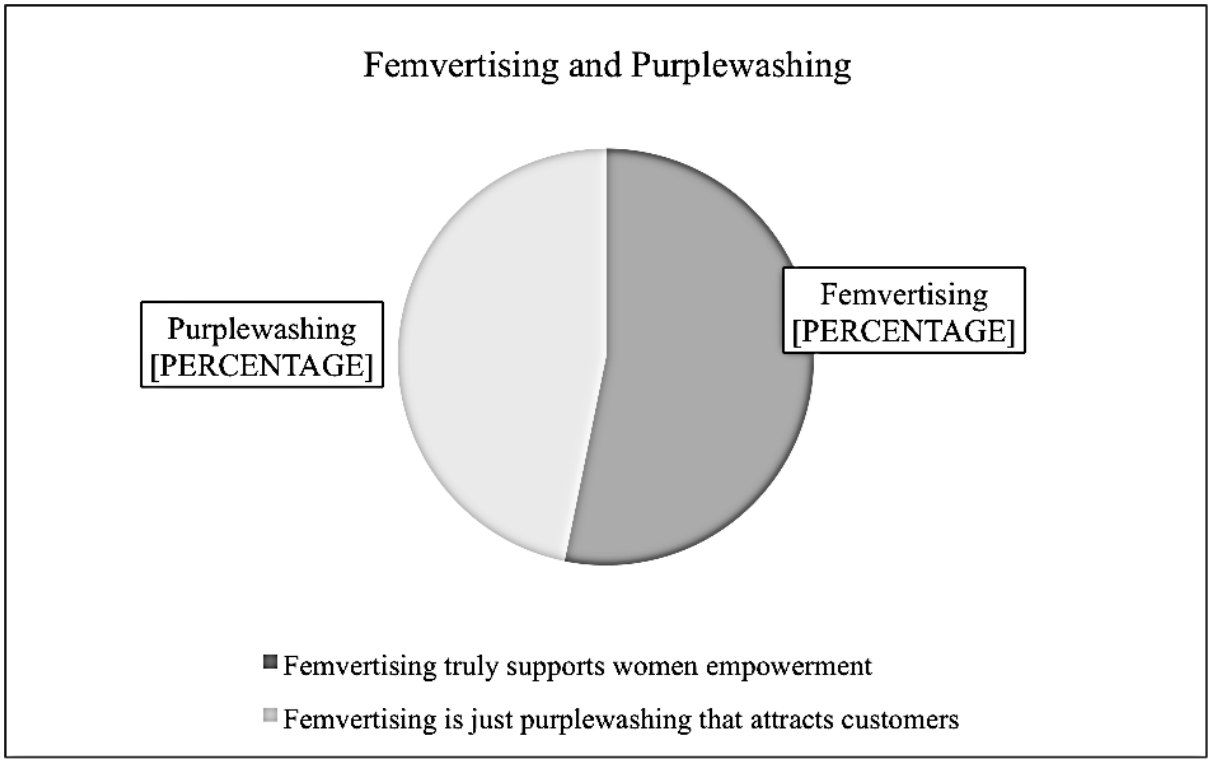
DATA ANALYSIS

Reliability Testing

VARIABLE	NO. OF ITEMS	CRONBACH'S ALPHA
Awareness	5	0.879
Perception	8	0.938
Expected Outcome	7	0.943
Purplewashing	7	0.889
Attitude	6	0.903
Purchase Intention	5	0.895

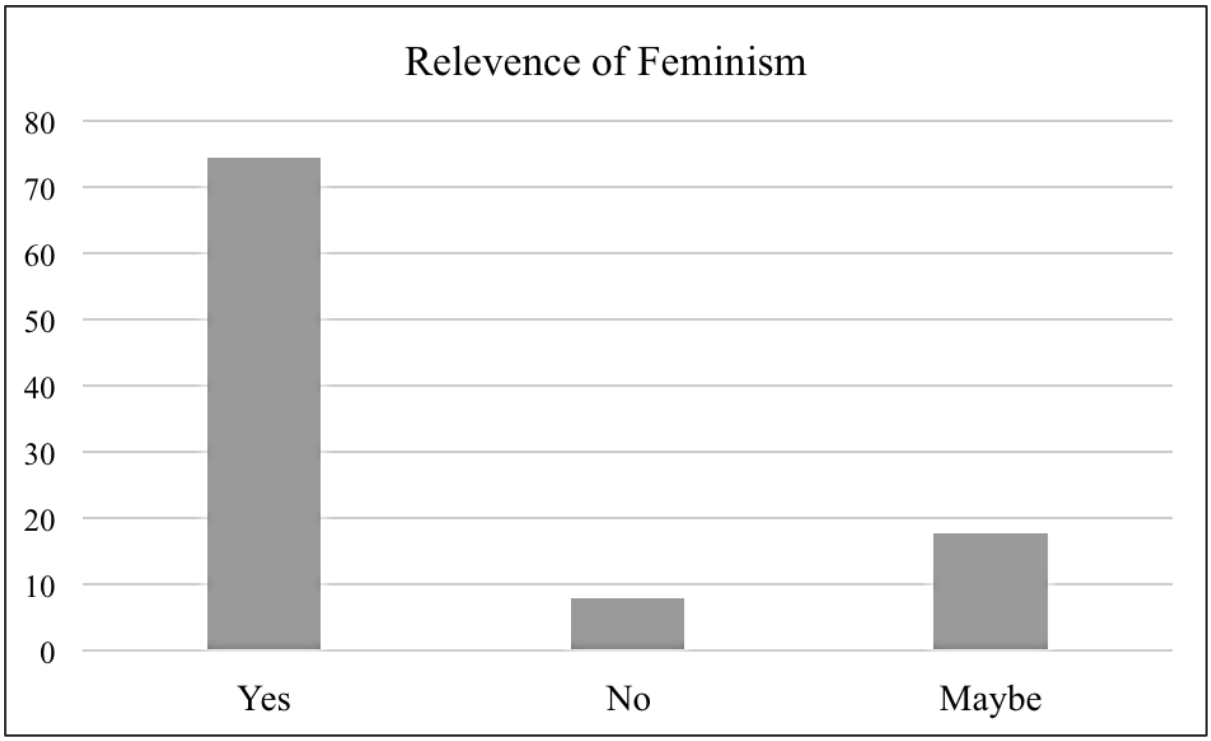
The items were considered to represent an acceptable level of internal consistency if Cronbach's alpha value is between 0.5 to 0.7 and a good level if Cronbach's alpha value is more than 0.7. The results showed that all variables obtained good level reliabilities of Cronbach's alpha larger than 0.8. Therefore, all measures used in this study were reliable.

Opinion on Femvertising and Purplewashing



The chart illustrates that a greater number of respondents believe that femvertising truly supports women empowerment.

Opinion on the Relevance of Feminism



The above chart shows that the majority of respondents believe that feminism is relevant in the present-day world.

Hypothesis Testing

Level of Awareness and Perception

Regression analysis explaining the relationship between the level of consumer awareness and consumer perception

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.163	.170		12.690	<.001
	Awareness	.468	.042	.515	11.051	<.001
R						.515
R Square						.265
Adjusted R Square						.263
F						122.120
Significance						<.001

The regression result shows that The R-value, indicating the strength of the relationship between consumer awareness and consumer perception towards femvertising was 0.515. The R^2 score in this analysis indicated that the variance of consumer perception is

26.5%, this percentage was statistically significant (F=122.120, p<0.001). Therefore Hypothesis 1 was significant at (p<0.05) showing that the level of consumer awareness influences consumer perception.

Perception and Expected Outcome

Regression analysis explaining the relationship between consumer perception and expected outcome

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.505	.131		3.849	<.001
	Perception	.845	.032	.819	26.223	<.001
R						.819
R Square						.670
Adjusted R Square						.669
F						687.627
Significance						<.001

The regression result shows that The R-value, indicating the strength of the relationship between consumer perception and expected outcome of femvertising was 0.819. The R^2 score in this analysis indicated that the variance of the expected outcome is 67%, this percentage was statistically significant (F = 687.627, p<0.001). Therefore Hypothesis 2 was significant at (p<0.05) showing that consumer perception influences expected outcome.

Attitude and Purchase Intention

Regression analysis explaining the relationship between consumer attitude and their purchase intention

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.473	.118		4.022	<.001
	Attitude	.815	.033	.798	24.383	<.001
R						.798
R Square						.638
Adjusted R Square						.636
F						594.550
Significance						<.001

The regression result shows that The R-value, indicating the strength of the relationship between consumer attitude and purchase intention was 0.798. The R^2 score in this analysis indicated that the variance of purchase intention is 63.8%, this percentage was statistically significant ($F = 594.550$, $p<0.001$). Therefore Hypothesis 3 was significant at ($p<0.05$) showing that consumer attitude influences purchase intention.

Perception on Femvertising and Purplewashing

Regression analysis explaining the relationship between consumer perception towards femvertising and purplewashing

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.266	.176		12.906	<.001
	Perception	.385	.043	.438	8.951	<.001
R						.438
R Square						.192
Adjusted R Square						.189
F						80.112
Significance						<.001

The regression result shows that The R-value, indicating the strength of the relationship between consumer perception and purplewashing was 0.438. The R^2 score in this analysis indicated that the variance of purplewashing is 19.2%, this percentage was statistically significant ($F=80.112$, $p<0.001$). Therefore Hypothesis 4 was significant at ($p<0.05$) showing that consumer perception towards femvertising influences consumer perception of purplewashing.

CONCLUSION

Based on the results of this study, the level of consumer awareness influences consumer perception towards femvertising. As a majority of respondents believe that feminism is still relevant in today's world, brands are recommended that they employ femvertising to increase awareness among consumers and to improve their brand image. This research identifies that there is a positive relationship between consumer perception and the expected outcome of femvertising in society. Femvertising not only is perceived as a harbinger of change in society but also amasses a positive consumer attitude toward brands. This favorable attitude influences consumer purchase decision. Despite being aware of commodity feminism and purplewashing consumers agree that femvertising ultimately will support women empowerment in addition to attracting significantly more number customers. Therefore, brands that sincerely and effectively adopt femvertising can attract and retain consumers' support and approval and ultimately cultivate successful brand loyalty among customers.

REFERENCES

1. Descouens, M., & Gerbault, V. (2021). Generation Y's attitude towards femvertising in cosmetics: women empowerment or purplewashing?: A mono-method qualitative study.

2. Drake, V. E. (2017). The impact of female empowerment in advertising (femvertising). *Journal of Research in Marketing*, *7*(3), 593-599.

3. Hsu, C. K. J. (2018). Femvertising: State of the art. *Journal of Brand Strategy*, *7*(1), 28-47.

4. Pillay, S. (2020). The future is female: femvertising and attitude formation towards beauty brands. *Journal of Contemporary Management*, *17*(2), 102-125.

   http://cdn.sheknows.com/corporate.sheknows.com/production/nodes/attachments/24521/iBlog_Magazine-SheKnows-FemvertisingFeature.pdf?1429105587

   https://en.wikipedia.org/wiki/Purplewashing

   https://en.wikipedia.org/wiki/Purplewashing#Marketing

   https://www.adobe.com/express/learn/blog/femvertising-what-is-it-and-how-to-do-it-well

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PUBLIC SATISFACTION TOWARDS CM'S FREE BUS TRAVEL SCHEME FORWOMEN

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ABSTRACT

This paper investigates the satisfaction level of the public towards the scheme, their opinions and attitude towards the free buses and also to check whether the reasons for introducing the scheme has achieved its motive. The study established that the public are highly satisfied with the scheme, the opinions of the public differ according to their occupation and there is no impact in public's attitude towards free buses. The findings revealed that the reasons for introducing the scheme have achieved its purpose as there is a significant increase in women passengers in buses. The research suggested that the government should provide more white board instead of making it all free.

INTRODUCTION

The free bus travel scheme for women which is being implemented by Chief Minister M.K. Stalin in Tamil Nadu is attracting attention with experts stating that it will not only boost ridership but also change the lives of the women and boost the economy of the state. Tamil Nadu Transport Minister RS Raja Kannappan said that 7.8 million women availed themselves in this free bus travel within three days of launch of the scheme. (Hindustantimes.com, 2021).

According to a Comprehensive Mobility Plan, a transport roadmap for Chennai till 2048, the passenger transport usage has shrunk from 26% in 2008 to 23% in 2018. According to Gita Krishnan Ramadurai, Associate Professor, Department of Transportation, Indian Institute of Technology, Madras, terms the move by the Tamil Nadu government to allow women to travel in buses as an innovative one. He also added that the public transit ridership was falling and we need innovative ideas to boost ridership. (Shivakumar, 2021). Therefore, this paper aims to study the satisfaction level of the public towards the scheme, public's attitude and their opinions towards free bus, whether the scheme has achieved its purpose.

PURPOSE OF RESEARCH

The purpose of the research is to obtain satisfaction level of public, their opinions and attitude towards the free buses and also to check whether the reasons for introducing the scheme has achieved its purpose. The results of the study will help the government to understand the views of public which will be helpful to them while introducing a scheme or while redesigning the old scheme.

RESEARCH OBJECTIVES

The research objectives of this study are developed as follows:

→ To analyze the public's opinions towards free bus.

→ To obtain the satisfaction level of the public towards the free bus travel scheme.

→ To determine the public's attitude towards free bus.

→ To examine whether the reasons for the scheme has served its purpose.

→ To observe the travel convenience in free bus.

→ To find out the reliability of free bus.

→ To know about the public's safety in free buses.

→ To study the demographic profile of the respondents.

LITERATURE REVIEW

Fare discounts and free fares in long distance public transport in central Europe aims to review and analyze the ridership and the development of modal transportation shares after the introductionof free fare transport and it has been found that there is a significant increase in ridership among different age groups of men and women. (Tomeš, 2022)

De Witte, A conducted a survey on students to examines their current travel behavior with their past travel behavior i.e.; before the introduction of free fare public transport. Their findings indicate that there is an indeed an increase in public transport among the students. (De Witte, 2006)

Fearnley, N. investigates the merits of free public transport and the political and societal motive behind the free public transport. He found that even though the free public transport may seem attractive at first it has poor goal achievement and incurs a high cost. The free public transport schemes are successful only when their goal is to grow patronage and are connected with social and environmental benefits with more targeted measures. (Fearnley, 2013)

As there are not any studies made on its satisfaction of public towards fare free public transportation system or policy, this study will fill the gap by researching on satisfaction, opinion and attitudes of public. Hence, this study will help the government to design the scheme accordingto public views in order to gather their attention.

CONCEPTUAL DEVELOPMENT

Public's Opinion

The term "opinion" may be the result of a person's perspective, understanding, particular feelings,beliefs and desires. Public opinion is the aggregate of individual attitudes or beliefs held by a population.

Hypothesis 1: There is a significant difference in public's opinions towards free bus based on occupation.

Safety

Safety is considered as an important factor in any mode of transport. It also means being protectedfrom uncertainty of risk or danger. Safety in bus includes theft, harassment.

Hypothesis 2: There is a significant difference in public's safety in free buses based on their age.

Public's Attitude

Eagly and Chaiken defines attitude as "a psychological tendency that is expressed by evaluating aparticular entity with some degree of favor or disfavor". Attitude may influence the attention to attitude objects, the use of categories for encoding information and the interpretation, judgement and recall of attitude relevant information.

Hypothesis 3: There is a significant difference in public's attitude towards free bus based on gender.

Reasons for introducing the scheme

The main purpose of free bus travel scheme is to increase the work participation rate of women and to promote public transportation. He launched the scheme to empower women with public mobility and accompanying social costs.

Hypothesis 4: There is a significant difference in the reasons for the scheme based on the increasein number of women passengers in MTC buses.

Public's Convenience

Convenience refers to the state of being able to proceed without facing any difficulty. The term "Convenience" means what makes the public choose to travel in free buses. There are many factorslike the fare is free, it arrived first, it is a straight bus, it had more empty seats.

Hypothesis 5: There is a significant difference in convenience towards free buses based on their awaiting to board on free bus.

Reliability

The essence of reliability lies in the principle well established in the bus industry, of keeping to aschedule, published or unpublished, which is usually designed to maintain even headways betweenbuses where the service is at all frequent.

Hypothesis 6: There is a significant difference in the reliability of free buses based on the frequency of free buses to the location (Bus Stop).

RESEARCH METHODOLOGY

A structured questionnaire was used to collect the primary data. The questionnaire contained multiple choice and five-point Likert scale question on public' satisfaction, opinion, attitude, reasons for the scheme, convenience, safety and reliability of free buses. Convenient sample of 300 were collected from men and women as they fall under the category of public. SPSS 26.0 wasused to analyze the descriptive statistics, ANOVA, T-Test and Regression.

DATA ANALYSIS

Reliability Testing

VARIABLE	NO. OF ITEMS	CRONBACH ALPHA VALUE
OPINIONS	5	0.881
SATISFACTION	6	0.948
REASONS FOR THE SCHEME	6	0.932
ATTITUDE	5	0.724
SAFETY	5	0.848
RELIABILITY	5	0.917
CONVENIENCE	5	0.947

The items were considered to represent an acceptable level of internal consistency if the Cronbach's alpha value is 0.5 to 0.7 and a good level if the Cronbach's alpha value is more than 0.7. The results showed that all the variables obtained good level reliabilities of Cronbach alphalarger than 0.7. Therefore, all measures used in this study were reliable.

Satisfaction level of public

The results shows that majority of the respondents feels highly satisfied with the free bus travelscheme.

Increase in women passengers

The above chart shows that 93% of the sample agree that there is indeed an increase in women passengers in MTC buses compared before the introduction free bus travel scheme.

Hypothesis Testing

→ ANOVA analysis compares the groups of public's opinions and occupation

Opinion	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.802	2	2.901	3.660	.027
Within Groups	235.431	297	.793		
Total	**241.233**	**299**			

The result in the above table shows that there is significant difference in the public's opinions towards free bus based on their occupation at **F = 3.660 and p<0.05.** This supports hypothesis 1 that the public's opinion significantly differs according to their occupation.

→ ANOVA analysis compares the groups of safety and age

Safety	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	5.271	2	2.635	3.663	.027
Within Groups	213.646	297	.719		
Total	**218.917**	**299**			

The above table shows that there is significant difference in the public's safety in the free bus based on their age at **F= 3.663 and p<0.05.** This supports hypothesis 2 as public's safety significantly changes according to their age.

→ T-Test analysis compares public's attitude towards free bus and gender

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Attitude	Equal variances assumed	.324	.570	-.589	298	.556	-.05011	.08502	-.21742	.11721
	Equal variancesnot assumed			-.588	293.806	.557	-.05011	.08515	-.21770	.11748

It is evident that there is no significant difference in the public's attitude towards free bus based on gender at **T= -0.589 and p>0.05**. This do not support the hypothesis 3 as gender does not impactthe attitude of public towards free buses.

→ T-Test analysis compares reasons for the scheme and increase in women passengers

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig.(2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Reasons	Equal variances assumed	.007	.932	2.667	298	.008	.55402	.20771	.14525	.96279
	Equal variancesnot assumed			2.610	22.957	.016	.55402	.21227	.11485	.99319

It is clear that there is significant difference in the reasons for the free bus travel scheme based onthe increase in the number of women passengers in MTC buses at **T= 2.667 and p<0.05**. This supports the hypothesis 4 that the reasons for the scheme significantly differs.

→ T-Test analysis compares convenience towards free bus and wait to board on free bus

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
convenience	Equal variances assumed	2.155	.143	2.388	298	.018	.47580	.19921	.08377	.86783
	Equal variances not assumed			2.054	28.392	.049	.47580	.23162	.00164	.94996

It is clearly understandable that there is significant difference in the convenience towards free bus based on their wait to board on free bus at **T= 2.388 and p<0.05.** This supports the hypothesis 5 that the travel convenience significantly differs.

→ Test analysis compares reliability of free buses and frequency of free buses

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig.(2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Reliability	Equal variances assumed	1.406	.237	6.677	298	.000	.74461	.11152	.52514	.96407
	Equal variances not assumed			7.005	195.803	.000	.74461	.10629	.53498	.95423

It is apparent that there is a significant difference in the reliability of free buses based on their frequency of free buses to bus stops at **T=6.677 and p<0.05.** This supports the hypothesis 6 that the reliability of free buses significantly differs.

CONCLUSION

Based on the results of the study, the public are satisfied with the scheme. The study concluded that public's opinions differ according to their occupation and that gender does not influences public's attitude towards free bus. The purpose of the scheme has been achieved as many women are travelling in buses. The travel convenience to board on free buses differs according to public's mindset. The reliability of free buses changes in accordance towards frequency of free buses. The public' safety in free buses changes according to their age. Hence, it is suggested that the government must redesign / remodel the bus in such a way that it grabs the attention of both men and women of all age groups to travel in public transport from using private transportation services. By doing so, the government can promote public transportation at the same time it can reduce traffic congestion.

REFERENCES

Tomeš, Z., Fitzová, H., Pařil, V., Rederer, V., Kordová, Z., & Kasa, M. (2022). Fare Discounts and Free Fares in Long-distance Public Transport in Central Europe. *Case Studies on Transport Policy*.

De Witte, A., Macharis, C., Lannoy, P., Polain, C., Steenberghen, T., & Van de Walle, S. (2006). The impact of "free" public transport: The case of Brussels. Transportation Research Part A: Policyand Practice, 40(8), 671-689.

Fearnley, N. (2013). Free fares policies: impact on public transport mode share and other transportpolicy goals.

Nunnally, J.C. (1978) Psychometric theory. 2nd Edition, McGraw-Hill, New York.

Stalin's free bus travel scheme for women wins nationwide accolades- The New Indian Express

Tamil Nadu: 7.8 million women availed of free bus travel in 3 days | Latest News India - Hindustan Times

BUS RELIABILITY-DEFINITION AND MEASUREMENT (trb.org)

https://en.wikipedia.org/wiki/Opinion

https://en.wikipedia.oíg/wiki/Attitude_(psychology)

https://frontline.thehindu.com/social-issues/gender/free-rides-women-empowerment-tamil-nadu- bus-ticket-scheme-critical-evaluation/article34793039.ece

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MENSTRUAL PRODUCTS – A STUDY ON THE AWARENESS, ACCEPTABILITY AND AVAILABILITY IN CHENNAI CITY.

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ABSTRACT:

This study was conducted to find out the awareness and acceptance level of menstrual products other than sanitary pads. To find out the availability of the menstrual products was also the objective of the study. The results showed that women were aware of the existence of menstrual products. They were aware of the environmental impact of using disposable menstrual product like sanitary pads. Women were hesitant to use the environment friendly menstrual product i.e. menstrual cups due to various reasons main reason being the lack of awareness about the ease and convenience in usage. The environmentally friendly menstrual products were available in the offline stores but in a very meager quantity as most of the women showed a high acceptance level towards sanitary pads.

INTRODUCTION:

Menstruation is a physiological phenomenon. Every girl child goes through the phase of menstruation during the period of adolescence. It is important to manage menstrual hygiene properly. In developing countries like ours, menstrual management is not only difficult but also has adverse effects on the lives of women. There is not enough awareness regarding the availability of convenient, less expensive, environment friendly and reusable menstrual products. Awareness about various existing menstrual products and educating women on their usage are of utmost importance for proper menstrual hygiene management. Acceptance level towards various existing menstrual products depends on the level of awareness about the existence of and usage of products. A key challenge for menstruating girls and women in low resource countries is the inadequate and unreliable supply of menstrual products.

PURPOSE OF THE RESEARCH:

The purpose of the research is to help the companies to analyze the level of awareness that people have about menstrual products and the acceptance level of various menstrual products. This would help them to find out the reasons for the non-acceptance of certain menstrual products and thereby takes steps accordingly to make people more aware of the existence of and the usage of various menstrual products which are environment friendly (reusable menstrual products like menstrual cups, reusable pads etc)This study would help society be aware of the various menstrual products that are available in Chennai and also helps them to self analyze and identify the reasons for the non-acceptance of various

menstrual products. This study also helps to analyze about the availability of environment friendly menstrual products both in offline as well online stores.

RESEARCH OBJECTIVES:

1) To study the awareness of menstrual products among women.
2) To identify the acceptance level of menstrual products among women.
3) To find out whether the menstrual products are available at an affordable price range.
4) To study the demographic factors of the respondents.

LITERATURE REVIEW:

Laura Medina Perucha and Tomas Lopez-Jimenez (2022) conducted a study on, "Use and perceptions on reusable and non-reusable menstrual products in Spain" and found that the usage of menstrual products shifted based on the experiences of menstrual poverty and access to information and products. (Laura Medina Perucha, 2022)

Iris Flamand's study on the topic, "Menstrual Cup Effect – an environmental impact analysis of four menstrual products and a menstrual waste scenario analysis of increasing future menstrual cups use" concluded that the environmental impact can be reduced in terms of waste if 84 per cent of Dutch females switch to the menstrual cups, 3388 trucks filled with tampons and sanitary pads could be saved per year in the Netherlands. The study suggested that the inclusion of absorbency levels of the disposables was significant. (Flamand)

According to **Beksinska, M., Nkosi, P., Zulu, B., & Smit, J. (2021)** study on, "Acceptability of the menstrual cup among students in further education institutions in KwaZulu-Natal, South Africa", the students were followed for up to 12 months to assess menstrual cup acceptability and user experiences. Disposable pads were the primary menstrual hygiene product used in the 3 months before the interview, and 8.1% of students used toilet paper or newspapers. 86% reported that they had tried to use the menstrual cup. Of those who attempted use, half reported that inserting the menstrual cup on first use was very easy or quite easy. (Beksinska, 2021)

The above collection of literature reviews provides a wide range of knowledge about menstruation and menstrual hygiene management. It also shows the level of awareness about various menstrual products and the awareness level regarding the environmental impact of using disposable menstrual products.

CONCEPTUAL DEVELOPMENT:

1. Psychological factors:

Psychological means concerned with person's mind and thoughts. The Psychological Factors are the factors that talk about the psychology of an individual that drive his actions to

seek satisfaction. The psychological factors include motivation, perception, attitude and belief of individuals.

In this research, it is proposed that the awareness level of consumers depends on the number of female members in the family.

Hypothesis 1: The choice of menstrual products depends on the number of female members in the family.

2. Cultural factors:

Cultural factors comprise of set of values and ideologies of a particular community or group of individuals. It is the culture of an individual which decides the way he/she behaves. In simpler words, culture is nothing but values of an individual. What an individual learns from his parents and relatives as a child becomes his culture. Cultural factors include culture, subculture and social class which includes age, educational qualification, occupation etc.…,

Hypothesis 2: There is a significant difference between being aware of the usage and availability of existing menstrual products based on occupation

3. Economic factors:

Economic factors are the fundamental data about the market and economy taken into consideration when an investment or business value is calculated. Economic factors include personal income and family income

Hypothesis 3: There is a significant difference in the factors considered while choosing menstrual products based on the family income.

RESEARCH METHODOLOGY

A structured questionnaire was used to collect primary data. The questionnaire contained multiple choice and five-point Likert-scale questions on factors considered while choosing menstrual product, convenience level of using various menstrual products and consumer's awareness level regarding various menstrual products and its usage. Convenient sample of 300 people was chosen, and responses were collected. SPSS 26.0 was used to analyze the descriptive statistics, regression and ANOVA of the measures.

DATA ANALYSIS:

Amount spent on purchasing menstrual products.

From the above pie chart, it is evident that 44% of the respondents spend less than 500 per month, 41% of the respondents spend between 500-1000 per month, 11% of the respondents spend between 1000 and 1500 and 4% of the respondents spend more than 1500.

COMMONLY USED MENSTRUAL PRODUCT

From the above chart, it is evident that 86% of the respondents agree that the price of the sugar substitutes is higher than that of sugar. And 14% of the respondents don't agree with this fact.

Safest menstrual product to use

From the above pie chart, it is evident that 51% of the respondents considered sanitary pads as the safest menstrual product to use, 30% considered menstrual cups to be the safest product, 11% considered cloth pads to be the safest product to use, 4% considered tampons to be the safest product and 4% considered reusable period panties to be the safest product to use

HYPOTHESIS TESTING:

SIGNIFICANT RELATIONSHIP BETWEEN THE LEVEL OF AWARENESS AND ACTIONS TO BE TAKEN FOR CREATING AWARENESS ABOUT ENVIRONMENT FRIENDLY MENSTRUAL PRODUCTS

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.108	.389		1	(Constant)
	Action	-.178	.099	-.103		Action
R						**0.103**
R Square						**0.11**
Adjusted R Square						**.007**
F						**3.215**
Significance						**.000**

The above table shows that the hypothesis was tested under linear regression method and it was significant at **p = 0.000**, the first table shows **R = 0.103** which is the correlation between level of awareness about the existing menstrual products and the actions taken to create more awareness about the environmental friendly menstrual products. In the model summary table, $R^2 = 0.11$ which means 11% of variance in the actions to be taken to create more awareness about the environmental friendly menstrual products is explained by the level of awareness. The ANOVA table shows the **F = 3.215** and the **t value** is **10.56** is significant at **p = 0.000.**

REGRESSION EXPLAINING THE RELATIONSHIP BETWEEN THE CONVENIENCE LEVEL AND THE FACTORS CONSIDERED WHILE CHOOSING MENSTRUAL PRODUCTS

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.295	.306		1	(Constant)
	Factors	-1.08	.078	-.080		Factors
Dependent Variable: Convenience						
R		0.08				
R Square		0.16				
Adjusted R Square		.003				
F		1.903				
Significance		P = 0.000				

The above table shows that the hypothesis was tested under linear regression method and it was significant at **p = 0.000**, the first table shows **R = 0.08** which is the correlation between the convenience of using menstrual products and the factors considered while choosing menstrual products. In the model summary table, **R^2 = 0.16** which means 16% of variance in the factors considered while choosing menstrual products is explained by the level of convenience in using menstrual products. The ANOVA table shows the **F = 1.903** is significant at **p = 0.000** and the **t = 10.783** is significant.

CONCLUSION:

The study reveals that people were aware of the existence of various menstrual products other than sanitary pads. There was a relationship between the level of awareness about the existing menstrual products and the actions taken to create more awareness about the environmental friendly menstrual products. Female respondents who were aware of the menstrual cups were hesitant to use them due to various reasons. Undergraduates were mostly aware of the existence and availability of products. There was a difference in the level of acceptance and awareness based on the educational qualifications. Few of them were using menstrual cups and found them to be cost-efficient, environment-friendly and long-lasting (a menstrual cup can last up to 10 years). This generation and the upcoming generation should start using environmentally friendly menstrual products to protect the environment. Most of

them were able to get the desired menstrual products and they were priced affordably. If people were given a choice to choose an alternative that is environment friendly, they preferred menstrual cups. The major problems faced while using menstrual products were leakage and difficulty in the disposal. This issue can be solved by shifting to menstrual cups which has no leakage issues and is reusable.

The future is going to be integrated with advanced technologies. There have already been predictions about the innovative menstrual products that are going to come up on the market most of them that will be disposable but we have to fix up our minds set to protect the environment and start using environment-friendly reusable menstrual products for better sustainability. Menstrual cups are the best alternative to use considering all various factors.

REFERENCES :

1. Flamand, I. (n.d.). *Menstrual Cup Effect – an environmental impact analysis of four menstrual products and a menstrual waste scenario analysis of increasing future menstrual cups use*.
2. Jean M Lamont, Kathleen M Wagner, Ciara G Incorvati. (2019). *The relationship of self-objectification and body shame to attitudes toward and willingness to use reusable products*.
3. Kambala, C. (n.d.). *Menstrual hygiene practices and hygiene management* .
4. L.A.G. Blair, Y. F. (n.d.). *An exploratory study of the impact and potential of menstrual hygiene management waste in UK*.
5. Laura Medina Perucha, T. L.-J. (2022). *Use and perceptions on reusable and non-reusable menstrual products in Spain*.
6. C:Van Eijk, A. M.-H. (2019). Menstrual cups-use,leakage,acceptability,safety and availabilty - a systematic review and meta analysis.
7. Caitlyn Shaye Weir, D. U. (2015). *A private economic cost and qualitative analysis of environmental and health implications of five menstrual products*.
8. Caitlyn Shaye Weir, D. U. (2015). A private economic cost and qualitative analysis of environmental and health implications of five menstrual products.
9. Caitlyn Shaye Weir, D. U. (2015). A private economic cost and qualitative analysis of environmental and health implications of five menstrual products".

10. https://jamanetwork.com/journals/jama-health-forum/fullarticle/2783499

11. https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=menstrual+products+awareness&oq=menstrual+products+awa#d=gs_qabs&u=%23p%3D9pZLuUlcmNEJ

12. https://www.hindawi.com/journals/jeph/2018/1730964/

13. https://www.healthline.com/health/spotlight-next-generation-menstrual-products

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A STUDY ON CONSUMER PREFERENCE TOWARDS SUGAR AND SUGAR SUBSTITUTES – PALM SUGAR, HONEY AND JAGGERY

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ABSTRACT :

This study was conducted to analyze the consumer preference toward sugar and sugar substitutes. The study showed that consumers prefer sugar over sugar substitutes. Their purchase preference is influenced by friends and family. This study identified a positive relationship between the factor that affects consumer buying behavior toward sugar and sugar substitutes.

INTRODUCTION:

Sugar has been a prominent food component in our lifestyle for many years. Though sugar has always been a part of our diet, too much of it is harmful to our health. Sugar consumption is a major contributor to the development of obesity, tooth decay, and diabetes. Consumers have become more health-conscious and seek to eat more nutritious foods. Consumers wanted to use food to boost their health and immunity, and they wanted to substitute sugar in their food, sweets, and beverages. Sugar substitute consumption is becoming more popular as a result of this acceptance.

People have become more aware of their health, diet, and way of life as a result of the outburst of COVID 19. Sugar consumption has been eradicated from their diet. The pandemic has made people aware of the importance of using natural sugar replacements such as jaggery, honey, and palm sugar. **The Sugar Substitutes Market is expected to grow at a CAGR of 5.35% by APAC.** (Technavio, 2021). The market for sugar substitutes is mainly improving because of people's awareness of the adverse health effects of sugar as it increases the chances of obesity and diabetes.

PURPOSE OF THE RESEARCH:

The purpose of the research is to find out the consumer's preference towards sugar and sugar substitutes and consumption and purchase pattern towards sugar and sugar substitutes. The results from this study helps the manufacturers could focus their manufacturing of the products thereby, improvising the features that the customer would want while purchasing the product.

RESEARCH OBJECTIVES:

- To examine the sugar & sugar substitute consumption and purchase pattern among consumers.
- To analyze the significant difference between consumer preference towards sugar and sugar substitutes based on demographics.
- To analyze the consumer's satisfaction level from their preferred choice.
- To compare the consumer preference towards sugar and sugar substitutes.
- To identify the consumer's purchase intention of sugar and sugar substitutes.
- To study the factors that impact consumer's behavior towards the purchase of sugar and sugar substitutes.

LITERATURE REVIEW:

According to the study conducted by **Macario Rodríguez-Entrena et al. (2016),** the consumers from rural areas with a high level of education considered brown sugar to be healthier and people who read nutritional information were prone to consume granulated brown sugar. (Rodríguez - Entrena, 2016)

Wa Kuasa Baka et al. (2016) conducted this study to analyze the consumer purchasing behavior of brown sugar. This study is very useful to the existence of the brown sugar business, and to increase the brown sugar business scale to meet the needs of national and international markets for alternative sources of healthy sweeteners. (Baka W. &., 2016)

Marlena Pielak et al. (2019) conducted a cross-sectional study to analyze the use of sugars and selected sweeteners by Polish consumers in their diet. Respondents' initiatives to reduce sugar intake in their diet mostly due to health-related reasons. It was more emphasized in particular by women taking part in the survey. The most adopted way to limit the amount of sugar in the diet consisted in choosing sweeteners. (Pielak M, 2019)

Kirtida R. Tandel (2011) conducted this study to review the health controversy over the perceived benefits of sugar. The information gathered in this study could also be useful in guiding the design and format of any investigative study that might be undertaken to determine individual sensitivity to sugar substitutes. (Tandel, 2011)

The above collection of literature reviews provides a wide range of knowledge about consumer perceptions and attitudes about sugar and sugar substitutes and the factors that influence consumers' purchase intentions. It's been clear that there's been a widespread awareness among consumers to less consume sugar and other sugar substitutes because of their increased concern for their health and nutrition. This study concentrates on the analysis of consumers' preference towards sugar and sugar substitutes in India.

CONCEPTUAL DEVELOPMENT:

Consumer's reason for purchase and purchase decision

In this research, it is proposed that the consumer's purchase decision towards the purchase of sugar and sugar substitutes is influenced by the consumer's reason for purchase.

Hypothesis 1: Consumer's purchase decision is influenced by the consumer's reason for purchase.

Factors influencing purchase decision towards sugar and sugar substitutes

In this research, it is proposed that the consumer's purchase decision towards the purchase of sugar and sugar substitutes is influenced by the certain factors like taste, quality, health, price and nutrients contents in the product.

Hypothesis 2: Factors like taste, quality, health, price and nutrients contents in the product influences consumer's purchase decision.

Factors influencing purchase decisions and consumer's reason for purchase

This study proposes that consumer's reason for the purchase of sugar and sugar substitutes has a positive impact on factors influencing the purchase decisions.

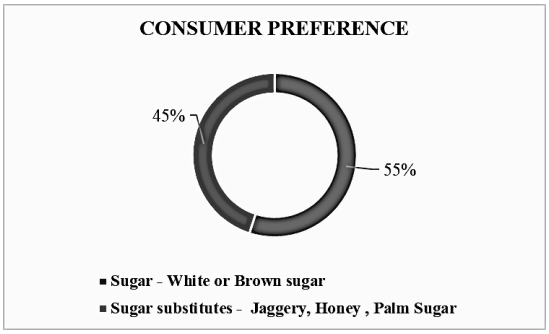
Hypothesis 3: Consumer's reason for the purchase of sugar and sugar substitutes has a positive impact on factors influencing the purchase decisions.

RESEARCH METHODOLOGY

A structured questionnaire was used to collect primary data. The questionnaire contained multiple choice and five-point Likert-scale questions on consumer's reason for purchase, factor influencing purchase decision and consumer's buying behavior towards sugar or sugar substitutes. Convenient sample of 300 consumers from different age groups in India were collected. SPSS 26.0 was used to analyze the descriptive statistics, regression and ANOVA of the measures.

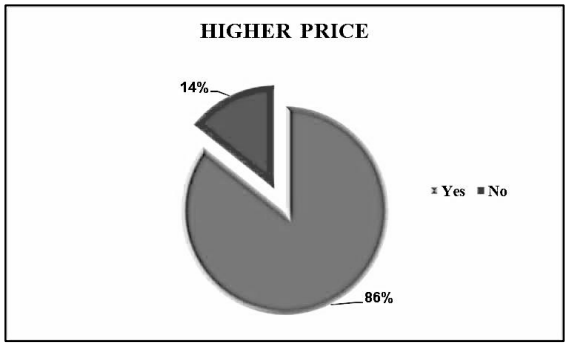
DATA ANALYSIS:

Consumer Preference Toward Sugar or Sugar Substitutes



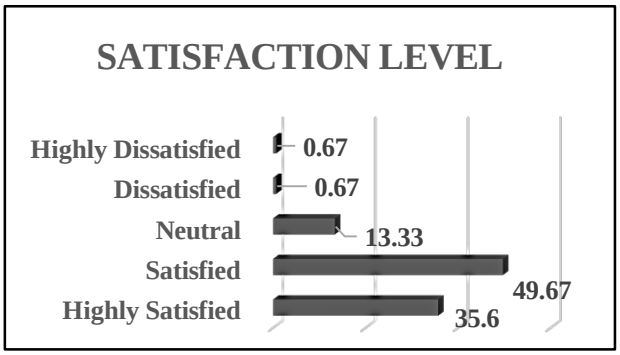
This chart illustrates that the majority of the respondents are preferring sugar – white or brown sugar which constitutes 55% of the total respondents. 45% of the consumer prefer sugar substitutes – jaggery, honey, and palm sugar.

The Price of Sugar Substitutes Is Higher Than Sugar



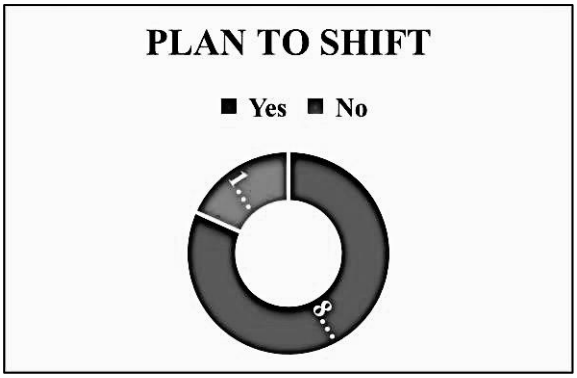
From the above chart, it is evident that 86% of the respondents agree that the price of the sugar substitutes is higher than that of sugar. And 14% of the respondents don't agree with this fact.

The Satisfaction Level of Consumers from Their Preferred Choice – Either Sugar or Sugar Substitutes



From the above chart, it is evident that 36% of the respondents are satisfied with their preferred choice. And 50% of the respondents are also satisfied with their choice. Some of the respondents are neutral and very few are dissatisfied with their choices also.

The Consumer's Plan to Shift to Sugar Substitutes in The Future



From the above chart, it is evident that 82% of the respondents are planning to shift from sugar- to-sugar substitutes. And 18% of the respondents are not planning to shift to sugar substitutes.

HYPOTHESIS TESTING :

Regression explaining the relationship between the consumer's reason for purchase and the consumer's purchase decision towards the purchase of sugar and sugar substitutes.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.258	.090		13.963	.000
	reason	.454	.039	.555	11.532	.000
a) Dependent Variable: purc_decisions						
R						**.555**
R Square						**.309**
Adjusted R Square						**.306**
F						**132.981**
Significance						**.000**

The above chart shows that the hypothesis was tested under the linear regression method and it's significant at **p = 0.000**, the first table shows **R = .555** which is the correlation between the consumer's reason for purchase and the consumer's purchase decision towards the purchase of sugar and sugar substitutes which is the correlation between. In the model summary table, **R^2 = .309** which means **30.9%** of the variance in the purchase decision of consumers towards the purchase of sugar and sugar substitutes is explained by the consumer's reason for purchase. The ANOVA table shows the F value of **132.981** is significant at **p = 0.000** and the T value is **11.532.**

Regression explaining the relationship between a consumer's purchase decision and the factors influencing the purchase towards the purchase of sugar and sugar substitutes

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.079	.097		11.172	.000
	Factors	.512	.041	.590	12.606	.000
a) Dependent Variable: purc_decisions						
R						**.590**
R Square						**.348**
Adjusted R Square						**.346**
F						**158.910**
Significance						**.000**

The above chart shows that the hypothesis was tested under the linear regression method and it's significant at **p = 0.000**, the first table shows **R= .590** which is the correlation between the consumer's purchase decision and the factors influencing the purchase towards the purchase of sugar and sugar substitutes. In the model summary table, **R^2 = .348** which means **34.8%** of the variance in the purchase decision of consumers towards the purchase of sugar and sugar substitutes is explained by the factors influencing the purchase behavior. The ANOVA table shows the F value of **158.910** is significant at **p = 0.000** and the T value is **12.606.**

Regression explaining the relationship between the factors influencing the purchase and the consumer's reason for the purchase of sugar and sugar substitutes.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.644	.113		5.703	.000
	Factors	.677	.048	.637	14.246	.000
a) Dependent Variable: reason						
R		**.637**				
R Square		**.405**				
Adjusted R Square		**.403**				
F		**202.958**				
Significance		**.000**				

The above chart shows that the hypothesis was tested under the linear regression method and it's significant at **p = 0.000**, the first table shows **R = .637** which is the correlation between the e factors influencing the purchase towards the purchase of sugar and sugar substitutes and the consumer's purchase decision. In the model summary table, **R^2 = .405** which means **40.5%** of the variance in the consumers reasons for the purchase of sugar and sugar substitutes is explained by the factors influencing the purchase behavior. The ANOVA table shows the F value of **202.958** is significant at **p = 0.000** and the T value is **14.246.**

CONCLUSION:

The result suggests that most of the respondents prefer sugar over sugar substitutes and their purchase decision is mostly influenced by friends and family. Consumers prefer sugar because they feel the price of the sugar substitutes is higher than that of sugar. The reasonable price the consumer is willing to pay for a kilo of sugar or sugar substitutes is Rs 100 to Rs 150. Moreover, most consumers are satisfied with their preferred choice. This study identified a positive relationship between the factors which affect consumer purchase behavior towards sugar or sugar substitutes. Consumer buying behavior acts as a predictor and

has a direct influence on the decision process when purchasing sugar or sugar substitutes. The consumers are also willing to shift from sugar to sugar substitutes in the future. And, the reason to shift from sugar to sugar substitutes is mostly due to its health benefits. As the consumers want to shift to sugar substitutes in the future, the manufacturers could grab the opportunity to provide an edge over their competitors.

REFERENCES:

- Baka, W. &. (2016). Analysis Of Correlation Between Brown Sugar Attributes and The Consumer Preferences. *International Journal of Business Innovation and Research*, 444- 460.
- Pielak M, C.-S. E. (2019). Contemporary Trends and Habits in the Consumption of Sugar and Sweeteners – A Questionnaire Survey among Poles. *International Journal of Environmental Research and Public Health*
- Rodríguez-Entrena, M. S.-O.-P. (2016). Analysing granulated brown sugar – panela – market in Western Honduras. *British Food Journal, 118* (2), 495-512.
- Tandel, K. R. (2011). Sugar substitutes: Health controversy over perceived benefit. *Journal of pharmacology & pharmacotherapeutics, 2(4),* 236–243. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3198517/
- Technavio. (2021). *technavio*. Retrieved from technavio: https://www.technavio.com/
- https://www.healthline.com/nutrition/brown-sugar-vs-white-sugar
- https://foodyaari.com/recent-trends-on-sugar-substitutes/
- https://www.refreshyourlife.in/blog/jaggery-and-brown-sugar-the-healthiest-substitutes-to-white-sugar
- https://goqii.com/blog/all-that-you-should-know-about-brown-sugar-and-white-sugar/
- https://en.wikipedia.org/wiki/Sugar_substitute
- https://www.emerald.com/insight/content/doi/10.1108/BFJ-04-2015-0130/full/html
- MATH-48.pdf (wseas.us)
- IJERPH | Free Full-Text | Contemporary Trends and Habits in the Consumption of Sugar and Sweeteners—A Questionnaire Survey among Poles (mdpi.com)
- Sugar substitutes: Health controversy over perceived benefits (nih.gov)

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A STUDY ON THE INDIVIDUALS PERCEPTION TOWARDS CRYPTOCURRENCY

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ABSTRACT

In today's world, cryptocurrency is an important innovation that entered the Indian market in 2013. According to the crypto analysis platform, in 2021, India was ranked second in cryptocurrency adoption rate in 20 countries. Cryptocurrency is something new that has crept into our economy. There are many debates regarding its implementation, i.e., as an asset or a legal tender, or to ban it. Very few studies aim to discover people's knowledge and perception in India. Still, no studies have been conducted to know what form people would accept cryptocurrency. Therefore, appropriate measures can be taken only when there is a clear idea of what form people prefer to use cryptocurrency.

Hence, this study explores whether media reports on scams influence cryptocurrency's acceptance among the people in and around Chennai. Furthermore, it checks whether cryptocurrency's main merits and demerits affect cryptocurrency's acceptance decision as an asset or a legal tender. Finally, this study would reveal the most acceptable form of cryptocurrency, i.e., as an asset or legal tender, or whether it is expected to be banned.

Keywords: Cryptocurrency, Perception, Asset, Legal Tender, Acceptance form

INTRODUCTION

Cryptocurrencies are digital currencies that can replace local fiat currencies and many other potential global assets. These digital currencies are currently breaking the exchange barriers and are integrating the economies into one. Cryptocurrencies are computer-generated digital currencies that work on an interconnected and transparent blockchain network. The exchange database gets stored on a decentralized distributed ledger system, i.e., the blockchain. It enables peer-to-peer transactions and creates a copy of each transaction on every node present on the network. This ensures transparency and removes the need for third-party interference in the transactions.

The information which stands stored on a blockchain is immutable and permanent. It uses cryptography and algorithms to secure its transactions or exchanges. Furthermore, it limits the production of a particular type of cryptocurrency. Finally, it keeps track of every transaction in the entire blockchain network.

Amidst such vibrant shades, one has to note that it is still in its infancy stage and requires development. It lacks usage knowledge, and people are unaware of the benefits of using cryptocurrencies, and this new technology stays limited to the technical pool. Furthermore, as these currencies remain digitally transacted over the internet, they are prone to online scams. There is no place to report such crimes and get back the cryptocurrency as no authoritative body governs them. Hence, the loss obtained in cryptocurrencies is borne entirely by the holders. Thus, thoroughly examining all possible pros and cons is vital before implementing cryptocurrencies.

OBJECTIVES OF THE STUDY

- To determine whether cryptocurrency's acceptance as an Asset or as a Legal Tender remains influenced by the media reports of fraud among people or is it a piece of fake news among the people in and around Chennai.
- To assess the degree of impact of the features of cryptocurrency (as an asset or as legal tender) on an individual's acceptance decision.
- To analyze whether it is accepted as an ASSET or LEGAL TENDER or is looked for to be banned.

SIGNIFICANCE OF THE STUDY

The study theme underlines the vitality of knowing the perception of individuals on cryptocurrency to conclude whether its implementation is expected or resisted. Hence, the scope of this study is to investigate the impact of cryptocurrency's essential pros and cons on the acceptance decision of various age groups in and around Chennai. Furthermore, this study also checks whether media reports on fraud are a dominant influencer of decisions in this aspect. Finally, it also highlights whether people look forward to implementing or banning cryptocurrencies.

REVIEW OF LITERATURE

The study of **Peter D. DeVries (2016)**, in **"An Analysis of Cryptocurrency, Bitcoin, and the Future"** states that the rate of cryptocurrency adoption is faster than the early adoption phase, which any new technology would experience. Furthermore, he points out that cryptocurrency can act as a major currency solution for inflation in the future since it can bridge the economic gap because of its potential to make micropayments.

Nadim Mahomed (2017), in his research paper **"Understanding consumer adoption of cryptocurrencies"** explores the factors driving toward cryptocurrency adoption. He highlights that people do not look at cryptocurrency primarily like cash. Yet the support mechanisms for usage and the satisfaction derived from each usage experience are the major driving factors in adopting cryptocurrency in day-to-day life. In addition, his results show that pleasure-seeking attitude, trust, and social influence strongly impact behavioral intention.

Chan Kok Han et al. (2018), in their investigation **"Acceptance of Cryptocurrency Among Ipoh Residents"** aims to determine the behavioral intention and variables influencing the Ipoh (Capital city of Malaysia) residents. They put forth that trust, imparted habits, existing living conditions, price value, social influence, risk, performance anticipation, and conceptual framework significantly impact the intention to use cryptocurrency. Thus, such factors must be looked into while considering acceptance. Only when cryptocurrency promoters positively influence such factors will citizens think about accepting cryptocurrency.

Dr. Neha Parashar and Ms. Farida Rasiwala (2018), in their investigation titled **"A study on investor's awareness and perception regarding investment in Cryptocurrency with special reference to Bitcoin"** show the willingness to adopt cryptocurrency. They point out that individuals are ready to accept cryptocurrency as a speculation asset when specific barriers, such as security, trust, etc., stay removed. On the contrary, they point out that people fear using Bitcoin due to the danger of theft, hacking, and technical glitches or errors. Their findings state that people would feel more secure if standardized KYC norms were introduced.

Ludwig Christian Schaupp (2018), in his paper **"Cryptocurrency Adoption and the Road to Regulation"** investigates the persuading factors that determine the acceptance of cryptocurrency. They also explore among undergraduate students the comparative importance of such factors. He points out that the central idea of cryptocurrency aims to create a self-regulated market, which attracts many investors. However, many people trade in cryptocurrency with the expectation of getting an abnormal return. Such expectation leads to speculation and hinders the cryptocurrency market from regulating itself. Thus Government regulation is inevitable to control volatility, fraud, thefts, and manipulation. Therefore, this research brings out the theme of e-government to govern the cryptocurrency market.

The study of **Abdulla AlShamsi and Peter Andras (2019),** in their paper entitled **"User Perception of Bitcoin Usability and Security across Novice Users"** analyzes users' perceptions, experiences, and influence in terms of usableness and safety by comparing Bitcoin and other e-payment methods (credit / debit cards). In addition, the paper points out five noteworthy aspects that affect decisions: the ability to learn, effectiveness, help, safety, and satisfaction. Their results show that Bitcoin is still in its infancy stage, requiring usage education and change in people's thinking as there occupies a thought that it is of great challenge to use cryptocurrency. Finally, they suggest a public Blockchain platform, application standards, and application programming interfacing to encourage positive user perception and interaction.

So, this study seeks to discover whether media reports on fraud influence cryptocurrency's acceptance among people. In addition, it portrays the impact of cryptocurrency's main merits and demerits from the dimension of the employed and the student sector in influencing their decision to accept cryptocurrency as an investment asset or as a legal tender. Finally, the result of the analysis will show whether individuals accept cryptocurrency as an asset or legal tender or want it banned.

RESEARCH METHODOLOGY

Research problem - This research aims to know whether media reports on fraud influence cryptocurrency's acceptance among people. It also checks how cryptocurrency's main merits and demerits affect cryptocurrency's acceptance decision as an asset or a legal tender. Finally, it also proposes to determine whether people would accept cryptocurrency as an investment asset, legal tender, or should be banned.

Data Collection - This research employs first-hand information collected through a questionnaire circulated through google forms online to people around Chennai. In addition, an offline survey has also remained taken from the people in Chennai. The questionnaire had a total of 30 questions divided into three sections - one containing questions on demographics, another to find out the different perspectives of cryptocurrency as legal tender, and the final one to find out the different perspectives of cryptocurrency as an asset.

Sample Design and Sample Size - The sampling design chosen for this research is simple random sampling. A sample size of 120 respondents from different age groups from 18 onwards remained selected for the study. The respondents were selected from academic and professional fields. This method is chosen so that the sample could avoid bias and other ill effects, and results could be obtained more accurately.

ANALYSIS AND INTERPRETATION OF DATA

Independent T-Test Analysis

To determine whether cryptocurrency's acceptance as an Asset or as a Legal Tender remains influenced by the media reports on frauds or is it a piece of fake news among the people in and around Chennai.

As a Legal Tender

Null Hypothesis

$H_0 = 0$**;** There is no significant difference in accepting cryptocurrency as a Legal Tender due to media reports on fraud's influence on the people in and around Chennai.

Alternative Hypothesis

$H_1 \neq 0$**;** There is a significant difference in accepting cryptocurrency as a Legal Tender due to media reports on fraud's influence on the people in and around Chennai.

Table 1:- Media reports on fraud influence in accepting cryptocurrency as a Legal Tender among the people in and around Chennai

	Place	Mean	Std. Deviation	t value	df	P-value
Media reports on fraud	Chennai	3.26	1.158	-1.006	118	0.316
	Around Chennai	3.67	1.225			

Interpretation - It stands observed that accepting cryptocurrency as a Legal Tender decision is not influenced by media among the people in and around Chennai, as the results show t(118) = -1.006, P = 0.316. Hence the **null hypothesis is accepted at a 5% significance level** since the P-value is greater than 0.05.

As an Asset

Null Hypothesis

H_0 **= 0;** There is no significant difference in accepting cryptocurrency as an Asset due to media reports on fraud's influence on the people in and around Chennai.

Alternative Hypothesis

$H_1 \neq 0$**;** There is a significant difference in accepting cryptocurrency as an Asset due to media reports on fraud's influence on the people in and around Chennai.

Table 2:- Media reports on fraud influence in accepting cryptocurrency as an Asset among the people in and around Chennai

	Place	Mean	Std. Deviation	t value	df	P-value
Media reports on fraud	Chennai	3.62	1.062	-2.584	118	0.011*
	Around Chennai	4.56	.726			

Note:- * Denotes at 5% significant level

Interpretation - It stands observed that accepting cryptocurrency as an Asset decision is influenced by media among the people in and around Chennai, as the results show t(118) = -2.584, P = 0.011. Hence the **null hypothesis is rejected at a 5% significance level** since the P-value is lesser than 0.05.

- **Regression Analysis**

1. To find out the impact of the Merits of Cryptocurrency as a Legal Tender on the Acceptance decision of cryptocurrency as a Legal Tender

Null Hypothesis

H_0 **= 0;** There is no significant effect of the Merits of Cryptocurrency as a Legal Tender on the Acceptance decision of cryptocurrency as a Legal Tender.

Alternative Hypothesis

$H_1 \neq 0$**;** There is a significant effect of the Merits of Cryptocurrency as a Legal Tender on the Acceptance decision of cryptocurrency as a Legal Tender.

R value : 0.713 **R Square value** : 0.509 **F value** : 122.307 **P value** : <0.001**

Table 3:- Effect of the Merits of Cryptocurrency as a Legal Tender on the Acceptance decision of cryptocurrency as a Legal Tender

Variables	Unstandardized co-efficient (B)	SE of B	Standardized co-efficient (Beta)	t value	P value
Constant	23.729	1.716	-	13.835	<0.001
X	0.922	0.083	0.713	11.059	<0.001**

Note: ** Denotes significance at 1% level

Interpretation - It is observed that the Merits of Cryptocurrency as a Legal Tender is a significant predictor of the acceptance decision of cryptocurrency as a Legal Tender, as the results show β = 0.713, P = 0.001, t(118)=11.059 and R^2 = 0.509. Hence the **null hypothesis is rejected at a 1% significance level** since the P-value is lesser than 0.01.

2. To find out the impact of the Demerits of Cryptocurrency as a Legal Tender on the Acceptance decision of cryptocurrency as a Legal Tender

Null Hypothesis

H_0 = 0; There is no significant effect of the Demerits of Cryptocurrency as a Legal Tender on the Acceptance decision of cryptocurrency as a Legal Tender.

Alternative Hypothesis

$H_1 \neq 0$; There is a significant effect of the Demerits of Cryptocurrency as a Legal Tender on the Acceptance decision of cryptocurrency as a Legal Tender.

R value : 0.637 **R Square value** : 0.405 **F value** : 80.381 **P value** : <0.001**

Table 4:- Effect of the Demerits of Cryptocurrency as a Legal Tender on the Acceptance decision of cryptocurrency as a Legal Tender

Variables	Unstandardized co-efficient (B)	SE of B	Standardized co-efficient (Beta)	t value	P value
Constant	21.915	2.297	-	9.539	< 0.001
X	0.905	0.101	0.637	8.966	< 0.001**

Note: ** Denotes significance at 1% level

Interpretation - It is observed that the Demerits of Cryptocurrency as a Legal Tender is a significant predictor of the acceptance decision of cryptocurrency as a Legal Tender, as the results show β = 0.637, P = 0.001, t(118)=8.966 and R^2 = 0.405. Hence the **null hypothesis is rejected at a 1% significance level** since the P-value is lesser than 0.01.

3. To find out the impact of the Merits of Cryptocurrency as an Asset on the Acceptance decision of cryptocurrency as an Asset

Null Hypothesis

H_0 **= 0;** There is no significant effect of the Merits of Cryptocurrency as an Asset on the Acceptance decision of cryptocurrency as a Legal Tender.

Alternative Hypothesis

$H_1 \neq 0$**;** There is a significant effect of the Merits of Cryptocurrency as an Asset on the Acceptance decision of cryptocurrency as a Legal Tender.

R value : 0.504 **R Square value** : 0.254 **F value** : 40.244 **P value** : <0.001**

Table 5:- Regression table on the effect of the Merits of Cryptocurrency as an Asset on the Acceptance decision of cryptocurrency as an Asset

Variables	Unstandardized co-efficient (B)	SE of B	Standardized co-efficient (Beta)	t value	P value
Constant	**29.293**	**2.281**	**-**	**12.843**	**<0.001**
X	**0.703**	**0.111**	**0.504**	**6.344**	**<0.001****

Note: ** Denotes significance at 1% level

Interpretation - It is observed that the Merits of Cryptocurrency as an Asset is a significant predictor of the acceptance decision of cryptocurrency as an Asset, as the results show β = 0.703, P = 0.001, t(118)=6.344 and R^2 = 0.254. Hence the **null hypothesis is rejected at a 1% significance level** since the P-value is lesser than 0.01.

4. To find out the impact of the Demerits of Cryptocurrency as an Asset on the Acceptance decision of cryptocurrency as an Asset

Null Hypothesis

H_0 **= 0;** There is no significant effect of the Demerits of Cryptocurrency as an Asset on the Acceptance decision of cryptocurrency as an Asset.

Alternative Hypothesis

$H_1 \neq 0$**;** There is a significant effect of the Demerits of Cryptocurrency as an Asset on the Acceptance decision of cryptocurrency as an Asset.

R value : 0.364 **R Square value** : 0.132 **F value** : 17.989 **P value** : <0.001**

Table 6:- Effect of the Demerits of Cryptocurrency as an Asset on the Acceptance decision of cryptocurrency as an Asset

Variables	Unstandardized co-efficient (B)	SE of B	Standardized co-efficient (Beta)	t value	P value
Constant	**30.843**	**2.992**	**-**	**10.307**	**<0.001**
X	**0.558**	**0.131**	**0.362**	**4.241**	**<0.001****

Note: ** Denotes significance at 1% level

Interpretation - It is observed that the Demerits of Cryptocurrency as an Asset is a significant predictor of the acceptance decision of cryptocurrency as a Legal Tender, as the results show β = 0.364, P = 0.001, t(118)=4.241 and R^2 = 0.132. Hence the **null hypothesis is rejected at a 1% significance level** since the P-value is lesser than 0.01.

- **Chi-square Analysis**

To ascertain whether people expect a cryptocurrency to be implemented as a Legal Tender or as an Asset or is expected to be banned

As a Legal Tender

Null Hypothesis

H_0 **= 0;** There is no significant association between the Merits and Demerits of Cryptocurrency as a Legal tender and people's expectation of cryptocurrency to be implemented as a Legal Tender.

Alternative Hypothesis

$H_1 \neq 0$**;** There is a significant association between the Merits and Demerits of Cryptocurrency as a Legal tender and people's expectation of cryptocurrency to be implemented as a Legal Tender.

Table 7:- Association between the Merits and Demerits of Cryptocurrency as a Legal tender and people's expectation of cryptocurrency to be implemented as a Legal Tender

	Value	df	P-Value
Pearson Chi-Square	477.340[a]	418	0.024**
Likelihood Ratio	298.774	418	1.000
Linear-by-Linear Association	0.887	1	0.346

Note: ** Denotes significance at 1% level

Interpretation - It is observed that people expect a cryptocurrency to be implemented as a Legal Tender, as the results show X^2(**418, 120**) = **477.34** and P = 0.024. Hence the **null hypothesis is rejected at a 1% significance level** since the P-value is lesser than 0.01.

As an Asset

Null Hypothesis

H_0 **= 0;** There is no significant association between the Merits and Demerits of Cryptocurrency as an Asset and people's expectation of Cryptocurrency to be implemented as an Asset.

Alternative Hypothesis

$H_1 \neq 0$**;** There is a significant association between the Merits and Demerits of Cryptocurrency as an Asset and people's expectation of Cryptocurrency to be implemented as an Asset.

Table 8:- Association between the Merits and Demerits of Cryptocurrency as an Asset and people's expectation of Cryptocurrency to be implemented as an Asset

	Value	**df**	**P-Value**
Pearson Chi-Square	619.999[a]	550	0.020**
Likelihood Ratio	343.101	550	1.000
Linear-by-Linear Association	0.187	1	0.666

Note: ** Denotes significance at 1% level

Interpretation - It is observed that people expect cryptocurrency to be implemented as an Asset, as the results show X^2(**550, 120**) = **619.99** and P = 0.020. Hence the **null hypothesis is rejected at a 1% significance level** since the P-value is lesser than 0.01.

FINDINGS

Independent T-Test Analysis

In the first test regarding media reports' influence on perception as a Legal Tender, it is observed that there are no statistically significant differences between means. Hence it is **denied that the media was a significant influencer in accepting cryptocurrency as a Legal Tender**. This is because such a decision remains influenced by the Government's laws and not by media reports.

However in the second test regarding media reports' influence on perception as an Asset, there are statistically significant differences between means. Hence it is accepted **that the media was an important influencer in accepting cryptocurrency as an Asset,** as people look into the news to get information regarding the value of assets.

REGRESSION ANALYSIS

It stands seen that the impact of **Merits of Cryptocurrency,** such as privacy, cheap fees, 24/7 services, individual control, people regulated, peer-to-peer transactions, and globally adopted; **as a Legal Tender, has a major effect on the Acceptance decision** of cryptocurrency as a Legal Tender than the demerits. 50.9% of the variance in the Acceptance decision of cryptocurrency as a Legal Tender is impacted by the Merits of Cryptocurrency as a Legal Tender. In contrast, only 40.5% of the variance in the Acceptance decision of cryptocurrency as a Legal Tender is impacted by the Demerits of Cryptocurrency, such as irreversible transactions, reports on frauds, infancy stage, no physical form, and no authority to govern as a Legal Tender.

Owing to the fact 25.4% of the variance in the Acceptance decision of cryptocurrency as an Asset stands impacted by the Merits of Cryptocurrency as an Asset, such as increasing prices, confidentiality, highly secured, fewer operating procedures, faster transactions, and individual control and only 13.2% of the variance in the Acceptance decision of cryptocurrency as an Asset stand affected by the Demerits of Cryptocurrency as an Asset such as no stable prices, lack of governing body, infancy stage, irreversible transaction, reports on fraud and time taken to learn. Therefore, it is seen that the **impact of the Merits of Cryptocurrency as an Asset has a more significant effect on the Acceptance decision of cryptocurrency as an Asset than demerits**.

CHI-SQUARE ANALYSIS

There is a significant association between the Merits and Demerits of Cryptocurrency as a Legal tender or as an Asset and people's expectation of cryptocurrency to be implemented as a Legal Tender. It is observed that cryptocurrency is anticipated by the people to be implemented as a Legal Tender or as an Asset. Still, it is not expected to be banned as people find the technology interesting but are waiting for government approval. Because any form backed by the RBI or the Government provides security of monetary value to the people**.**

SUGGESTIONS

In order to implement cryptocurrency as a Legal Tender, the Government's regulation plays the primary role. A standard valuation must be implemented for cryptocurrency to be used as a Legal Tender. In order to implement cryptocurrency as an Asset, the positives of using cryptocurrencies must be emphasized equally to the dangers projected by the media. The current stage of Cryptocurrencies is suitable to be implemented as an Asset. The idea that people expect cryptocurrencies to be banned is a piece of fake news, and the implementation of cryptocurrency in any form would lead to economic growth.

CONCLUSION

In conclusion, media is a significant influencer in the acceptance decision of cryptocurrency as an asset and not a legal tender. On the other hand, the Government's laws and regulations play a major role in accepting cryptocurrency as a Legal. Hence the news displayed in the media must be given due consideration in case of implementing it as an asset to win the favor and goodwill of people. Therefore, there is a significant and positive impact of the merits and demerits of cryptocurrency in the acceptance decision of cryptocurrency as an Asset or as a Legal tender. It stands also shown that the merits of each form of cryptocurrency dominate the acceptance decision as an Asset or as a Legal tender.

Finally, it is observed that there is a positive and significant association between the merits and demerits of cryptocurrency with its acceptance in each form. This shows that cryptocurrency is looked forward to being implemented as an Asset or Legal tender and is not expected to be banned. However, government regulation and a stable price are expected by the people in the case of implementing it as a Legal Tender. In the case of an asset, the irreversible transaction feature must be removed, and a redressal mechanism needs to be set up.

BIBLIOGRAPHY

1. Caporale, G. M., Gil-Alana, L., & Plastun, A. (2018). Persistence in the cryptocurrency market. Research in International Business and Finance, 46, 141–148. https://doi.org/10.1016/j.ribaf.2018.01.002

2. Boshkov, T. (2018). Blockchain and Digital Currency in the World of Finance. In www.intechopen.com. IntechOpen. https://www.intechopen.com/chapters/62481

3. Gagarina, M., Nestik, T., & Drobysheva, T. (2019). Social and Psychological Predictors of Youths' Attitudes to Cryptocurrency. Behavioral Sciences, 9(12), 118. https://doi.org/10.3390/bs9120118

4. Boxer, M., & Thompson, N. (n.d.). Herd Behaviour in Cryptocurrency Markets. Retrieved September 29, 2021, from https://nikthompson.com/PDF/Boxer-Thompson-2020-ACIS.pdf

5. Phiromswad, P., Chatjuthamard, P., Treepongkaruna, S., & Srivannaboon, S. (2021). Jumps and Cojumps analyses of major and minor cryptocurrencies. PLOS ONE, 16(2), e0245744. https://doi.org/10.1371/journal.pone.0245744

6. Alaeddin, O., & Altounjy, R. (2018). Trust, Technology Awareness and Satisfaction Effect into the Intention to Use Cryptocurrency among Generation Z in Malaysia. International Journal of Engineering & Technology, 7(4.29), 8–10. https://doi.org/10.14419/ijet.v7i4.29.21588

7. Ayedh, A., Echchabi, A., Battour, M., & Omar, M. (2020). Malaysian Muslim investors' behaviour towards the blockchain-based Bitcoin cryptocurrency market. Journal of Islamic Marketing, ahead-of-print(ahead-of-print). https://doi.org/10.1108/jima-04-2019-0081

8. Mazambani, L., & Mutambara, E. (2019). Predicting FinTech innovation adoption in South Africa: the case of cryptocurrency. African Journal of Economic and Management Studies, ahead-of-print(ahead-of-print). https://doi.org/10.1108/ajems-04-2019-0152

9. Nakamoto, S. (2008). Bitcoin: a Peer-to-Peer Electronic Cash System. In bitcoin.org. https://bitcoin.org/bitcoin.pdf

10. Berentsen, A., & Schar, F. (2018). A Short Introduction to the World of Cryptocurrencies. Review, 100(1), 1–19. https://doi.org/10.20955/r.2018.1-16

11. A Study On The Awareness And Perception Of Cryptocurrency In Bangalore, Swati Shukla, Akshay. A INDIAN JOURNAL ON APPLIED RESEACH Volume-9 | Issue-4 | April-2019

12. Stix, H. (2019, May 22). Ownership and purchase intention of crypto-assets – survey results. Ideas.repec.org. https://ideas.repec.org/p/onb/oenbwp/226.html

13. Schaupp, L. C., & Festa, M. (2018). Cryptocurrency adoption and the road to regulation. Proceedings of the 19th Annual International Conference on Digital Government Research Governance in the Data Age - Dgo '18. https://doi.org/10.1145/3209281.3209336

14. Devries, P. (2016). An Analysis of Cryptocurrency, Bitcoin, and the Future. International Journal of Business Management and Commerce, 1(2). https://ijbmcnet.com/images/Vol1No2/1.pdf

15. O'Sullivan, F. (n.d.). *What Is Cryptocurrency?* How-to Geek. https://www.howtogeek.com/748405/what-is-cryptocurrency/

16. Kok, C., Shi, H., Chong, M., Yuan, J., Pui, F., Lee, Y., & Zhen, X. (2018). *ACCEPTANCE OF CRYPTOCURRENCY AMONG IPOH RESIDENTS*. http://eprints.utar.edu.my/3102/1/fyp_MK_2018_CKH.pdf

17. Mahomed, N. (2017). Understanding consumer adoption of cryptocurrencies. Repository.up.ac.za. https://repository.up.ac.za/handle/2263/64874

18. Parashar, Neha & Rasiwala, Farida. (2018). A study on investor's awareness and perception regarding investment in Crypto currency with special reference to Bitcoin. International Journal of Scientific and Research Publications (IJSRP). 8. 10.29322/IJSRP.8.12.2018.p8442.

19. Schaupp, L. C., & Festa, M. (2018). Cryptocurrency adoption and the road to regulation. Proceedings of the 19th Annual International Conference on Digital Government Research Governance in the Data Age - Dgo '18. https://doi.org/10.1145/3209281.3209336

20. Alshamsi, A., & Andras, Prof. P. (2019). User perception of Bitcoin usability and security across novice users. International Journal of Human-Computer Studies, 126(1071-5819), 94–110. https://doi.org/10.1016/j.ijhcs.2019.02.004

AN EMPIRICAL STUDY ON WORK LIFE BALANCE AND EMOTIONAL INTELLIGENCE OF IT EMPLOYEES

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ABSTRACT

Work-life Balance is a measure for balancing work and personal commitments. Emotional Intelligence is an understanding of one's emotions as well as those of others. This study looks at emotional intelligence in the context of employee work-life balance in IT companies.The main purpose of the study is to analyze how Emotional Intelligence impacts on Work Life Balance of IT employees.The sample included 200 Chennai-based IT employees, both male and female. The responses were collected using convenience sample technique. The tools used in this study are One-way Anova and Pearson's Correlation. The result of the study is that due to the sheer Pandemic situation, Emotional Intelligence has a minimal impact on Work Life Balance on Employees.

Key words: Work-Life Balance, Emotional Intelligence

INTRODUCTION

According to a report by India's software industry body, the National Union of Software solutions Companies, the IT industry in India Is Expected to grow at a rate of 12 - 14 percent from 2016 and 2017. (NASSCOM.) This simply proves that information technology is an industry which will most likely be one of the developing markets in the near future, as India's market demands more hardware, software, and other IT services.

As per conventional wisdom, a happy employee is a successful employee. But even so, it does seem that employers are having difficulty comprehending this fact. Moreover, when the pressure gets too high, it creates stress. Many stressful events are work-related, including rising unemployment, changes in working hours, changes in working conditions, layoffs, downsizing, organizational readjustments, and so on. In organizations and on the home front, the challenge of work / life balance is rising to the top of many employers' and employees' consciousness. In Today's fast-paced society, human resource professionals seek options to positively affect the bottom line of their companies, improve employee morale, retain employees with valuable company knowledge, and keep pace with workplace trends

Work-Family, a term more frequently used in the past than today. The Current trend is to use titles that include the phrase work-life, giving a broader work-life connotation or labeling referring to specific areas of support (e.g., quality of life, flexible work options, life balance, etc.) Work Family conflict is the push and pull between work and Family

responsibilities. Work life balance is ability to manage resources to meet Family and work demands so that individuals can show effect participation in both domains of life.

Emotional Intelligence is a set of qualities and competencies that embraces a diverse range of individual habits of mind referred to as soft skills or terms of inter skills that fall outside of the areas of detailed skills, smartness, and technical or professional skills. Emotions are an inbuilt part of our biological makeup, and they accompany us to work dailybasis, impacting our behavior.

OBJECTIVES OF THE STUDY

1. To study the role of emotional intelligence and work life balance
2. To analyze the relationship between emotional intelligence and balancing work life
3. To determine the factors causing stress in a workplace

REVIEW OF LITERATURE

Sneha Paryani (2014) "Study of Work Life Balance of faculties of Engineering and Management institution with special reference to Mumbai and Pune region" says that growing diversity of Family structures has heightened the relevance of balancing work and life role. They consider child supervision as their first priority and the employees need to express their needs otherwise, they cannot expect the institution to resolve matters for them.

Ashkan Khalili (2011) "Study of Emotional Intelligence and Organizational Commitment among employees of small and medium enterprise in private sector" states that examined terms are mutually related for employees. It also states that employees with top level of self-control and consciousness are more devoted rather than employees with low levels in these two elements.

Albertson (2008) "Relationship between work hours and Work Life balance" found a strong union between massive amount of work hours and subordinate of work Life Balance within women. The findings for men were less definitive, although a connection between extra hours and reduced levels of work-life balance was highly regarded in gender mixed groups

G.Radhika (2018) "Emotional Intelligence of employees in a Workstation" says that the emotional intelligence of the organization's employees has an impact on their degree of Job performance. Emotional intelligence is linked to improved success in participative management, attracting people with ease, balancing personal and professional lives, being direct and calm, and confronting problem employees

Casper, C. M. (2002) "Using emotional intelligence to improve project performance" found out that Project Managers who really understand the talents, values and potential of themselves and also their project teams, who savvy to manage their own emotions and the emotions of others, and who will connect with team members have their chance to own a project atmosphere second to none

RESEARCH GAP

Following the review of literature, it appears that there are few research studies on work life balance and emotional intelligence of IT employees in Chennai. Apart from that, there are a number of aspects that have still to be investigated, including the degree of stress among IT personnel, the relationship between work life balance and IT employees' emotional intelligence. The current study focuses on these aspects.

RESEARCH METHODOLOGY

This study follows the descriptive method and quantitative method to collect and analyze the numerical data. Data is collected through google forms and targeted people were IT employees of chennai. Likert method was used to prepare the questionnaire. The sample size was 200 respondents. The tools used for the study was one-way anova and pearson's correlation and descriptive statistics to test the hypothesis.

The following are the hypothesis used in the study:

H0 - There will be no significant relationship between work life balance and emotional intelligence.

H1 - There will be significant relationship between work life balance and emotional intelligence.

H2 - There is no significant difference among demographics and work life balance.

H3 - There is no significant difference among demographics and emotional intelligence

ANALYSIS AND INTERPRETATION

Study the role of Work Life Balance and Emotional Intelligence:

One way anova tool was used to analyze the first objective. For this purpose, independent variable(work life balance) and dependant variable (emotional intelligence) with 1 demographic factor (age) are used to show the relationship between them.

a) Work Life Balance and Age

ANOVA

Work life balance and Age		Sum of Squares	df	Mean Square	F	Sig.
productive at home and work	Between Groups	1.222	2	.611	.427	.653
	Within Groups	281.653	197	1.430		
	Total	**282.875**	**199**			
stay at work	Between Groups	1.426	2	.713	.490	.613

	Within Groups	286.394	197	1.454		
	Total	**287.820**	**199**			
turn off work mode	Between Groups	3.807	2	1.904	1.305	.273
	Within Groups	287.313	197	1.458		
	Total	**291.120**	**199**			
tired of work	Between Groups	3.011	2	1.505	1.429	.242
	Within Groups	207.544	197	1.054		
	Total	**210.555**	**199**			
break	Between Groups	7.102	2	3.551	2.955	**.054**
	Within Groups	236.773	197	1.202		
	Total	**243.875**	**199**			
work on holidays	Between Groups	13.161	2	6.580	4.724	**.010**
	Within Groups	274.419	197	1.393		
	Total	**287.580**	**199**			
Job interfere with Family	Between Groups	3.464	2	1.732	1.522	.221
	Within Groups	224.216	197	1.138		
	Total	**227.680**	**199**			
Family interfere with Job	Between Groups	2.024	2	1.012	.903	.407
	Within Groups	220.931	197	1.121		
	Total	**222.955**	**199**			
miss Family because of work	Between Groups	15.167	2	7.584	5.697	**.004**
	Within Groups	262.228	197	1.331		
	Total	**277.395**	**199**			
find time for hobby	Between Groups	5.167	2	2.584 emplo	1.967	.143
	Within Groups	258.753	197	1.313		
	Total	**263.920**	**199**			
Family complains about work	Between Groups	2.164	2	1.082	.808	.447
	Within Groups	263.916	197	1.340		
	Total	**266.080**	**199**			

INTERPRETATION:

From the above table, it is found that there is a significant difference between age and employees taking break (0.054), Age and employees working on holidays (0.010) and Age and employees missing their Family because of work (0.004)

b) **Emotional Intelligence and Age**

ANOVA						
Emotional intelligence and Age		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Understanding of self emotions	Within Groups	293.270	197	1.489		
	Total	**298.755**	**199**			
Set goals and try to achieve	Between Groups	1.011	2	.506	.404	.668
	Within Groups	246.489	197	1.251		
	Total	**247.500**	**199**			
Control self temper	Between Groups	2.936	2	1.468	1.411	.246
	Within Groups	204.939	197	1.040		
	Total	**207.875**	**199**			
Understanding emotions of others	Between Groups	7.111	2	3.555	3.009	**.052**
	Within Groups	232.764	197	1.182		
	Total	**239.875**	**199**			
Calm down quickly when angry	Between Groups	.790	2	.395	.298	.743
	Within Groups	261.030	197	1.325		
	Total	**261.820**	**199**			
Complimenting Others	Between Groups	2.662	2	1.331	.745	.476
	Within Groups	351.733	197	1.785		
	Total	**354.395**	**199**			
sensitive to others feelings	Between Groups	.422	2	.211	.138	.871
	Within Groups	300.998	197	1.528		
	Total	**301.420**	**199**			
sharing emotions with others	Between Groups	11.492	2	5.746	4.279	**.015**
	Within Groups	264.508	197	1.343		
	Total	**276.000**	**199**			

INTERPRETATION:

The above table indicates that there is a significant difference between Age and employees who share their emotions with others (0.015), between Age and employees who have good understanding of emotions of others (0.052).

2) To analyze the relationship between Emotional Intelligence and Balancing Work Life

Correlation tool was used to analyze the second objective. Here, factors from Work Life Balance and Emotional Intelligence were taken to check their relationship

c) Correlation between employees being Productive and Setting Goals

CORRELATIONS			
Correlation between Employees being productive and setting goals		**Productive at home and work**	**Set goals and try to achieve**
productive at home and work	Pearson Correlation	1	-.010
	Sig. (1-tailed)		.442
	N	200	200
Set goals and try to achieve	Pearson Correlation	-.010	1
	Sig. (1-tailed)	.442	
	N	200	200

INTERPRETATION:

From the above table indicates that employees being Productive and Setting Goals are inversely correlated

3) To determine the factors causing Stress in a workplace:

To find out the factors causing stress we use the one way anova tool. Here the demographic variable and stress factors are used to analyze the third objective.

d) Age and Stress factors

ANOVA						
Age and Stress Factors		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Job interfere with Family	Between Groups	3.464	2	1.732	1.522	.221
	Within Groups	224.216	197	1.138		
	Total	227.680	199			

Family interfere with Job	Between Groups	2.024	2	1.012	.903	.407
	Within Groups	220.931	197	1.121		
	Total	222.955	199			
Family complains about work	Between Groups	2.164	2	1.082	.808	.447
	Within Groups	263.916	197	1.340		
	Total	266.080	199			
tired of work	Between Groups	3.011	2	1.505	1.429	.242
	Within Groups	207.544	197	1.054		
	Total	210.555	199			
work on holidays	Between Groups	13.161	2	6.580	4.724	**.010**
	Within Groups	274.419	197	1.393		
	Total	287.580	199			

INTERPRETATION:

It is found from the above that there is a significant difference between Age and Employees working on Holidays (0.010)

FINDINGS

1. It was found that there were significant difference in Age and employees taking a break, employees who work on holidays, employees who miss their Family
2. There were a significant difference between age and emotional intelligence of employees who share their emotions with others and who have a better understanding of emotions of others
3. There was highly significant difference between working hours and employees who take regular breaks
4. There were a significant difference between age and emotional intelligence of employees who share their emotions with others and who have a better understanding of emotions of others
5. There was no significant difference between Gender and stress factor of IT employees
6. There was a significant difference between experience and employees who get tired because of work pressure which causes stress for them.
7. While doing pearson's correlation, it was found to have a inversely weakly correlation among the tested variables of work life balance and emotional intelligence

SUGGESTIONS

1. Proper Appraisal and effective work management help the employees to reach the potential of best from better

2. Aiming for providing the Work Life balance helps the employees in managing and keeping the stress level at a minimum level

3. Gender Diversity and unbiased work environment lead to better productive situation

4. Employees benefits should also reach the betterment of the employees immediate dependents such as spouses, children in terms of Insurance, Education allowances etc

5. Adequate mandatory break from work should be allocated to employees to not only help employees to relieve their stress but also to maintain a healthy relationship within Family that can avoid any issues and complain

6. Maternity benefits should be provided to all women employees unbiased at all working ranks equally. Providing Paternity breaks helps the Working husbands to raise a Family and manage the work productively to a great extent.

CONCLUSION

The Study can be concluded that Employees may achieve a perfect productive work style if they are treated fairly and have a good work-life balance. The current pandemic crisis has brought new insight on this. Many employees became a victim of stress disorder in the fear of losing their Jobs and wage cuts.

It's past time to assess critical roles and key positions, as well as form a team of interim successors in the event of an unforeseen situation. Because top management is frequently on business travels, there is a greater chance that certain employees will be unable to work due to quarantine or illness. Under numerous conditions, businesses need to build an effective management decision-making process.

Adequate counseling and introducing a hybrid work environment that brings their work closer to their Family is a better solution that helps the employees in the IT sector.

BIBLIOGRAPHY

1. Jayamala, r. (2014). Impact of emotional intelligence on employee engagement. International journal of multidisciplinary research and development, 2(3), 255–256.

2. Kaur, j., & sharma, a. (2019). Emotional intelligence and work performance. International journal of recent technology and engineering, 8 (2 special issue 3), 1658–1664.

3. Satchwell, l., & smallwood, j. (2016). The role of emotional intelligence in managing construction projects. Creative construction conference 2016, 557–562.

4. Farmer, s. (2013). Emotional intelligence questionnaire (pp. 1–3)

5. Sinha, d. (2014). Study of emotional intelligence amongst the employees of the organized retail sector. International journal of commerce & management., 4 (march).

6. The effect of emotional intelligence on job satisfaction and organizational commitment of dietitians in elementary schools. Culinary science & hospitality research, (2013). 19(4), 307–320.

7. Muştu, d., & kaya, e. (2022). The effect of emotional intelligence on leadership orientation. Iedsr association, 7(17), 15–37.

8. Sharma, d., mishra, i., & sharma, v. (2014). Emotional intelligence among employees of government and public sectors deeksha sharma indiwar mishra. International journal of social science, 3(3), 124–142

9. A study about the work life balance in hospitality industry with reference to kerala. (n.d.).

10. https://www.researchgate.net/publication/353013145_Work_Life_Balance

11. https://www.researchgate.net/publication/353013145_Work_Life_Balance https://www.researchgate.net/publication/351547913_RESEARCH_PAPER_ON_WORK_LIFE_BALANCE_AND_Job_SATISFACTION

12. https://www.researchgate.net/publication/354144486_Impact_of_work_life_balance_on_Job_satisfaction

A STUDY ON RETARGETING ADVERTISEMENT IN THE CONSUMER BUYING BEHAVIOR

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ABSTRACT

Marketing is necessary for every business to promote its product. Finding the best marketing strategy is a challenge for marketers. With all these technological development marketing has become much easier than before. Marketers work hard to attract their customers through customized advertisements which are now popular in digital advertising. The recent strategy which has been used by most marketers is retargeting. It is a digital marketing tool which targets the audience when they leave the website without making a conversion. This marketing tool has a double win situation where it targets the audience who already know the product and audience those who are not aware of the product. This tool aims to increase website traffic and brand awareness.

The purpose of this research is to study the effects of retargeting advertisements on consumer buying behavior. To do so, the deductive research approach is applied, which started with a review of existing literature that made it possible to create the theoretical framework and generate hypotheses. To test these hypotheses, numerical data is collected via a questionnaire. 200 valid responses were collected that helped to do further research. From the study, it is proved that the retargeting advertisement increases the purchase intention of the consumers. However, several factors should be taken into consideration when marketers target audiences with customized advertisements.

Visitors' privacy usage, dynamic pricing and frequency of advertisements are a few factors that impact consumer buying behavior. These negative factors should be improved by the companies so that retargeting advertisements can be even more successful and effective.

INTRODUCTION

Marketing refers to any activities that a company uses to promote its products and services and improve its market share. To be successful, marketing requires a combination of advertising savvy, sales, and the ability to deliver goods to end-users (Adam Barone, 2021). Traditional advertising lacked in many ways which are now the main features of digital advertising. Digital advertising made the buyers and sellers interact with each other which resulted in high consumer satisfaction and led to more sales. There are many types of

digital advertising, and the marketers must choose the correct one based on their marketing goals.

Retargeting is one of the advanced digital advertising which is used by many advertisers to convert their website visitors into buyers. Ad retargeting, also known as retargeting, is the marketing process in which you target ads to users who have previously engaged with your website or social media platform, and haven't converted to a sale (Brian Jackson, 2021).

Retargeting advertisement has a huge effect on consumers' buying behavior as it nudges the website visitors by targeting them on every third-party website. The consumer decision making funnel is disturbed by displaying discount/ offer advertisements to the consumers. The above statement is one of the hypotheses which is included in this study.

The Indian advertising market was valued at nearly INR 670 billion in 2020. The market is further expected to grow at a CAGR of 11% during the forecast period of 2022-2027 to reach INR 1253.2 billion by 2026. The major factors driving the Indian advertising market growth are rapid urbanization, the growing acceptance of technology, the increasing population, and favorable government regulations in the region. (expertmarketsearch.com, 2022)

Digital media has emerged as the white knight for the overall advertising industry which has grown by 18.6% over 2020. While traditional media has been growing by 12.6%, digital media has been leading the growth rally for the Indian advertising industry, growing at almost twice the rate of the overall industry (exchange4media Staff, 2021). The report added that the digital advertising industry has witnessed a growth in market size from ₹15,782 crores in 2020 to ₹21,353 crores in 2021, growing at 35.3% CAGR. Digital media is expected to grow at 29.5% CAGR by 2023. From the above reports, it is found that digital advertising may surpass television advertising by 2023 (Varuni Khosla, 2022).

REVIEW OF LITERATURE

Menno Nelis (2007) "Online Retargeting Based on Consumer Behavior: A Comparison Between Models" points out that the behavioral retargeting campaign of Bettman model has indicated higher scores than the model which followed the control group that almost has no model basis. The researcher addresses the marketer's need to implement behavior retargeting campaigns based on the models of consumer behavior which increase the effectiveness of the campaign.

Anja Lambrecht and Catherine Tucker (2011) "When Does Retargeting Work? Timing Information Specificity" states that when the customer's preferences are detailed and well explained, the dynamic retargeting is more effective as it can target the visitors with personalized advertisements to match their preference. When the customer's preference is not detailed but in general, dynamic retargeting is less effective than generic retargeting. The more the preference details are specific the more the customer's engagement is added to the website.

Hyunyoung Choi (2012) "Retargeting, taking full advantage of the online shopping behavior" demonstrates that the online users visit the website again when they see an advertisement regarding a product which they have searched for earlier. The Click-Through-Rate of the display advertisement is low when compared to the search engine advertisement. The display advertisement is effective and should target the audience who has visited the product page before. **Gaurav Bakshi (2013) "Online Advertising and Its Impact on Consumer Buying Behavior"** states that online advertising has become a necessary advertising tool for every firm to attract more customers. Only using online advertising to display the products is not an effective way to sell the products. The researcher points out that the advertisement should target the right audience to be effective and in turn, it saves resources for the firm.

Mesay Sata (2013) "Factors Affecting Consumer Buying Behavior of Mobile Phone Devices" states the factors that affect the consumer buying behavior of mobile phones. The researcher concluded by saying that the price and the features of the mobile are the major factors that affect consumer buying behavior.

Muhammad Ehsan Malik, Muhammad Mudasar Ghafoor et al (2013) "Impact of Brand Image and Advertisement on Consumer Buying Behavior" proves that the brand image and advertisement have a huge effect on consumer buying behavior. The effect of advertisement is higher than the brand image as the advertisement influences the consumer's buying behavior. When people see a brand with a good perception, the brand image turns out to be the major factor that influences their buying behavior.

RESEARCH GAP

Many studies have researched the effect of retargeting advertisements and their impact on the consumer buying process. My study analyzed about the behavior of the consumer and their opinion towards the usage of private data. Cookies play an important role in the retargeting advertisement and the suggestion is also given in the later chapter as to how to protect their privacy from the third-party websites.

RESEARCH OBJECTIVE

In this study, the main objectives we aim to prove are as follows.

1. To identify whether retargeting advertisements help to achieve consumer satisfaction.
2. To assess the perception of consumers about retargeting advertisements.
3. To analyze how the retargeting advertisements, change the consumer buying behavior.

RESEARCH METHODOLOGY

This study follows a post-positivism research paradigm and quantitative method to collect and analyze the numerical data. Data is collected using the google form to the targeted audience and the questionnaire was prepared by the Likert scale method. The targeted

audience are those who do online shopping. The total sample size of the study is 200 respondents and the questionnaire included 3 demographic questions and 18 questions regarding the perception of retargeting advertisements and consumer satisfaction during November 2021. Anova, Correlation and percentage frequency distribution has been used as the statistical tools for the hypotheses.

HYPOTHESES

TESTINGFIRST

HYPOTHESIS

H_0: There is no significant relationship between the age and effectiveness of retargeting advertisement

H_1: There is a significant relationship between the age and effectiveness of retargeting advertisement

SECOND HYPOTHESIS

H_0: There is no significant relationship between employment status and the effectiveness of theretargeting advertisement.

H_1: There is a significant relationship between employment status and the effectiveness of aretargeting advertisement.

THIRD HYPOTHESIS

H_0: Retargeting advertisements do not increase the intention to purchase a product after seeingadvertisements again and again.

H_1: Retargeting advertisement increases the intention to purchase a product after seeing advertisements again and again.

FOURTH HYPOTHESIS

H_0: Consumers do not do anything to protect their privacy when companies use their personal data.

H_1: Consumers do something to protect their privacy when companies use their personal data.

DATA ANALYSIS AND INTERPRETATION

Percentage Analysis of Demographic Factors

- **Gender of the Respondents**: Out of 200 respondents, 24 are male and 176 are female. Female dominates the respondents in the survey as 88% of respondents are female.

- **Age of the Respondents:** From the survey it is interpreted that 81.5% of the respondents are below 20 years and 17%are between 21-30 years and the remaining three categories are 0.5%. It is concluded that more than half of the respondents are below 20 years.

- **Status of the Respondents:** 91.5% of the respondents are students, 5% of the respondents are employed and 3% are unemployed. It shows that 0.5% is self-employed which results inthe least category.

RELIABILITY TEST

Reliability Statistics

Cronbach's Alpha	N of Items
.691	18

Item-Total Statistics

	Scale Mean if Item Deleted	**Scale Variance if Item Deleted**	**Corrected Item - Total Correlation**	**Cronbach's Alpha if Item Deleted**
USSM	54.45	41.997	.115	.697
USOS	55.37	43.119	.068	.698
Display	54.84	42.229	.093	.700
Target	55.43	37.804	.450	.657
Time Consuming	54.96	39.245	.424	.664
Best Choices	55.11	38.169	.515	.653
Effective	55.10	38.830	.471	.659
Irritation	54.32	44.922	-.103	.717
Connect	54.85	40.232	.346	.672
Dynamic Pricing	55.51	38.010	.337	.671
Personal Data	56.41	42.163	.097	.699
Protection	54.68	43.797	-.003	.705
Other Brand Awareness	54.73	40.691	.328	.674
Intension	55.00	38.729	.485	.658
Visit	54.57	40.276	.334	.673
Purchase	55.54	40.019	.263	.680
Best Product	55.19	38.956	.470	.660

Alpha Cronbach's value above 0.6 is considered high reliability and acceptable index. Whereas the value of Alpha Cronbach is less than 0.6 considered low. Alpha Cronbach values in the range of 0.60 - 0.80 are considered moderate, but acceptable. The

dataset and the questionnaire are deemed to be reliable because the values of the Cronbach's Alpha of each variable is within the acceptable range, i.e., >0.6, which means that the questionnaireis reliable.

ANALYSIS OF THE FIRST OBJECTIVE

To identify whether the retargeting advertisements help to achieve consumer satisfaction

In this section we attempt to show the results of the collected data analysis of the effectiveness of the retargeting advertisement. Two demographic factors (Age and Status) and dependent variable (effectiveness of retargeting advertisement) are used to show the relationship between the variables.

I. Age and Effectiveness of Retargeting

H_0: There is no significant relationship between the age and effectiveness of retargeting advertisement

H_1: There is a significant relationship between the age and effectiveness of retargeting advertisement

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item - Total Correlation	Cronbach's Alpha if Item Deleted
USSM	54.45	41.997	.115	.697
USOS	55.37	43.119	.068	.698
Display	54.84	42.229	.093	.700
Target	55.43	37.804	.450	.657
Time Consuming	54.96	39.245	.424	.664
Best Choices	55.11	38.169	.515	.653
Effective	55.10	38.830	.471	.659
Irritation	54.32	44.922	-.103	.717
Connect	54.85	40.232	.346	.672
Dynamic Pricing	55.51	38.010	.337	.671
Personal Data	56.41	42.163	.097	.699
Protection	54.68	43.797	-.003	.705
Other Brand Awareness	54.73	40.691	.328	.674
Intension	55.00	38.729	.485	.658
Visit	54.57	40.276	.334	.673
Purchase	55.54	40.019	.263	.680
Best Product	55.19	38.956	.470	.660

ANOVA

Effective					
	Sum of Squares	**Df**	**Mean Square**	**F**	**Sig.**
Between Groups	3.849	4	.962	1.359	.250
Within Groups	138.106	195	.708		
Total	141.955	199			

INTERPRETATION:

The significance level is greater than .05 which indicates that there is no significant relationship between the age and effectiveness of retargeting advertisements. Thus, the null hypothesis is accepted.

II. Employment Status and Effectiveness of Retargeting Advertisement

H0: There is no significant relationship between employment status and the effectiveness of theretargeting advertisement.

H1: There is a significant relationship between employment status and the effectiveness of aretargeting advertisement.

ANOVA

Effective					
	Sum of Squares	**Df**	**Mean Square**	**F**	**Sig.**
Between Groups	10.498	3	3.499	5.217	.002
Within Groups	131.457	196	.671		
Total	141.955	199			

INTERPRETATION:

The above table shows the significant level as .002 which is less than .05 and it interprets that there is significant relationship between the employment status of the respondents and effectiveness of the retargeting advertisement. Hence, the null hypothesis is rejected.

ANALYSIS OF THE SECOND OBJECTIVE

To assess the perception of consumers about retargeting advertisement.

I. To Analyze the Perception of Consumer Towards the Statement that Retargeting Saves Time.

Frequency Distribution of Time Consuming

		f	%	Cf
Valid	Strongly Disagree	4	2.0	2.0
	Disagree	26	13.0	15.0
	Neutral	73	36.5	51.5
	Agree	86	43.0	94.5
	StronglyAgree	11	5.5	100.0
	Total	**200**	**100.0**	

INTERPRETATION:

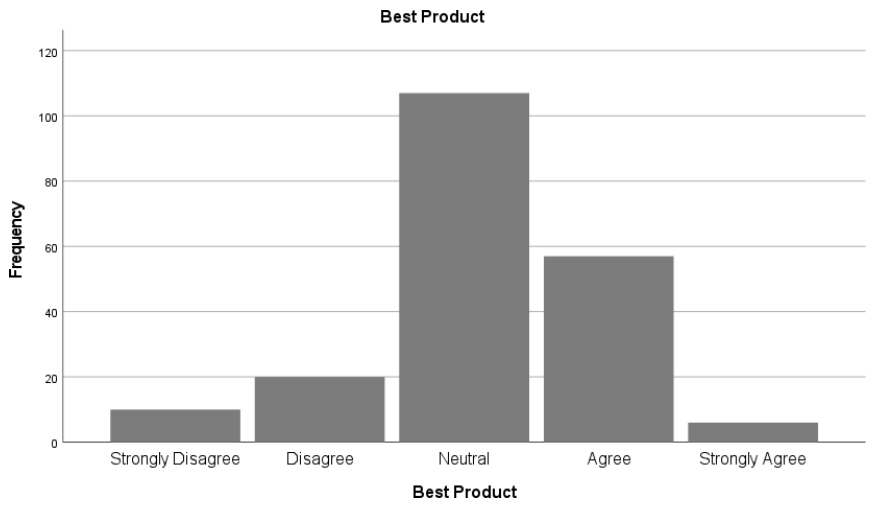
From the above table it is shown that 94.5% of the respondents agree to the statement that retargeting advertisement saves time of the consumers while searching a product.

II. To analyze the perception of the consumers towards the statement that retargeting advertisement shows the best product to purchase.

Best Product to Purchase

		f	%	Cf
Valid	Strongly Disagree	10	5.0	5.0
	Disagree	20	10.0	15.0
	Neutral	107	53.5	68.5
	Agree	57	28.5	97.0
	StronglyAgree	6	3.0	100.0
	Total	**200**	**100.0**	

Bar Graph of Best Product to Purchase



INTERPRETATION:

From the above table, it is evident that 53.5% of the respondents are neutral i.e., they are not sure whether retargeting shows the best products or not. 31.5% of the respondents agree that retargeting advertisement shows the best products to purchase.

ANALYSIS OF THE THIRD OBJECTIVE

1. To Analyze How the Retargeting Advertisements, Change the Consumer Buying Behavior.

H_0: Retargeting advertisements do not increase the intention to purchase a product after seeing advertisements again and again.

H_1: Retargeting advertisement increases the intention to purchase a product after seeing advertisements again and again.

Correlation Between Purchase and Intention Variable

Correlation		Purchase	Intention
Purchase	Pearson Correlation	1	.411**
	Sig. (1- tailed)		<.001
	N	200	200
Intention	Pearson Correlation	.411**	1
	Sig. (1- tailed)	<.001	
	N	200	200

INTERPRETATION:

It is proved that there is positive relationship between the intention to purchase a product and seeing the advertisement again and again makes them to purchase a product. Hence, the null hypothesis is rejected.

FINDINGS

Hypothesis 1 of the research is rejected, which stated that "There is a significant relationship between the age of the respondents and effectiveness of retargeting". By going through the reasoning, it is concluded that there are many factors which rejected the hypothesis such as only most of the teens use online shopping and age is not relevant to the effectiveness of retargeting advertisement

Hypothesis 2 of the research is accepted, which stated that "There is significant relationship between the employment status and effectiveness of retargeting". By going through the reasoning, the dependent factor 'employment status' P value is 0.002 which shows there is statistically significantdifference between the factors.

Hypothesis 3 of the research is accepted, which stated that "Retargeting advertisement increases the consumers' purchase intention". Some of the factors that influenced this

statement to be accepted is retargeting is time consuming as it already shows the relevant advertisements of what the consumer is searching for. It displays discounts or offer advertisements which urges the consumersto click on the advertisement.

Hypothesis 4 of the research is rejected, which stated "Consumers protect their private data from the companies". By going through the reasoning, many don't know what is retargeting and how it works. Whenever a user visits a website, the website asks to 'accept all cookies' and this is how the tracking starts. People do not know how their data is used and accept each popup that appears. Thus, we have to customize the cookies in settings and do not allow access to other third-party websites. And one of the solution I personally suggest is to use 'walled garden tool'. A walled garden is an environment that controls the user's access to network-based content and services. In effect, the walled garden directs the user's navigation within areas to enable access to a selection of material or prevent access to other material.

SUGGESTIONS

Companies use private data to target the audience as it helps them to filter out the advertisements and display the relevant advertisement to them. But it is necessary for the companies to take some precautions such as minimizing the redirection to third party websites which in turn increases the consumers' trust and loyalty towards the brand.

Companies can add a clear privacy policy including the data protection towards the third-party websites. Every website should introduce the option 'customize cookies' which helps the users to protect their data.

SCOPE FOR FUTURE RESEARCH

The future research can be based upon the dynamic pricing of the products which is one of the factor that influences the consumer buying behavior. Researchers can study more about the 'walledgarden tool' which will be a game changer in the privacy issues.

CONCLUSION

The aim of this research is to determine the impact of retargeting advertisement on consumer buying behavior. To determine this, literature review regarding the topic is created, which directed towards the theoretical framework of retargeting advertisement and consumer buying behavior. The theoretical framework helped to understand the topic in depth and to frame the questionnaire. The responses collected from the respondents is the base of primary data collection. After collecting the data, SPSS tool has been used to create hypothesis and test them. Four hypothesis has been created and tested.

The hypothesis which stated that the retargeting is effective has been accepted as many positive factors influence the consumer buying behavior which increases the consumer satisfaction. Therefore, it can be concluded that retargeting advertisement help to achieve consumer satisfaction.

BIBLIOGRAPHY

1. C. (2019, August 17). *History of Billboard Advertising | Evolution of Outdoor Media*. bMedia. Retrieved January 12, 2023, from https://www.bmediagroup.com/news/history-of-billboard-advertising/

2. Lebo, T. (2021, May 19). *Retargeting Statistics and Research for 2021 Reveal Challenges & Opportunities for Marketers*. Convince & Convert. Retrieved January 12, 2023, from https://www.convinceandconvert.com/digital-marketing/retargeting-statistics-research/

3. *State of Retargeting 2021 - SharpSpring Ads*. (n.d.). SharpSpring Ads. Retrieved January 12, 2023,from https://sharpspring.com/ads/state-of-retargeting-2021/

4. S. (n.d.). *6 Unique Retargeting Ad Examples to Sell More to Existing Customers*. 6 Unique Retargeting Ad Examples to Sell More to Existing Customers. Retrieved January 12, 2023, from https://blog.smartshyp.com/6-retargeting-ads-to-sell-products-to-existing-customers

5. *Search Engine Marketing (SEM): How to Do It Right | WordStream*. (n.d.). WordStream. Retrieved January 12, 2023, from https://www.wordstream.com/search-engine-marketing

6. C. (n.d.). *9 of the Most Popular Types of Online Advertising*. 9 Of the Most Popular Types of Online Advertising. Retrieved January 12, 2023, from https://www.cyberclick.net/advertising/types-of- online-advertising

7. *The Latest in Digital Marketing Trends - ReTargeter Blog*. Retrieved January 12, 2023, fromhttps://retargeter.com/blog/

8. Traditional Marketing vs Modern Marketing. (2022, January 5). Indiafreenotes. Retrieved January 12, 2023, from https://indiafreenotes.com/traditional-marketing-vs-modern-marketing/

9. How the TV Advertising Industry Works. (2022, March 12). Investopedia. Retrieved January 12, 2023, from https://www.investopedia.com/articles/investing/100615/how-tv-advertising-industry- works.asp

A STUDY ON INDIVIDUALS ATTITUDE TOWARDS STARTING AN ONLINE BUSINESS DURING THE COVID-19 PANDEMIC

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ABSTRACT

During Covid-19 online businesses boomed in India due to the lockdowns and other factors. This study aims to determine if an individual is interested in starting an online business due to the popularity of the E-Commerce sector received during Covid-19.

After studying the topic and conducting data analysis, the study concludes that individuals have no significant interest in starting an online business due to the sector's boom during covid-19. The study also concentrates on the factors that are favourable for starting an online business and if individuals are interested in learning new skills to start and run an online business.

Keywords: *E-Commerce, Covid-19, Starting an online business*

INTRODUCTION

The E-Commerce sector saw a remarkable boom in sales during the covid-19 pandemic. Most of this was attributed to the lockdowns and the fact that people were afraid to step out of their homes out of fear of contracting the virus.

In India, this phenomenon gave rise to a lot of small-scale online shops and also encouraged people to start an online business either as a hobby or as a means to earn an extra source of income.

This study aims to find if individuals were motivated to start an online business due to this factor.

OBJECTIVES

1. To Analyse if an individual will start an online business due to Covid-19
2. To examine the conditions favourable for commencing an online business during Covid-19
3. To determine if a person Intends on learning new skills to start an online business

RESEARCH METHODOLOGY

Research Problem

1. Will an individual start an online business due to Covid-19?
2. What are the conditions favourable for starting an online business during Covid-19?
3. Are individuals interested in learning new skills to start an online business during Covid 19?

Research Design

For the purpose of this study, the research design used is descriptive. In Descriptive Research Design, the scholar explains / describes the situation or case in depth in their research materials. This type of research design is purely on a theoretical basis where the individual collects data, analyses, prepares and then presents it in an understandable manner. It is the most generalised form of research design. (Team Leverage Edu, 2021)

Sampling Design

For the sampling unit, any individual with knowledge of E-Commerce above the age of 18 is taken into account. The study area extends to Chennai, the Rest of Tamilnadu and Kerala. Convenience sampling is the method used in this study.

Sampling Size

For the purpose of this study, 276 individuals have been selected as the sampling size. The sample was chosen based on geographical location, age of the person, gender and status of the person.

Source of Data for the Study

Primary data is used for the purpose of research and analysis. It is gathered directly from the sample size of 276 individuals, via a questionnaire sent to them directly by the researcher.

Questionnaire Design

The questionnaire comprises 34 questions. 5 demographic questions and 29 questions related to research objectives.

ANALYSIS AND INTERPRETATION

Analysis of the first objective:

To Analyse if an individual will start an online business due to Covid-19

Hypothesis:

H0: there is no relationship between starting an online business and the boom in the E-Commerce sector during Covid-19

H1: there is a relationship between starting an online business and the the boom in E-Commerce sector during Covid-19

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.584[a]	.341	.339	.759

a. Predictors: (Constant), Pandemic Motivated To Start E-Com?

Interpretation:

The hypothesis testing for the first objective is done using Regression analysis. The R-Square value indicates the proportion of the dependent variable (Starting E-Commerce?) that can be predicted from the independent variables (Pandemic motivated to start E-Com). Here we observe a value of 0.341 or 34.1%. This means that the dependent variable does not explain much about the independent variable. In other words, the Covid-19 pandemic will motivate only a small group of individuals to start online businesses. Therefore the null hypothesis is accepted.

Analysis of the second objective:

To examine the conditions favourable for commencing an online business during Covid-19

Hypothesis:

H0: There is no relation between all the factors and starting an online business
H1: There is a relation between at least 3 factors and starting an online business

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Overall Boost	Between Groups	12.293	4	3.073	3.752	.005
	Within Groups	221.954	271	.819		
	Total	234.246	275			
Increased Internet Usage	Between Groups	7.944	4	1.986	2.147	.075
	Within Groups	250.607	271	.925		
	Total	258.551	275			
Cost Efficiency	Between Groups	9.638	4	2.409	2.559	.039
	Within Groups	255.185	271	.942		
	Total	264.822	275			
Safety	Between Groups	12.143	4	3.036	2.929	.021
	Within Groups	280.853	271	1.036		
	Total	292.996	275			
Increased creative opportunities	Between Groups	14.246	4	3.561	4.147	.003
	Within Groups	232.740	271	.859		
	Total	246.986	275			

Interpretation:

The analysis of variance (ANOVA) is used to determine if the following factors are favourable for starting an online business. Overall Boost, Increased Internet usage, Cost Efficiency, Safety and Increased Creative Opportunities. As per the above table, all the above-mentioned factors except Increased Internet usage has a significance less than 0.05. Therefore the null hypothesis is rejected and the alternate hypothesis is accepted.

Analysis of the third objective:

To determine if a person Intends on learning new skills to start an online business.

Hypothesis:

H0: there is no relationship between learning a new skill to start an online business

H1: there is a relationship between learning a new skill to start an online business

ANOVA

Learn New Skill

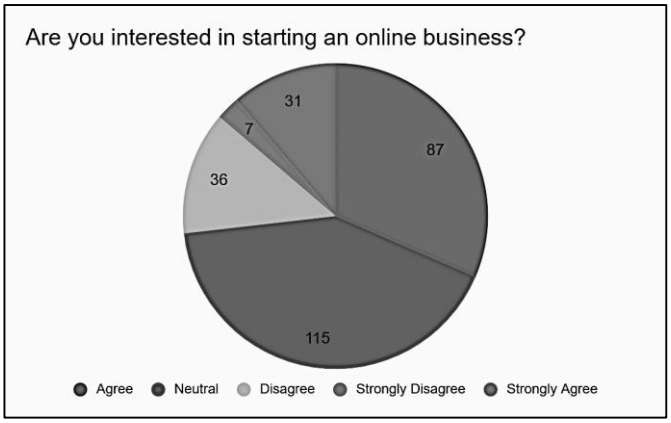
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	9.965	4	2.491	4.413	.002
Within Groups	153.002	271	.565		
Total	162.967	275			

Interpretation:

ANOVA is used to find the significance of Starting E-commerce and Learning new skills. The significance is 0.02 which is less than 0.05. This means that individuals are willing to learn new skills to start an online business. Therefore the null hypothesis is rejected and the alternate hypothesis is accepted.

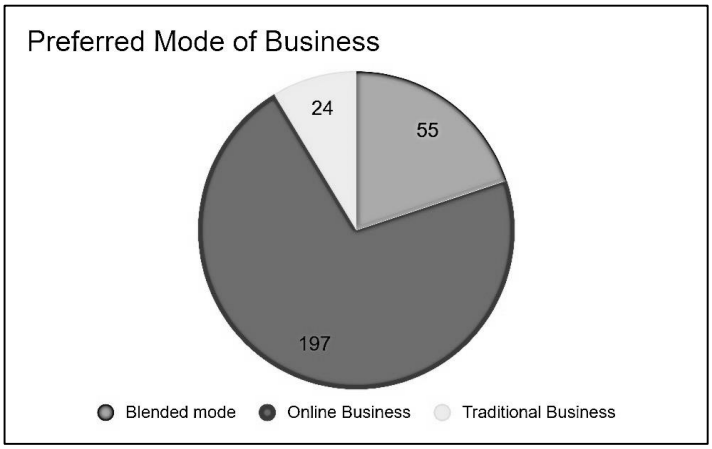
FINDINGS SUGGESTIONS

1) A lot of individuals aren't confident about starting an online business.



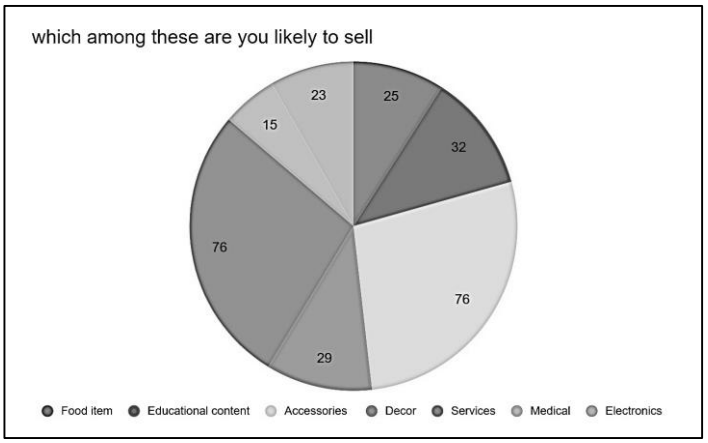
31 individuals have strongly agreed that they are willing to start an online business. 87 have said that they might start an online business. 115 individuals are neutral about their decision. 36 have said that they might not start an online business. 7 Strongly disagree with starting an online business.

2) Preferred Mode of doing Business



Although the majority of the individuals are still deciding about starting an online business they have provided information that the most preferred medium of business is the online business. 197 have voted for online business. 55 have voted for blended mode both online and offline business only 24 are willing to do brick-and-store business.

3) The Factors Demotivating Individuals from starting an online business



72 of them say that attracting customers is demotivating. 67 of them quote that lack of technological knowledge is demotivating. 41 of them say that high competition is demotivating. 27 cite payment options as a demotivating factor. 21 say geographical location is a disadvantage. 20 say that Internet Speed is demotivating. 20 cite other reasons.

SUGGESTIONS

1. There are several resources and government policies and schemes available to women who wish to start an online business or small business in any medium. Due to the lack of awareness about these resources and government policies, many do not avail them.

2. Many individuals hesitate to start an online business due to a lack of technological knowledge. It might be tough to build a website or it might be costly to source third parties and they need constant evaluation. So the author suggests that beginners and those who want to do online business can do so via Social media.

BIBLIOGRAPHY

1. Team Leverage Edu (2021) (https://leverageedu.com/blog/research-desi/)

2. Victoria Fryer. Understanding COVID-19's Impact on Ecommerce and Online Shopping Behavior. (https://www.bigcommerce.com/blog/covid-19-ecommerce/#post-covid-commerce-is-omnichannel)

3. E-commerce, (https://www.britannica.com/technology/e-commerce)

4. One-way ANOVA (https://statistics.laerd.com/statistical-guides/one-way-anova-statistical-guide.php).

THE NEED TO INCLUDE MEDIA LITERACY AS A SUBJECT / COURSE IN SCHOOLS AND COLLEGES IN INDIA

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Anna Mathew has an MPhil in English Literature and a PG Diploma in Journalism. She has worked as Assistant Professor in the Department of English, Women's Christian College, from the year 2000 to date. She specializes in teaching media-related courses such as Journalism, Understanding Cinema, Short Film Production, Advertising and Public Relations to undergraduate students of the Department. She enjoys interacting with students in class and keeping in touch with their youthful pulse. This paper is a result of these interactions.

ABSTRACT

With two decades of teaching experience at the college level in a metropolitan city in India, I have witnessed the extensive reach of mass/social media in its various avatars among students across socio-economic stratas and the problems caused by media-illiteracy. While there are discussions about the need for media literacy whenever there are fresh cases of cybercrime in the country, a lot more needs to be done in a sustained manner. This paper is a call for Media Literacy as a mandatory subject in all schools and colleges in India, to train students to be critical thinkers and responsible media users for life. Such orientation should reach children from an early age and be developed in a graded manner as they go up the academic ladder both in school and college. I have highlighted the need for the same and touched upon some of the problems faced by youngsters who are not media-literate. I have also made some recommendations for media literacy initiatives in educational institutions.

Keywords*: media literacy, educational curriculum, mass communication, youngsters, media culture and influence*

INTRODUCTION

Among a plethora of literacies, competencies, courses and soft skills currently imparted to students across disciplines at the school, college or university level in India, a subject of study mostly neglected or missing is Media Literacy, which is defined by National Association for Media Literacy Education, USA, as "the ability to access, analyze, evaluate, create, and act using all forms of communication" and "the ability to encode and decode the symbols transmitted via media." (2010). The Center for Media Literacy, USA, terms it as a "21st century approach to education" that imparts an "essential and empowering life-skill" to students who inhabit a "global media world" (medialit.org). CML goes on to define its function as "helping students become competent, critical and literate in all media forms so that they control the interpretation of what they see or hear rather than letting the interpretation control them" (medialit.org). Researchers in this field also consider media literacy as a discipline which provides a "framework for critically examining and producing media" (JMLE, 2014).

FOUNDATION AND CORE CONCEPTS

The foundation for media literacy as an academic discipline was laid by UK-based Len Masterman in the 1980s, based on his key concept of media being "representative", leading to the formulation of a set of basic principles for the same. In other words, focus had to shift from studying the subject, to studying the way subjects were "represented and symbolized and packaged by the medium" (JMLE, 2014). The idea spread to Canada where Barry Duncan and his colleagues through their Association for Media Literacy (AML) introduced a set of "key concepts", soon followed by the US with its own contributions. This was mainly through the founding of the Center for Media Literacy by Elizabeth Thoman and her "principle of inquiry" articulated in five core concepts of media literacy in 1993, namely,

1. All media messages are 'constructed.'
2. Media messages are constructed using a creative language with its own tools.
3. Different people experience the same media message differently.
4. Media are primarily businesses driven by a profit motive.
5. Media have embedded values and points of view. (JMLE, 2014)

These concepts correlate with five key questions developed by CML namely "who created this message", "what creative techniques are used…", "how might different people understand this message differently…", "why is this message being sent" and "what lifestyles, values and points of view" are "represented in; or omitted from, this message" (medialit.org). This helps the student of media literacy develop a spirit of inquiry instead of

passively taking in all that the media delivers to a targetted audience. Thus the framework for media literacy education was properly established and spread to other parts of the world with the help of organisations such as UNESCO which believed that "We must prepare young people for living in a world of powerful images, words and sounds" (medialit.org).

Media literacy started receiving attention in India from the 1980s, though according to Professor Keval J Kumar, a Mass Communication researcher and author, it did not enter the school curriculum until 2010, but that too mostly as an elective course in "mass media studies" (2019). Kumar reiterates that the "focus continues to be on skill development rather than critical thinking" (2019). While some universities offer a few courses on media and information literacy, a lot remains to be done in this area in Indian educational institutions.

NEED FOR MEDIA LITERACY

This paper is a call for media literacy as a mandatory subject / course in all educational institutions in India. The consumption or creation of media content (using traditional, new and social media) has become an integral, influential and indispensable part of life today. Hence it is important to interpret it accurately, use it wisely and be informed of its dangers and abuses, so that the wealth of information procured from it or put into it may be used responsibly, productively and ethically for constructive instead of destructive ends. Thus the need for proper media orientation should be addressed at both the school and college levels through a systematic and graded course of study for students of all disciplines and age groups, in order to make this an informed doorway through which young people enter the world of mass media, equipped with healthy curiosity, critical thinking skills and the right amount of skepticism.

In the absence of this significant literacy, young adults are often at considerable disadvantage in their personal and professional life. This could be perceived in terms of incomplete or flawed comprehension of the meanings, contexts, subtexts, nuances, connotations and implications of media content pertaining to news, information, entertainment or infotainment, thereby affecting opinions, attitudes, beliefs, values, behaviour and actions.

UNDERSTANDING THE MEDIUM AND THE MESSAGE

Mass media are symbolic sign systems according to Masterman (JMLE, 2014). They serve as channels for mass communication and include print, broadcast, outdoor, transit, internet and social media. Media invades all spaces, both physical and mental, and people are constantly exposed to media content at home and outside which influences them at different levels, both liminally and subliminally. This takes the form of texts, subtexts, images, artistic expressions and audio-visual content that reaches people through journalism, advertising, public relations, film, politics, propaganda, internet and social media, for purposes of information, instruction, persuasion, opinion moulding, marketing or entertainment. In other words there is no escaping the all-encompassing, global 'media culture' of the 21st century.

All these messages are prepared with a definite purpose and intended effect on the receiver which may or may not be in accordance with established standards and ethics of mass communication. The receiver also interprets these messages on the basis of his/her judgements, prior knowledge, understanding, mindset, culture, preferences, prejudices, biases and outlook. A person's demographic and psychographic background also plays a definite role in interpreting the meaning of messages received. The onus lies on the recipient to be fully aware of how mass communication operates so that he/she may interpret or analyse messages objectively based on a comprehensive understanding of what is presented. Media literacy plays an invaluable part in developing this awareness. It helps the receiver discern the truth, intent, reliability and credibility of messages and their sources. Educational institutions have a vital role to play in imparting this literacy to children and young adults (a demographic group that is heavily exposed to media and especially vulnerable to the influences, manipulation, exploitation and forms of abuse perpetrated through it).

REPRESENTATIVE SCENARIOS

The first hypothetical scenario is of a student who has to do a home assignment which requires information or data to be sourced using the internet. The first thing he / she does is a simple Google Search[1] using keywords. He / she then refers to the first few sites that show up, mostly starting with Wikipedia[2] or blogs by random individuals, which in no way befits authentic reference work like using an academic/research library. Most school and UG level students have no inkling how Wikipedia works (where random individuals collaborate to contribute random information or edit content on a given subject) or about data authentication, sourcing reliable websites and so on. Many are not even familiar with search engines like Google Scholar[3] or authorised digital repositories which are better equipped for research and reference purposes. They are also largely ignorant about acknowledging the sources from where they gather information for assignments and projects, thus giving rise to plagiarism.

The second hypothetical scenario is of a group of students being solicited for an interview recording just outside their school or college gate, by a few individuals who claim to be news reporters for a "private radio/TV/Net channel". The students oblige willingly in the excitement of seeing themselves on screen, without any attempt to know the actual intention behind such requests and without any attempts to verify the credentials of the 'news reporters' or the channel. They voluntarily share their identities as well as their personal views on camera, which may be used/misused to malign the reputation of these students or their educational institutions.

The third scenario is from the world of social media such as Whatsapp[4] and Facebook[5]. Users are constantly exposed to 'feeds' and 'forwards' that are widely circulated, with no effort being made by any of the receivers to verify the credibility of news or information. An example would be the wide circulation of fake news or rumour-mongering using social media. This causes varying degrees of harm to society and has become a threat

even to journalists who have to constantly guard their work from compromising truth when they are under pressure to release news instantly in a fast-moving world.

The fourth scenario has to do with the spread of content / information using media, in a way that maligns individuals or institutions. For instance, if a student receives text, images or videos (real or morphed) meant to damage someone's reputation (maybe an acquaintance or a teacher) or show him / her in a poor light, especially within known social circles, what is the student's response? Is it to stall the spread of such information quickly or to circulate it indiscriminately for the love of malicious gossip? Students need to be oriented to make ethical decisions and adopt the right course of action so that they don't harm themselves or others. The infamous case of the Bois Locker Room[6] created a storm in the world of social media in recent times. A group of teenagers, mostly from a few schools in South Delhi allegedly created an Instagram[7] account by this name to share objectionable (sometimes morphed) pictures of girls (many of them underage) they knew and indulged in objectionable discussions about them using graphic sexual language. The scandal came to light when a few of the victims took screenshots of this content and posted them online. The case was particularly disturbing due to the fact that the perpetrators and victims were all young, educated and from elite schools and cosmopolitan backgrounds.

Scenario five deals with how individuals, especially young people are conned or victimized through cybercrime which has widespread ramifications. Very often youngsters become easy targets because of their ignorance and the fact that such matters are rarely discussed with parents or teachers. For instance, not many youngsters know of the existence of the Dark Web[8], which poses various threats to society, ranging from malicious activities like data leaks, phishing, malware, botnets, ransomware and trojans, to more serious crimes such as drug and human trafficking, to name a few.

Online child prostitution rackets and pornographic sites are just two examples of widespread criminal activity that operates using internet and social media. Again, there are numerous instances of young girls and women being blackmailed or victimised by their "boyfriends" who threaten to or actually expose objectionable photographs or video clips of their "girlfriends" on the internet. This has even cost many young women their lives through suicide. Students should be trained to detect and keep away from sites, media content and individuals with criminal intentions. They should also know where and how to seek help when faced with such problematic or potentially dangerous situations before they get out of hand, rather than suppressing information due to fear or guilt.

In India students invariably start using media for entertainment or information from a very early age without any orientation about its use from parents or teachers. This is harmful because their ignorance can make them easily gullible. Students have to be taught from an early age how to access / process media content responsibly. Knowledge is the key to proper use of media and a lot can be achieved by familiarizing them within the classroom about the way mass media works. This should include across-the-table discussions where trained teachers or mentors help students tackle actual scenarios or situations they come across while accessing media on any platform.

GERBNER'S CULTIVATION THEORY

It is common knowledge that the world today is predominantly experienced through media, especially by young people. Globally, numerous studies reveal disturbing statistics about the number of hours youngsters are exposed to media every day as well as to acts of violence on screen which leads to responses such as desensitization, aggression or fear. In the context of the effects of media, it is relevant to examine George Gerbner's Cultivation Theory which questions the way people "consume" mass communication. The theory was first proposed in 1969, to study the impact of television on viewers in terms of "collective perceptions". According to Gerbner, "… over time, repeated exposure to media cultivated the belief that the messages conveyed by the media apply to the real world. As people's perceptions are shaped by media exposure, their beliefs, values, and attitudes are shaped as well" (Hahn et al., 2011). In other words media serve as "cultural indicators", creating a homogeneous viewpoint about the world in an otherwise heterogeneous mass audience. While other studies examined the connection between media violence and aggressive behaviour in viewers, Gerbner's finding was that "people who viewed a great deal of television became fearful of the world, believing that crime and victimization were rampant." This is called the "mean world syndrome" (Hahn et al., 2011).

Based on Cultivation Theory, Gerbner put forth the three B's "which state that media blurs people's traditional distinctions of reality, blends people's realities into one common cultural mainstream, and bends the mainstream to fit its institutional interests and the interests of its sponsors" (Hahn et al., 2011). The third B points towards powerful media conglomerates that are rapidly taking over the entire world. The research initiated by Gerbner with television was later extended to include other media, to study their impacts on materialism, sexuality, sex roles, drug use, racialism, family, minorities, mental health and body image, to name a few (Hahn et al., 2011). The results invariably point to the fact that mass media act as major socio-cultural agents that represent, reflect, shape and create popular culture.

GENERATION Z

The aim of education in general should be to provide students with proper exposure, awareness, competence, sensitivity and self-preservation skills so that they may contribute productively and qualitatively to society, make informed choices and be able to protect themselves and their loved ones from danger of every sort. The need for media literacy to be included in the curriculum for Generation Z (present-day students) in schools and colleges is evident when one examines the current trends that prevail. Generation Z are the successors of the millennials, or "digital natives" who have "used digital technology since a young age and are comfortable with the Internet and social media, but are not necessarily digitally literate" (wikipedia). This assertion points to realities, sometimes disturbing, such as an excessive dependence of youngsters on short and juicy news / gossip feeds offered by social media platforms (mainly as a means of instant self-gratification and influenced primarily by peer pressure or the need to conform to prevalent trends and fads), a corresponding gullibility to

fake news, falling prey to cybercrimes, stalking and bullying, and a general aversion to and avoidance of news or analysis delivered by traditional media such as newspapers, which run more authenticity checks on information as opposed to new generation media. All this could lead to ignorance, misconception, lack of objectivity, and in more serious cases, exploitation of young people or victimization of various kinds through nefarious means such as hacking, fraudulence etc. The problem is compounded by the fact that youngsters turn to their peers (who are equally inexperienced and gullible) instead of their parents or teachers for clarification. In fact parents are often kept in the dark about the media content that youngsters access most often and are the last people to know of the trouble their wards get into. Furthermore, parents may not be media-literate enough to mentor their wards' media use. Even if they are fairly media-literate themselves, blatant censorship or blocking of sites accessed their wards is not the solution to all the problems involved.

Media literacy is an essential skill which is as important as the subject / professional knowledge imparted in school or college because today it is more through the internet and media that students access information rather than through conventional sources such as libraries or newspapers. Media literacy helps students understand how media affects us and puts in perspective the delicate balance that exists between humanity and technology, questioning whether our interactions are "mindful" or "thoughtless" (Heisenberg, 1958). Media literacy helps students understand properly the channels through which they receive or communicate any information from/to the outside world. It equips and empowers youngsters to safeguard themselves from the numerous pitfalls and dangers prevalent in the digital space which they increasingly inhabit. Media literacy also complements their subject knowledge by teaching them where and how to access authentic information (for example, in research activities) and steer clear of misinformation or misuse of information.

SOCIALISING IN DIGITAL SPACE

Media literacy also includes another significant dimension and that is helping people manage their social relationships in digital space. The internet and social media are powerful communication tools that have effectively erased boundaries of space and time in the world, making it possible for an individual to communicate anytime, anywhere and with anyone, using one's smartphone or laptop. This has certain implications worth noting. Laptops and smartphones are essentially personal-use, portable gadgets which students start using on their own from an early age or in most cases before they are properly aware of the risks involved. Though parental monitoring is widely advised and there are a few applications such as Google Families[9] which help parents keep a close tab on their children's gadget use, it is a challenge for an adult to monitor constantly or effectively the content (and contacts) that a youngster personally accesses using internet and social media. From an early age children are often left unmonitored with gadgets, given by parents, to keep them "engaged" or "seated still in a place". Quite often parents also boast of how tech-savvy their children are. This gives the latter the impression that they are much better equipped to access not just the technology but also the content, as compared to their parents, who they may consider to be "outdated" or "old-fashioned". Recently the media reported how American entrepreneur and

reality show star Kourtney Kardashian deleted the Instagram account of her 10-year old son because he had created it without her permission and was posting comments publicly, both of which the boy's mother considered unacceptable for his age (ET, 2020).

The use of gadgets such as laptops, tablets and smartphones is predominantly an individual's private activity, often hidden from others, which is very different from television viewing by the family as a whole or going to the movie theatre for instance, where viewership may be regulated by age, censorship or parental guidance (PG). It is also to be remembered that there is absolutely no censorship of media content on the internet. While some safety checks may be in place for pornography or other openly objectionable sites, there is hardly any safeguard against most other dangers that lurk in digital space except the awareness that a well-informed and discerning user brings to it. These problems can be effectively tackled by imparting media literacy through schools and colleges, to educate students and stem the rising incidence of youngsters falling prey to cybercrimes involving extortion, fraudulence, obscenity, pornography, paedophilia, sex, prostitution, terrorism and drug and human trafficking.

With the massive spread of social media platforms such as Facebook, Whatsapp, Twitter[10], Instagram and Youtube[11], the content of mass communication is no longer restricted to messages disseminated by professional or recognized communicators, but to any lay person with good or bad intentions who wishes to send messages to large and diverse audiences using such channels. This is potentially dangerous because truth and authenticity may be easily compromised; there is also every possibility of manipulation and distortion of information as well as use of such channels for criminal purposes.

INFLUENCE OF MEDIA

Media plays multiple roles in society, including surveillance, transmission, mobilization, validation and sensationalisation of information (Hahn et al., 2011). A lot depends on the understanding of the *mediated environment* all around and media literacy imparts the necessary skills (Hahn et al., 2011). These skills help students understand the *content, internal language, genre conventions* and *power* of mass communication, as well as the *emotional versus reasoned reactions* to such content (Hahn et al., 2011). The influence that media wields is enormous and this is evident in so many arenas. For instance, the common man's source of political news and views is almost entirely what the media relays as a result of the love-hate relationship between media and politics. Here too it is up to the discerning viewer or reader to sift the husk and find the grains of truth hidden therein. A report commissioned by Teachers College, Columbia University concludes that "Students must be media literate to be democracy ready" since the internet is the "new public square" and it has become a "critical arena for information and civic debate" (tc.columbia.edu).

The COVID-19 pandemic is another case in point of the increasing dependence on media for information and news on the one hand, and the need to steer clear of rumour and misinformation on the other, what with messages about the "dangers" of vaccination or the

"benefits" of herbal remedies ruling the roost and swaying popular sentiments in the wrong direction. Social media was rife with information and misinformation of every sort, a 'Tower of Babel' as it were, confusing the public with contradictory views shared extensively by all and sundry about the nature of the virus and about ways to tackle it. Was anyone paying heed to what the government wanted people to know or do about the virus? There were far too many voices on social media drowning the official voice of authority and causing pandemonium in the country during the pandemic. Forwards on social media that were widely circulated by users without any attempt to check their authenticity (most users have no orientation about sites like GNI[12] and Snopes[13]), caused numerous problems both big and small. Now more than ever before, the need is felt for a media-literate citizenry that will access media responsibly and be benefitted by it rather than be harmed.

SOME RECOMMENDATIONS FOR MEDIA LITERACY INITIATIVES IN SCHOOLS AND COLLEGES IN INDIA

- A mandatory, graded Media Literacy course to be included in the curriculum at the school level in all schools in India from Std. V to XII and a mandatory course for a minimum of one semester at the undergraduate college level for students of all disciplines and degrees. Both these should aim to make students responsible media users in every sense.
- Libraries to be well equipped with books and other visual aids on the subject of Media Literacy.
- Mentoring cells that offer counselling and guidance to students on handling media-related problems (in response to or in anticipation of problems or concerns faced by students).
- Training of teaching faculty and counsellors / mentors in this discipline.
- Workshops, lectures, seminars and campaigns to promote media literacy with emphasis on cybercrime, legal recourse etc.
- Cybercrime cells within institutions to address issues at the grassroots level.
- Media Literacy awareness / familiarisation drives/competitions to popularize the idea among students.
- Media ethics orientation for students as part of academic integrity and ethics.
- Deployment of applications that help institutions stay connected with students in matters of media use.
- Media literacy outreach programmes by educational institutions to serve the community at large.
- Encouraging faculty and students to engage in research on media literacy that will help unravel this complex, evolving field and find solutions to its numerous problems.

- Collaborating with government departments, corporate houses and NGOs to run campaigns (like the Manforce campaign against child porn called #ProtectChildhood which aims to create awareness in children) and facilitate student access to portals such as National Cyber Crime Reporting (MHA)[14] or Google News Initiative (GNI).

- Developing media literacy games and fun activities for youngsters to learn through play.

CONCLUSION

Thus a well-planned and systematic media literacy course combined with media counselling or mentoring are the need of the hour for students in Indian schools and colleges to equip and empower them to access all types of mass media effectively and safely. This will also address the growing concerns of parents of children ranging from preschoolers to young adults who are constantly exposed to media of various forms for educational and other purposes. Media literacy is a potent tool and safety valve which will open young minds to think critically about and act responsibly with the medium and the message while accessing or producing them.

REFERENCES

1. *A Call for New York State to Dramatically Improve Media Literacy Education.* Teachers College, Columbia University. https://www.tc.columbia.edu/articles/2020/june/a-call-for-new-york-state-to-dramatically-improve-media-literacy-education/.

2. *Five Key Questions Form Foundation for Media Inquiry.* Center for Media Literacy. https://www.medialit.org/reading-room/five-key-questions-form-foundation-media-inquiry.

3. *Generation Z*. In Wikipedia. https://en.wikipedia.org/wiki/Generation_Z.

4. Gerbner, George. (1990). "Epilogue: Advancing on the Path of Righteousness (Maybe)." Cultivation Analysis: New Directions in Media Effects Research. By Nancy Signorielli and Michael Morgan. Newbury Park, CA: Sage Publications. 249-62. Print.

5. Hahn, Laura K, Lippert, Lance, & Paynton, Scott. (2011). *Survey of Communication Study*. Humboldt State University. Wikibooks. https://en.wikibooks.org/wiki/Survey_of_Communication_Study.

6. Heisenberg, Werner. (1958). *The Physicist's Conception of Nature*. New York: Harcourt, Brace. Print.

7. Jolls, Tessa & Wilson, Carolyn. (2014). The Core Concepts: Fundamental to Media Literacy Yesterday, Today and Tomorrow. T*he National Association for Media Literacy Education's Journal of Media Literacy Education* 6(2), 68-78. https://digitalcommons.uri.edu/cgi/viewcontent.cgi?article=1156&context=jmle

8. Kile, Meredith B. (2020, March 25). Kourtney Kardashian Reveals Why She Deleted Son Mason's Instagram Account. ET. https://www.etonline.com/kourtney-kardashian-reveals-why-she-deleted-son-masons-instagram-account-143669.

9. Kumar, Keval. (2019). *Media Literacy in India*. 1-6. 10.1002/9781118978238.ieml0152. https://www.researchgate.net/publication/332992823_Media_Literacy_in_India

10. Manral, Mahender Singh. (2020, May 6). Bois Locker Room case: 5 boys questioned over messages on Instagram group. The Indian Express. https://indianexpress.com/article/cities/delhi/bois-locker-room-case-5-boys-questioned-over-messages-on-instagram-group-6396040/.

11. *Media Literacy: Five Core Concepts*. Young African Leaders Initiative. https://yali.state.gov/media-literacy-five-core-concepts/

12. *Media Literacy Basics*. Media Literacy Week. https://medialiteracyweek.us/resources/media-literacy-basics/

13. *Multiple Literacies: Definition, Types, and Classroom Strategies.* ThoughtCo. https://www.thoughtco.com/multiple-literacies-types-classroom-strategies-4177323.

14. *What is Media Literacy? A Definition...and More*. Center for Media Literacy https://www.medialit.org/reading-room/what-media-literacy-definitionand-more/.

15. *Who is NAMLE?* Media Literacy Week. https://medialiteracyweek.us/about/who-is-namle/

NOTES

1. Google Search is a web search engine owned by Google Inc. The main purpose of Google Search is to hunt for text in publicly accessible documents offered by web servers. It was originally developed by Larry Page and Sergey Brin in 1997.

2. Wikipedia is a website or database developed collaboratively by a community of users, allowing any user to add and edit content.

3. Google Scholar is an online, freely accessible search engine that lets users look for both physical and digital copies of articles. It provides a simple way to broadly search for scholarly literature. From one place, you can search across many disciplines and sources.

4. WhatsApp Messenger is a cross-platform instant messaging application that allows iPhone, Blackberry, Android, Windows Phone and Nokia smartphone users to exchange text, image, video and audio messages for free.

5. Facebook is defined as an online social networking website where people can create profiles, share information such as photos and quotes about themselves, and respond or link to the information posted by others.

6. Bois Locker Room is a sensational and controversial case involving a group of school students and their Instagram account in Delhi in May 2020.

7. Instagram is an American photo and video sharing social networking service created by Kevin Systrom and Mike Krieger in 2010.

8. Dark Web is the part of the World Wide Web that is only accessible by means of special software, allowing users and website operators to remain anonymous or untraceable.

9. Google Families allows controls across a family group, allowing parent(s) to control child devices, to varying degrees. It lets you create and manage a specific Google account for your child.

10. Twitter is a 'microblogging' system that allows you to send and receive short posts called tweets. Tweets can be up to 140 characters long and can include links to relevant websites and resources.

11. YouTube is a free video-hosting website that allows members to store and serve video content. YouTube members and website visitors can share YouTube videos on a variety of web platforms by using a link or by embedding HTML code.

12. Google News Initiative (GNI) is a cooperative effort between Google and a number of large traditional news media providers to restore viewership of these channels as a claimed effort to support authoritative journalism.

13. Snopes is a fact-checking website founded by Barbara and David Mikkelson in 1995.

14. National Cyber Crime Reporting Portal is an initiative of the Ministry of Home Affairs, Government of India, to facilitate victims/complainants to report online cybercrime complaints.

WHEN MEMORIES SERVE AS WARNINGS: REMEMBERING THE COVID-19 PANDEMIC IN THE DIGITAL AGE

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ABSTRACT

Sometimes memories have the potential to serve as warnings and act as reminders of things that went wrong or provide caution against not committing the same mistakes again, and this is especially true in the context of the digital age. The COVID-19 pandemic is something that humanity has experienced and continues to experience with the digital world as a backdrop to it. In the digital age, the idea of connectivity is given a lot of importance. Memories often become the catalyst in the process of establishing connections and staying connected in the digital world. With digital aid, memories are created, recorded, saved, and shared every day. This paper aims to look at how the initial phase of the COVID-19 crisis is recorded and remembered in the digital age, and for this purpose the paper will closely examine the essay titled "Pandemic is a Portal" by Arundhati Roy, which was published in April, 2020. This essay deserves to be recalled at this point as it serves as a reminder and warning about how humanity would pass through the portal, that is the pandemic, to enter a new world, a world which has to be imagined differently.

Key Words: Memories, Pandemic, Warnings, Digital World, Connectivity

Memories are a byproduct of experiencing life each day. Memories are important to man because an individual's memories define him or her in many ways. Apart from the nostalgic aspect commonly attributed to memories, it also has the power to serve as warnings. Sometimes, memories come floating back as reminders of things that went wrong or mistakes that one could have avoided, or simply to remind one of difficult times that one has experienced. As observed by Pramod K. Nayar in the essay "Cultures of Memory", "Memory, as commentators inform us, constitute us as *subjects.* Our identities are embedded in what we recall *of* ourselves. Thus our knowledge of ourselves is also founded, at least partially, on the memories we possess, and share." (Nayar 187)

This paper aims to look at the initial phase of the COVID-19 pandemic- a time when the world was brought to a sudden halt, when humanity was forced to stop and reconsider their priorities- and look at how the initial phase of the pandemic is remembered and recorded

in today's digital age and examine how these memories serve as strong reminders to all of humanity to anticipate human destiny.

The conflict between man and nature is inevitable and man had to always struggle for survival from time immemorial. On 20 July, 1665, Samuel Pepys lamented: "But, Lord! To see how the plague spreads." London was facing an epidemic." Every month, he wrote in his diary would end "with great sadness upon the publick, through the greatness of the plague everywhere through the kingdom almost. Every day sadder and sadder news of its encrease." India too had been hit by major outbreaks in the past: the Asiatic/Russian flu in 1890, Bombay influenza in 1918, Asian influenza flu in 1958, small pox epidemic in 1974, bubonic plague in 1994, H5N1 & H5N8 subsequently in 2006 & 2008, swine flu in 2014-15 and nipah virus in 2018. History always repeats itself.

COVID-19 is a pandemic that the world witnessed and experienced with the digital world as a backdrop to it. In India, people saw, heard about and read about COVID-19 even before cases were reported in the country. With the onset of the digital era, the speed at which news or information is generated and circulated is beyond what one can imagine. When the world was trying to grapple with a situation that was hard to perceive, difficult to manage and with uncertainty becoming the new norm, people were even more glued to their digital devices hoping for some kind of clarity. Many made it a point to record and share their experiences through social media. As mentioned in the essay "Media and Memory" from the book *Memory in Culture*, "Whatever we know about the world, we know through media and in dependence on media. The images of the past which circulate in memory culture are thus not extrinsic to media. They are media constructs. (Erll 114) Forced to remain indoors during the lockdown period, it was mostly through digital aid that people managed to experience connectivity. The pandemic also became a reason for fast-forwarding man's involvement with the digital world. "When the COVID-19 pandemic broke out earlier this year, much of the world moved online, accelerating a digital transformation that has been underway for decades." (OECD 2020).

In this context, it is crucial to examine the role of memories in a world that saw an accelerated digital transformation soon after the outbreak of the COVID-19 pandemic. This paper will closely examine the essay titled "The Pandemic is a Portal" by Arundhati Roy, which was published in April, 2020. Roy's essay deserves to be recalled at this point primarily because of the time at which it was published that is the initial phase of the pandemic. This essay serves as a reminder of how the world was threatened by the virus and it also echoes a warning about how humanity would have to pass through the portal, that is the pandemic, to enter into a new world, a world which has to be imagined differently.

"Who can think of kissing a stranger, jumping on to a bus or sending their child to school without feeling real fear? Who can think of ordinary pleasure and not assess its risk?" (Roy). Roy begins the essay by mentioning a few things that can be considered as ordinary memories of ordinary people. But even these ordinary memories or experiences changed when fear crept into people's lives: fear of contracting the corona virus while involved in mundane everyday activities like shopping for groceries.

When people were forced to stay indoors, they were indeed annoyed and unhappy but at the same time, when streets and cities were deserted it allowed different elements of nature to thrive. As Roy says, "… even while the virus proliferates, who could not be thrilled by the swell of birdsong in cities, peacocks dancing at traffic crossings and the silence in the skies?" This was something that people noticed and many tried to capture these moments using digital aids.

"The virus has moved freely along the pathways of trade and international capital, and the terrible illness it has brought in its wake has locked humans down in their countries, their cities and their homes." (Roy). Days of lockdown cannot be erased from one's memory. How unprepared the nation was, how unexpected and sudden it was and how uncertain about its duration. During that time many had no other choice but to turn to digital mediums for sustenance, physically and mentally. Work from home, online shopping for groceries, online education, virtual modes of family or friend's get-togethers etc. are just a few activities that suddenly became possible through digital mediums.

Another factor that cannot be forgotten about the pandemic is that it affected the rich and poor equally. The devastating impact of the pandemic on a rich and powerful nation like America is something the world witnessed in horror. As Roy says:

…unlike the flow of capital, this virus seeks proliferation, not profit, and has, therefore, inadvertently, to some extent, reversed the direction of the flow… and struck hardest — thus far — in the richest, most powerful nations of the world, bringing the engine of capitalism to a juddering halt.

Roy comments on how different governments battling corona preferred to use terms associated with war to refer to the virus and its impact. And she asks, "…if it really were a war, then who would be better prepared than the US? If it were not masks and gloves that its frontline soldiers needed, but guns, smart bombs, bunker busters, submarines, fighter jets and nuclear bombs, would there be a shortage?" (Roy). The crisis faced by hospitals, even in developed countries, in dealing with the huge number of COVID positive patients created panic amongst people worldwide. It was shocking to know how severely unprepared those hospitals and their governments were to tackle a pandemic like COVID-19. While it was shocking to see the state of hospitals in America, it was unimaginable to even think what would happen in a country like India if the same thing were to happen here.

"The tragedy is immediate, real, epic and unfolding before our eyes. But it isn't new. It is the wreckage of a train that has been careening down the track for years." (Roy). The use of the word "unfolding" is noteworthy here because it highlights how each of these aspects mentioned about the initial phase of the pandemic is something that is officially and unofficially recorded in digital and other modes. According to Roy, the tragedy is not new because when the tragedy actually hit these countries, they realised that this was bound to happen one day considering how insensitive and inconsiderate their governments have been towards the healthcare needs of its people.

Another factor to be considered is the initial days of the pandemic in India. Roy refers to India as "my poor-rich country, India". Recalling those times one may ask if the government had their priorities right back then. While in other countries many were losing their lives due to the virus, the Indian government was focused on political issues that were not that critical at the time of crisis. Maybe the government and the people of India never imagined that the virus in China would soon reach India and cause havoc.

Roy criticises the authorities concerned for conveniently putting aside the threat of corona and focusing instead on other things, when she says, "But there was too much to do in February for the virus to be accommodated in the ruling party's timetable." Having denied the seriousness of the virus and not considering it a health emergency for a long time, it was a sudden blow when the entire country was forced to go into a lockdown without any kind of preparation. Hand sanitizers, masks, social distancing, people's curfew, quarantine, are all things that had to be adapted to very quickly, even before one could completely comprehend as to what was happening. Asking people to come out on their balconies and ring bells and bang pots and pans to support and recognise the efforts of health care workers, when hospitals and healthcare workers were struggling to find masks and other things that they needed to protect themselves from being infected was indeed tactless.

The confusion, conspiracy theories on who was responsible for Corona and the shifting of blame from one country to the other is documented in newspapers and other forms of mass media. Along with the pandemic, the world had to simultaneously deal with the spread of false news associated with the pandemic.

On March 24th, 2020, the first lockdown was imposed in India. Roy comments on the way in which lockdown was imposed in India as she points out "the calamitous lack of planning or preparedness that turned the world's biggest, most punitive lockdown into the exact opposite of what it was meant to achieve."

It may be argued that the nation did not have a choice at that moment other than going into a complete lockdown, just like it was happening in other countries affected by the pandemic, but it should be noted that Roy here seems to point out the lack of planning behind the decision. "As an appalled world watched, India revealed herself in all her shame — her brutal, structural, social and economic inequality, her callous indifference to suffering." (Roy)

Today, looking back at those first few days of lockdown, one can only regretfully think of that time when those who were financially sound were safe and secure in their homes, while helplessly watching what was happening to the migrant workers - the mass exodus of migrant workers, from towns and cities that provided their livelihood, and how they had to return home to penury. As Roy says:

The lockdown worked like a chemical experiment that suddenly illuminated hidden things. As shops, restaurants, factories and the construction industry shut down, as the wealthy and the middle classes enclosed themselves in gated colonies, our towns and

megacities began to extrude their working-class citizens — their migrant workers — like so much unwanted accrual.

The images of the plight of the migrant workers walking home were widely circulated in social media and newspapers at that point.

Roy connects it to a much older memory when she says, "Among older people it evoked memories of the population transfer of 1947, when India was divided and Pakistan was born. Except that this current exodus was driven by class divisions, not religion."

In the article titled, "Coronavirus: How can society thrive post-pandemic?" which appeared in BBC.Com, different questions have been asked to various experts and one among them is Swati Janu: Researcher, University of Oxford, and Senior Designer at mHS City Labs, Delhi, who answers the question, "What lessons could be learned from India?" In her answer, she mentions:

The pandemic has also made visible those who have had no safety nets to fall back on, with mass exodus of migrant workers from cities to their respective villages, left without livelihoods and in many cases, even without a roof over their heads. How we can … bridge the gaps is what we urgently need to focus on at macro levels of policy and governance.

It may be said that the primary aim of Roy's essay published in April, 2020, is to urge the people of India to be mindful of the situation of the country and to shed light on the much graver problems existing in the country apart from the pandemic and to force the readers to open their eyes and see the plight of the poor and the disabled.

One can recall how the media was obsessed with finding somebody to put the blame on. As Roy says, "The economic crisis is here. The political crisis is on-going. The mainstream media has incorporated the Covid story into its 24/7 toxic anti-Muslim campaign."

In almost a prophetic voice Roy says, "The Covid crisis is still to come. Or not. We don't know. If and when it does, we can be sure it will be dealt with, with all the prevailing prejudices of religion, caste and class completely in place." Today, more than two years have gone by since this article and the world has seen and experienced the peak of the pandemic, and COVID still continues to be a threat, but at least now, humanity is used to the idea of a pandemic affected world. In the article titled, "Coronavirus: How can society thrive post-pandemic?" The Dalai Lama answers the question, "How can humanity pull together in these times?" and says:

The Covid-19 pandemic has reminded us how interdependent we are: what happens to one person can soon affect many others, even on the far side of our planet. …It is natural to feel worry and fear at a time when so many are suffering. But only by developing calmness and clear-sightedness can we help others and, in so doing, even help ourselves.

The concluding paragraphs of Roy's essay is highly relevant, especially today because it is a warning to acknowledge the existence of a rupture and not go back to a kind of "normality" that conveniently ignores all that is wrong with the world. As Roy says:

It's a virus, yes. In and of itself it holds no moral brief. But it is definitely more than a virus. …. Our minds are still racing back and forth, longing for a return to "normality", trying to stitch our future to our past and refusing to acknowledge the rupture. But the rupture exists. … Nothing could be worse than a return to normality.

How has the pandemic changed humanity's ways of living? What are the changes that one should bring in one's own life as individuals and as a nation to ensure that there is no going back to a normal world that is slowly dissipating due to other reasons? History, according to Roy, has provided man new perspectives and understanding of the pandemic. She seems to give us a suggestion on this when she concludes the essay with the following lines:

It is a portal, a gateway between one world and the next. We can choose to walk through it, dragging the carcasses of our prejudice and hatred, our avarice, our data banks and dead ideas, …Or we can walk through lightly, with little luggage, ready to imagine another world. And ready to fight for it.

People, who have experienced the pandemic, will have many stories to tell about the pandemic days, but the bigger question is what is the moral emerging out of those stories. In the article "You Won't Remember The Pandemic The Way You Think You Will", by Melissa Fay Greene, published in *The Atlantic,* the writer says:

We're already shaping our future pandemic narratives—the stories we will tell as individuals, as communities, as societies, and as nations about this epoch. The process of crafting these stories will help determine our resilience and well-being. How we tell our stories can transform how we move forward from hard times.

However disastrous the pandemic has been, the only silver lining that one can see in it is if there is a positive change in one's own self and in the world.

WORKS CITED

1. "Coronavirus: How can society thrive post-pandemic?", *BBC Worklife* https://www.bbc.com/worklife/article/20201118-coronavirus-how-will-it-affect-inequalities-mental-health

2. Erll, Astrid. *Memory in Culture*. Translated by Sara B. Young, Palgrave Macmillan, 2011.

3. Green, Melissa Fay. "You Won't Remember The Pandemic The Way You Think You Will". *The Atlantic.* 2021, https://www.theatlantic.com/magazine/archive/2021/05/how-will-we-remember-covid-19-pandemic/618397/

4. Nayar, Pramod K. *An Introduction to Cultural Studies*. 2nd ed.,Viva Books, 2016.

5. OECD (2020), *Digital Transformation in the Age of COVID-19: Building Resilience and Bridging Divides,* Digital Economy Outlook 2020 Supplement, OECD, Paris, www.oecd.org/digital/digital-economy-outlook-covid.pdf.

6. Pepys, Samuel. *The Diary of Samuel Pepys M.A. F.R.S.*. Edited by Henry B. Wheatley. e-book ed., Project Gutenberg's Diary of Samuel Pepys, Complete, by Samuel Pepys, 2003, https://www.gutenberg.org/files/4200/4200-h/4200-h.htm.

7. Roy, Arundhati. "The pandemic is a portal". *Financial Times.* 2020, https://www.ft.com/content/10d8f5e8-74eb-11ea-95fe-fcd274e920ca

INDIA AND CHINA'S VACCINE DIPLOMACY: STRONG DOSE OF SOFT POWER

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ABSTRACT

When Joseph Nye (1990) popularised the concept of soft power, little may have one perceived the potential of vaccines to be used as a tool of soft power. Vaccine diplomacy – a type of international health diplomacy that involves the use or supply of vaccines has been under popular discourse post the COVID-19 pandemic. While developed countries generally practiced vaccine nationalism – stockpiling of their vaccines, in contrast, India and China were at the forefront in exporting millions of COVID-19 vaccines across the world.

India's vaccine diplomacy pits it against China, which has made no secret of the fact that vaccine distribution is entwined with its larger geopolitical goals. China's vaccine diplomacy efforts have been based on three important pillars: the speed with which it distributed vaccines, the quantity, and simpler logistics than Western vaccines[1]. China focused its efforts on low- and middle-income countries and by late 2020 was one of the key vaccine suppliers for much of the world.

India joined the race a little later; however, its comparative edge over China in the development and distribution of vaccines along with its pre-established position as the world's largest producer of generic medicines, meant that it emerged as a fierce competitor to China in this arena. India currently meets 62% of the global vaccine demand. The country has supplied hydroxychloroquine (previously considered to help cure COVID-19) and paracetamol (a painkiller) to several countries including Brazil, the United States, and Israel. Additionally, India had spent $16 million on medications, test kits, and other medical equipment for around 90 nations by May 2020.[2]

This paper applies the theoretical lens of co-optive soft power to undertake a comparative study of India and China's bilateral vaccine diplomacy objectives and outcomes. It is found that while India faced criticisms over stopping the vaccine supply in South Asia (concerns about the 'Neighbourhood First' policy), allowing China to step in, on the other hand, doubts regarding the efficacy and safety of the Chinese vaccine created credibility issues in the international sphere. In both cases, the lack of sufficient data was a problem. The paper concludes by raising questions such as whether China has used vaccines as an

[1] Darren Choi and Sean Jake – "Vaccine Diplomacy"? – China's Global Vaccine Efforts and Controversies, 2021).
[2] Harsh V. Pant & Aarshi Tirkey, Observer Research Foundation. Accessed at: https://www.orfonline.org/research/indias-vaccine-diplomacy/

extension of its debt-trap policies, especially in South Asian and African contexts, and whether India has been able to reap soft power dividends through its vaccine diplomacy.

Keywords: *Vaccine Diplomacy, Soft Power, India, China, Vaccine nationalism*

INTRODUCTION

Vaccine Diplomacy is a type of international health diplomacy that involves the use of the supply of vaccines to strengthen a country's diplomatic ties and influence with other governments. Each vaccine delivered represents a lifeline based on international diplomacy. The attempts of so many countries to develop and distribute their own anti-COVID vaccines around the world have sparked a new type of geopolitical and soft power competition.

Tracing back to the world's first vaccine - the smallpox vaccine was discovered by English physician Edward Jenner amid the French Revolutionary War between England and France in 1798. The end of the plague era was marked by the discovery of the vaccine and by 1800, it became easily obtainable in England. Surprisingly, the vaccine was not only confined within the country's boundaries but was also transferred over the English Channel to its adversary, France. This was the first instance of "Vaccine Diplomacy" that has been recorded but the term was coined later in 2014 by Dr. Peter Hotez, an American scientist, in his paper "Vaccine Diplomacy: Historical Perspectives and Future Directions" (Hotez PJ (2014) Vaccine Diplomacy": Historical Perspectives and Future Directions[3])

The COVID-19 pandemic has wreaked havoc on almost every country on the planet, affecting billions of people. Amidst this, countries such as China, India, Israel, Russia, Turkey, and the United States were able to develop and supply vaccines successfully. Each came up with its own vaccine, one after the other, and proved to the world that there is a clear distinction between people and politics and that nations should prioritise the people over everything else. But there were some countries that rushed to sign deals with pharmaceutical companies to secure vaccines for their populace, curtailing the stock available for others. The prospect of a pandemic drove countries to make the tough decision to prioritise and inoculate their populations before making vaccines available to other countries. This began to be known as "Vaccine Nationalism."

According to Duke University's Global Health Innovation Center,[4] high-income countries have acquired 4.6 billion doses of the COVID-19 vaccine, whereas low-income countries only managed to secure 670 million.

The Sustainable Development Goal 3 of the United Nations is to ensure that everyone has access to good health and well-being. It can be accomplished by measures that provide

[3] Accessed at: https://journals.plos.org/plosntds/article?id=10.1371/journal.pntd.0002808
[4] 2021 02.15 Weekly COVID Vaccine Research Update.pdf (launchandscalefaster.org)

universal health coverage and combat infectious diseases and other health-related issues. Vaccine nationalism jeopardises efforts in combating the COVID-19 pandemic and raises the risk of increasing severe poverty by making it more difficult for low-income nations to obtain vaccines and combat the virus.

Against this backdrop, this paper applies the theoretical lens of co-optive soft power and hegemony theory to undertake a comparative study of India and China's bilateral vaccine diplomacy objectives and outcomes.

VACCINE DIPLOMACY AS A MEANS OF SOFT POWER

Joseph Nye[5], an American political scientist, first coined the term "soft power" in his paper "Soft Power: The Means to Success in World Politics" in the late 1980s[6][7] (Public Affairs Books). Power, according to Nye, is the potential to manipulate others' behaviour in your favour, which can be done in a variety of ways. Methods of coercion, such as terror tactics or bodily force, were frequently used to obtain power, which Nye refers to as 'Hard Power.' Then there is 'Soft Power,' which is the ability to persuade others to seek what you seek.

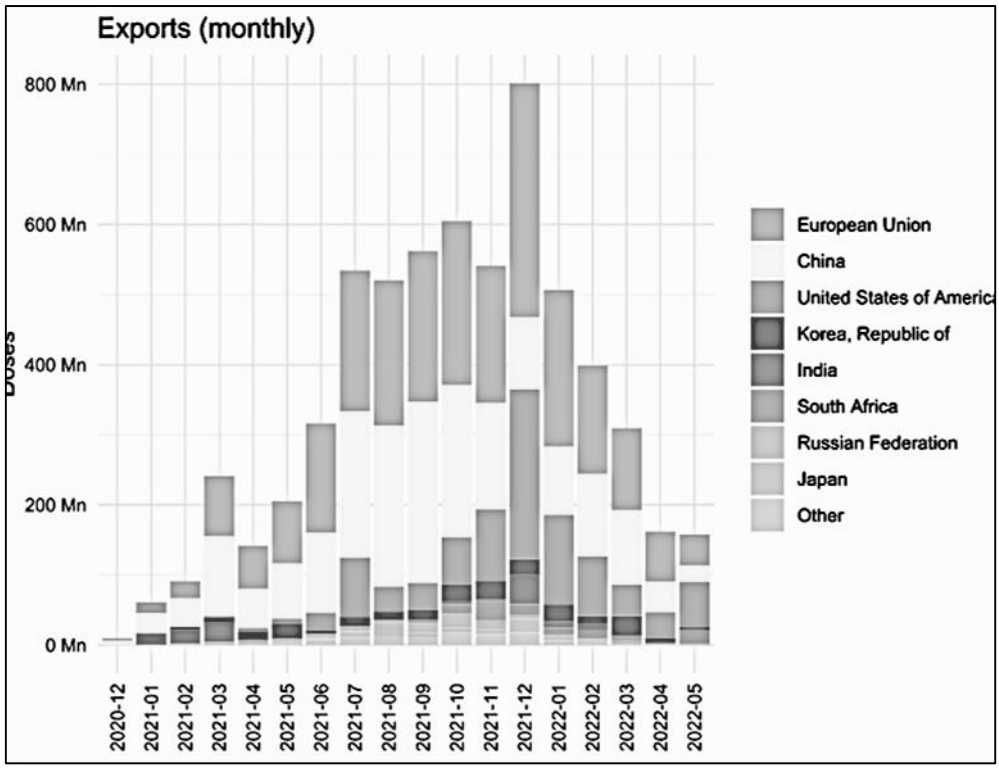
Nye emphasises that convincing others to pursue the same goals as you do can be a considerably more effective technique for attaining your aims, and he emphasises the difference between co-opting and coercing others. He outlines three key sources of soft power: Political principles, culture, and foreign policy as he refined the notion. Soft power avoids the traditional carrot-stick-and-sermon foreign policy tools in favour of forming networks, articulating engaging narratives, establishing international laws, and leveraging the resources that make a country naturally desirable to the rest of the world (The Soft Power 30, Portland).

Since the pandemic began, a new type of soft power took over countries' ambitions to play an important part in the international arena called "vaccine diplomacy". This is the power to influence other countries, particularly poor countries, through the distribution of vaccines.

According to the WTO-IMF COVID-19 Vaccine Trade Tracker[8], as of May 31st, 2022, a total of 12.9 billion doses have been supplied. The following graphs show the vaccine exports of countries over 17 months ranging from December 2020 to May 2022.

[5] https://www.hks.harvard.edu/faculty/joseph-nye
[6] Nye, Joseph S., Jr. 2005. Soft Power: The Means to Success in World Politics
[7] https://wcfia.harvard.edu/publications/soft-power-means-success-world-politics
[8] https://www.wto.org/english/tratop_e/covid19_e/vaccine_trade_tracker_e.htm

Figure 1: Vaccine export by country from December 2020 to May 2022



[9]

Source: WTO IMF Covid 19 Vaccine Trade Tracker

Figure 2: Total number of doses exported by producing economy:

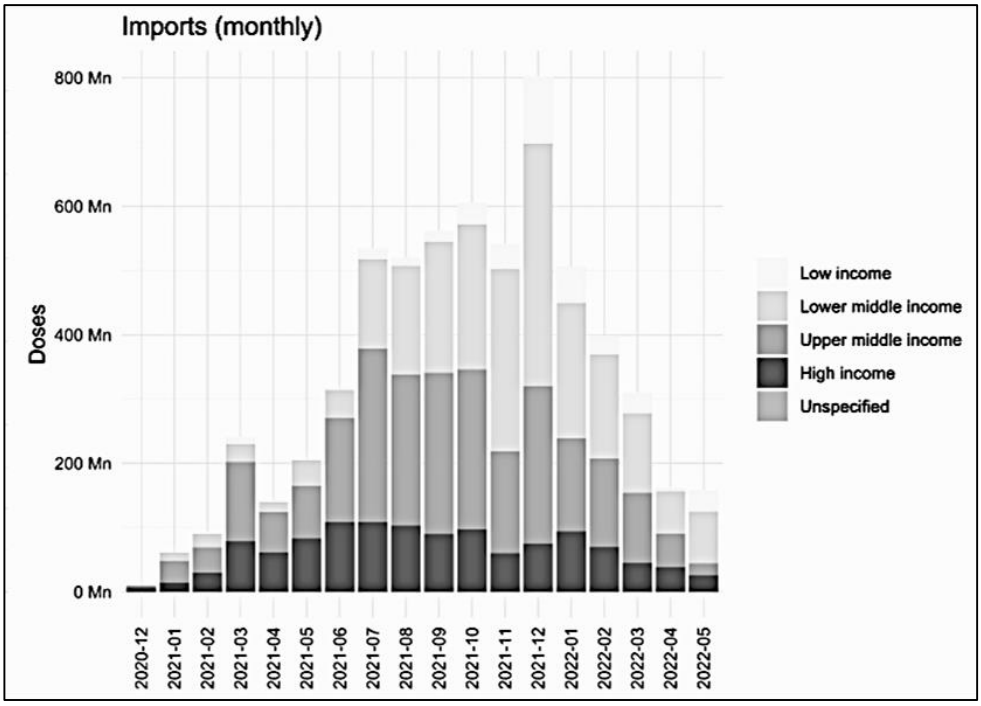
Producing economy	Number of doses (million)	Share of world exports	Cumulative share	Exports as share of total supply
European Union	2,440.4	39.6%	39.6%	65.6%
China	1,986.4	32.2%	71.8%	32.7%
United States of America	968.0	15.7%	87.5%	60.1%
Korea, Republic of	240.4	3.9%	91.4%	91.2%
India	140.2	2.3%	93.6%	5.7%
South Africa	110.4	1.8%	95.4%	88.2%
Russian Federation	102.4	1.7%	97.1%	35.8%
Japan	67.0	1.1%	98.2%	79.0%
Other	113.4	1.8%	100.0%	
Note: as of 31 May 2022				

Source: WTO IMF Covid 19 Vaccine Trade Tracker

[9] Exports are defined as the number of doses delivered across borders from producing economies to economies where vaccines are administered.

It can be seen from the above statistics that China is second only to the collective countries of the European Union and has been a top producer and exporter of vaccines. Similarly, if we look into the vaccine import data, the low-income countries have imported the greatest number of vaccines but still not enough to suffice the doses needed per 100 people.

Figure 3: Vaccine import by continent from December 2020 to May 2022



[10]

Source: WTO IMF Covid 19 Vaccine Trade Tracker

Figure 4: Number of doses imported by income groups:

Income Group Imports	Number of doses (million)	Doses per 100 people	Population (million)
Low income	390.6	55.5	704.3
Lower middle income	2,206.5	73.7	2,995.4
Upper middle income	2,376.2	81.1	2,930.4
High income	1,195.3	96.0	1,244.6
Note: as of 31 May 2022			

Source: WTO IMF Covid 19 Vaccine Trade Tracker

Before the rise of vaccine diplomacy, there were worries about equity, as wealthy countries were better able to pay for vaccines for their citizens, and in some cases even participate in COVID-19 vaccine research and development, allowing them to acquire doses

[10] Imports are defined as the number of doses received from producing economies, mirroring the information provided in the exports section

first. This was in stark contrast to destitute countries, which struggle to keep their food supplies consistent.

It is against this backdrop that India and China emerged at the forefront as two developing countries, exporting millions of COVID-19 vaccines across the world.

VACCINE DIPLOMACY OF INDIA

India is already regarded as the world's pharmacy. It is the world's largest manufacturer of generic medications, accounting for 20% of global output. It supplies 62% of the world's vaccination needs[11]. The country has been at the forefront of supplying pharmaceuticals and generic drugs to others since the coronavirus pandemic began. (Harsh V. Pant & Aarshi Tirkey, Observer Research Foundation).

The development of a low-cost vaccine was critical for effectively combating the deadly COVID-19 epidemic. India worked hard to reach this goal to meet the large demand for the cheapest COVID-19 vaccine. The country harbours the second largest population in the world, many of whom cannot afford an expensive vaccine. Thus began the research and development of an effective vaccine that was also affordable to the poor.

The Serum Institute of India (SII)[12] and AstraZeneca, a British-Swedish pharmaceutical corporation, have supplied a billion doses of Oxford University COVID vaccine to underprivileged countries under a licensing deal. SII also supplied “CoviShield” to the Indian government and Bharat Biotech International Ltd and the Indian Council of Medical Research, started working together on a vaccination known as "Covaxin" (Precision vaccinations, CoviShield COVID-19 Vaccine[13]).

The Indian government was one of the first to undertake vaccine diplomacy and Bangladesh became the first country to acquire vaccines from India in October 2020 after the Sheikh Hasina government declined China’s offer of its CoronaVac vaccine, doubting its efficacy and because the purchase would have involved a clause on sharing the cost of clinical trials. (Sohini Bose, Ed., “The Dynamics of Vaccine Diplomacy in India’s Neighbourhood,” ORF Special Report No. 145, June 2021, Observer Research Foundation). Not only does India have a purpose to respond quickly to Bangladesh's request for vaccines, but it also has the desire to boost the country's image in the eyes of the Bangladeshi people.

On January 20, 2021, Bhutan and the Maldives became the first two nations to receive 150,000 and 100,000 vaccines, respectively, under the 'Neighbourhood First[14] policy. On January 21, Bangladesh and Nepal received two million and one million doses respectively. On January 22, Myanmar received 1.5 million doses, the Seychelles 50,000 doses, and

[11] https://www.business-standard.com/article/current-affairs/india-pharmacy-o
[12] https://www.seruminstitute.com
[13] CoviShield COVID-19 Vaccine — Precision Vaccinations
[14] Distinguished Lectures Details (mea.gov.in)

Mauritius 100,000 doses. (Ashok Sajjanhar, January 29, 2021, India's 'Vaccine Maitri' Initiative)

To date, the Indian government under the Vaccine Maitri (Vaccine Friendship) initiative has either sold or granted over 1.77 billion doses of COVID-19 vaccine to 96 countries[15] across the world. India has also supplied to the United Nations Health workers and the United Nations Peacekeepers.

The initiative, which was in line with India's philosophy of 'Vasudhaiva Kutumbakam[16]' (the world is one family) was a massive diplomatic effort to gift and distribute vaccines developed in India to low-income and developing countries around the world (Ruchita Beri, March 11, 2021, India's Vaccine Maitri with Africa). In addition to being less expensive, vaccinations manufactured in India are better suited to countries with a weak cold chain and infrastructure. Pfizer and Moderna vaccines must be kept at sub-zero temperatures, whereas both Indian-made vaccines can be kept at 2 to 8 degrees Celsius, or refrigerator conditions (Mandakini D. Surie, March 29, 2021, India's Vaccine Diplomacy: Made in India, shared with the World)

VACCINE DIPLOMACY OF CHINA

The Chinese have a new route to strengthen Chinese influence on the world stage thanks to the COVID-19 pandemic and the chance for vaccine diplomacy that has resulted. Due to the pandemic, China has become the world's leading exporter of COVID-19[17] vaccinations, primarily due to countries that have been unable to pay or obtain more effective vaccines from the United States and Europe.

At a press conference, Zhang Yesui, spokesperson for the fifth session of the 13th National People's Congress, stated that China has provided over 2.1 billion doses of COVID-19 vaccines to over 120 countries such as Indonesia, Iran, Pakistan, Brazil, Philippines, Morocco, Myanmar, Mexico, Bangladesh, and Vietnam, etc. and international organisations, making up for one-third of the total number of vaccines administered outside China (Source: Xinhua, Editor: Huaxia). The four Chinese vaccines that are shipped and supplied are BBIBP-CorV (Sinopharm Company), CoronaVac (Sinovac Co.), Convidecia (CanSino Co.), and AstraZeneca (Shenzen Kangtai) (Source: Vaccine diplomacy: nation branding and China's COVID-19 soft power play[18], Author: Seow Ting Lee)

Because China has not actively been a vaccine exporter in the past, this transformation during the pandemic is one of the ways the pandemic has changed the world. The development is a significant step forward for China's pharmaceutical industry, and it could lower the cost of vaccines for economically disadvantaged countries.

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[15] https://mea.gov.in/vaccine-supply.htm

[16] https://vasudhaivakutumbakamubuntu.org/

[17] Tracking China's COVID-19 Vaccine Distribution - Bridge Consulting (bridgebeijing.com)

[18] Vaccine diplomacy: nation branding and China's COVID-19 soft power play (nih.gov)

China may also be attempting to restore the image that was damaged during the COVID-19 pandemic. China's lack of accountability and inefficiency in handling the initial outbreak of the coronavirus from Wuhan has harmed the country's global reputation, which throws a wrench in President Xi's foreign policy aspirations (Darren Choi and Sean Janke, 21 July 2021, "Vaccine Diplomacy"? – China's Global Vaccine Efforts and Controversies[19]). Vaccine diplomacy provides China with a potent tool to repair some of the damage to its international reputation while also gaining influence in countries that are unable to manufacture their vaccines.

The large number of doses committed to international sales and contributions by both the Chinese government and vaccine manufacturers aided the speed with which China's vaccine diplomacy activities took off. The rapidity with which China's vaccinations arrived on the coasts of many countries, notably low-income countries in the Global South, was the greatest soft power coup for China.

COMPARISON BETWEEN INDIA AND CHINA

While western vaccines such as Pfizer, Moderna, and AstraZeneca were widely distributed throughout the Western countries, the rest of the globe had been forgotten. In the form of vaccine nationalism, vaccine manufacturers prioritised Western countries. This includes "using wartime methods to force manufacturers to fill enormous U.S. government orders first" and thereby blocking vaccine exports from the US. Many vaccine-producing countries had adopted this approach. Many affluent countries have been chastised by the World Health Organization[20] for stockpiling vaccines, leaving little for middle- and low-income countries. This reality forced countries who were unable to obtain vaccines from Western countries to look to alternative sources, such as China and India.

With the widespread distribution of COVID-19 vaccinations, China and India became the two countries that other developing or poor countries could turn to for assistance in times of crisis and need.

Despite China's advantages in vaccine diplomacy – speed, numbers, and better logistics – the country nonetheless faced the same obstacles and suspicion that hampered early vaccine diplomacy initiatives. Many countries and communities were hesitant to utilise Chinese vaccines even after they arrived. This distrust can be summarised on three fronts: pre-pandemic suspicion of a Chinese-designed vaccine, criticism of China's opaque scientific methods in vaccine development, and concern over low efficiency. Also, studies[21] have revealed the Chinese shots to be less effective than some Western vaccinations, such as Pfizer's and Moderna Inc.'s mRNA vaccines.

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[19] "Vaccine Diplomacy"? - China's Global Vaccine Efforts and Controversies | China Institute (ualberta.ca)

[20] https://www.who.int

[21] https://www.bloomberg.com/news/articles/2021-04-13/are-china-s-covid-shots-less-effective-experts-size-up-sinovac

As a result of these issues, India will be able to portray itself as a more responsible global power. Simply put, India has a long history of exporting medicines and vaccines to the rest of the globe, particularly low and middle-income countries. Nonetheless, China has a significant edge over practically every other country: it has mainly been able to contain the outbreak within its boundaries, and its economy has substantially recovered. As a result, China may be able to dedicate more diplomatic resources and attention to its worldwide vaccine effort.

China has already overtaken trade in Africa in recent years and now has a more convenient route to take over pharmaceutical exports from African countries. China has also vowed to supply 1 billion vaccines and 1,500 health experts to the continent (Vincent Ni and Helen Davidson[22]). China has also used vaccine diplomacy to entrap Nepal into debt and establish a foothold in the country's political and economic realms. With the Himalayan country's primary source of income being tourism, the economy was taking a hit since the pandemic. To resurrect the economy, the government sought inoculation methods. China is taking advantage of Nepal's powerlessness to get a sufficient vaccination supply. By supplying roughly 6 million medicines, China has successfully enticed Nepal to accept its aid (Dipaneeta Das[23]).

CONCLUSION

There has been a sudden shift in international policy regarding vaccine diplomacy because of the COVID-19 pandemic. The pandemic has opened new doors in the international arena for two developing countries, namely, India and China. Both countries have provided a chance for underdeveloped and other developing countries to get their hands on cheap, effective, and timely vaccines.

The situation has helped India to further solidify its status as the world's pharmacy and strengthen its bonds with the neighbouring countries. This shift in the future could be a concern for both India and Western countries, as China currently has a significant advantage over other countries in terms of vaccine manufacturing and export and has had a significant impact on the global vaccine trade.

[22] https://www.google.com/amp/s/amp.theguardian.com/world/2021/dec/08/more-cautious-china-shifts-africa-approach-from-debt-to-vaccine-diplomacy

[23] China's vaccine diplomacy aims to lure Nepal into vicious debt-trap: Report (republicworld.com)

BIBLIOGRAPHY

Choi, Darren and Jake, Sean (2021) "Vaccine Diplomacy"? China's Global Vaccine Efforts and Controversies

Pant, Harsh V. and Tirkey, Aarshi (2021) Observer Research Foundation. Accessed at: https://www.orfonline.org/research/indias-vaccine-diplomacy/

Hotez, Peter J. (2014) "Vaccine Diplomacy": Historical Perspectives and Future Directions

2021 02.15 Weekly COVID Vaccine Research Update.pdf (launchandscalefaster.org)
Lock, Helen (2021) Vaccine Nationalism: Everything You Need to Know
Nye, Joseph S., Jr. (2005) Soft Power: The Means to Success in World Politics.
The Soft Power 30, Portland
WTO-IMF COVID-19 Vaccine Trade Tracker
Business Standard
CoviShield COVID-19 Vaccine — Precision Vaccinations
Sohini Bose, Ed., (2021) "The Dynamics of Vaccine Diplomacy in India's Neighbourhood," ORF Special Report No. 145, June, Observer Research Foundation
Sajjanhar, Ashok (2021) India's 'Vaccine Maitri' Initiative
Beri, Ruchita (2021) India's Vaccine Maitri with Africa
Surie, Mandakini D., (2021) India's Vaccine Diplomacy: Made in India, shared with the World
Distinguished Lectures Details (mea.gov.in)
COVID-19 Updates. Vaccine Supply. Accessed at: https://mea.gov.in/vaccine-supply.htm
China's Vaccine Diplomacy Aims To Lure Nepal Into Vicious Debt-trap: Report
Tracking China's COVID-19 Vaccine Distribution - Bridge Consulting (bridgebeijing.com)
Huaxia, Xinhua website
Lee, Seow Ting, (2021) Vaccine diplomacy: nation branding and China's COVID-19 soft power play
Are China's Covid Shots Less Effective? Experts Size Up Sinovac. Accessed at: https://www.bloomberg.com/news/articles/2021-04-13/are-china-s-covid-shots-less-effective-experts-size-up-sinovac
Ni, Vincent and Davidson, Helen, (2021) 'More cautious' China shifts Africa approach from debt to vaccine diplomacy, The Guardian
Das, Dipaneeta, (2022) China's Vaccine Diplomacy Aims To Lure Nepal Into Vicious Debt-trap: Report, Republicworld.com

THE END OF AN ERA AND THE BEGINNING OF ANOTHER: JOURNALISM IN INTERNATIONAL RELATIONS

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ABSTRACT

The aim of this research paper is to study the role of media-effects on contemporary international relations by considering the Al-Jazeera and the CNN effects 'case studies. This research paper hypothesises that geography is no more the sole determinant of global politics, thanks to the advancements in technology and the way news gets delivered across the globe. It also argues that modern media plays a central role in disseminating information that have the potential to change the existing political fabric in this international arena.

After CNN was created in the 1980s, its first 24 hour cable network began and as novel as this medium was, the world experienced instances such as the horrors of the Vietnam war right in their drawing rooms. The following decade, Al-Jazeera also emerged as a powerful media network in West-Asia, disapproving the media censorship and speaking up against the tyranny of the governments. Though news from across the world made headlines of local newspapers, this was the first time international news especially from south-east-Asia was given public attention. The networking also lead to a possible understanding of a more nuanced global perspective.

This paper theorises the Hypodermic-needle theory, Gerbner's Mean World Syndrome and the Spiral of Silence to understand the role of foreign correspondence worldwide.

Keywords: CNN effect, Al-Jazeera effect, West Asia, Vietnam War, media censorship

THE CNN EFFECT

The 1990s saw a series of humanitarian crises that elevated the role of news media in foreign policy decision-making. The Kurdish crisis in 1991 and Operation Restore Hope in Somalia (1992-93) were associated with a doctrine of humanitarian intervention, which challenged the idea that sovereignty was sacrosanct. In Northern Iraq, media coverage of the Kurdish crisis led to the creation of protected "safe havens" for Kurds to shield them from attacks by Saddam Hussein's forces. In Somalia, news media coverage of famine appeared to persuade President George Bush (Snr) to deploy troops in support of aid workers.

For some, this emerging doctrine of humanitarian intervention was driven by news media and came to be known as the "CNN effect." This development was welcomed by liberals and those in humanitarian circles as a way of opening up traditionally conservative and non-interventionist foreign policy communities. Overall, the 1990s marked a significant

turning point in the relationship between news media and foreign policy decision-making. The CNN effect and the emergence of a doctrine of humanitarian intervention highlighted the potential influence of news media in shaping political responses to international crises.

The CNN effect debate attracted significant attention for a number of reasons. One of the most important was the evolution of a doctrine of humanitarian intervention, which represented a shift from a statist international society to a cosmopolitan international society in which justice was allowed to trump order. The role of news media in this shift was significant, as media pressure was seen as a force to be reckoned with.

The changing geo-political conditions associated with the passing of the Cold War and the rapid expansion of global news media such as CNN were also important factors. These factors created an era in which foreign policy agendas were more fluid and open, and "distant" crises were mediated to an extent never seen before.

However, early claims about the power of media to initiate armed intervention during humanitarian crises were quickly tempered by a more sober assessment of media power. While news media could influence public opinion and shape foreign policy agendas, it was acknowledged that they were not the sole driving force behind humanitarian intervention. Other factors, such as the geopolitical interests of powerful nations and the willingness of the international community to intervene, also played important roles.

Overall, the CNN effect debate represented an important moment in the evolution of international relations and the role of news media in shaping foreign policy decision-making. While the power of media to initiate armed intervention during humanitarian crises was questioned, the role of news media in shaping public opinion and foreign policy agendas remains an important area of study today.

Since the Second World War, the countries have broadcasted the war efforts through media, initially radio and then the others. The inclusion of war in TV news channels and the coming about of choices to mediate for what gave off an impression of being compassionate purposes, involved a decent arrangement of academic and political consideration. In those days, it was the recently arising worldwide media players, for example, CNN that were seen by many individuals to be the main impetus between purportedly philanthropic mediations during emergencies in nations like Somalia and Bosnia. The CNN effect is a theory in political science and media studies. The development of the popular 24-hour international television news channel had a major impact on the conduct of the state’s foreign policy. This effect argues the extent, depth and speed of the new global media has created a new type of effects qualitatively different from those that preceded them. A few examples of the CNN Effect could be the Tiananmen Square Protest and American political consequence.

In 1989 thousands of students lead demonstrations against the government in Beijing’s Tiananmen Square demanding the end of corruption and the autocratic rule of the Maoist government in China. In response to this on the 3rd of June of the same year, the government sent in military troops to free China from the protests, leaving thousands of

young students dead. The Cable News Network did a very elaborate job on the incident. Though CNN was the media house of the western theatre, because the US government suspended military sales to the capital and froze the relations, the incident received a massive coverage. This entire incident and the qualitative media made this one of the biggest examples of the CNN effect.

THE AL-JAZEERA EFFECT

The Al-Jazeera effect is a term also used in political science and media studies to describe the tyranny of news delivered in the middle east and its effects on Global politics and foreign relations, Al-Jazeera started as an alternate media to deduce the government scams and the monopoly of media in the middle east, liberating groups of Sunni and Shia Muslims men as well as women who previously lacked a international and global voice. It also sowed the seeds of democracy better. The Al Jazeera impact has additionally been alluded to as a subaltern, concerning post imperialism. It takes resistance to uplift through the segment that doesn't have the money to have their voices be heard; this type of alternate media gives a "voice to the voiceless"

Today, regardless of the eclipsing clashes in Iraq and Afghanistan, the issue of the part of media as far as driving political reactions stays a wellspring of significant intellectual interest. Indeed, the mediation during the Libyan common conflict brought up natural issues of the media's job and, at the hour of composing, media inclusion of barbarities during the Syrian clash, joined with the chance of an outfitted intercession by US and French powers, bring up recognizable issues regarding the force of pictures and media to condition political responses. The Survey conducted showed how the general public are made to glorify the tyranny of the western world especially USA on the Asian and African country especially the Middle-East. To start with, worldwide media' is in a constant rush to form a Worldwide government or that we can highlight it is the countries themselves who use media to glorify their power in Global Journalism. The media supply data simultaneously shapes an individuals' perception and reality about the world, accordingly broad communications have correspondingly had huge effect on people's image of the world. In this unique circumstance, the media becomes a significant device for characterizing 'in-bunch' personality against 'out-bunch' character dependent on addressing an arrangement of differences and restrictions. It contends that media limitedly affects foreign relations and international strategy measure and that the political talk actually beats one of the media’s “what's more”.

Subsequently, the aim of this research paper is to conceptualize the exceptionally dissipated information about media-global relations connection and to introduce a model which places media on the perplexing territory of world governmental issues. Media does not generally have an obvious idea about their capacity either in international strategy measure or in worldwide relations.

NEWS STREAMING AND FOREIGN CORRESPONDENCE IN 2000s

The idea of information esteems could disclose somewhat how the news stream is overseen in regular editorial practice. There are groupings of models for an occasion to be newsworthy yet as per Bulgarian media specialist Maria Neikova says that a few news lingos in practice could better the global news media – IMPORTANCE, NEARNESS AND DRAMA. This implies that the occasion ought to be exceptionally significant, shameful and ought to have happened close by to get into the news. This way to deal with news coverage could barely clarify how media really works since it is a lot instrumental and as well less major. The significant inquiry is the thing that are and what ought to be media capacities in international strategy measure and in global relations.

In response to the above argument - It was a progression of occasions during the 1970s like the proxy wars between USA and USSR which included wars in Vietnam and Korea, the Cuban missile crisis, balkanisation of the USSR that lead to another field in Journalism popularly known as International or global Journalism. But above all the events which lead media effects to change perspectives were the gulf war and the Arab Spring of 2007 which was quickly followed. A progression of helpful emergencies were related with an arising principle of alleged mediation from the press.

In Northern Iraq, media inclusion of the Kurdish emergency seemed to prompt the primary instance of UN-legitimated helpful intercession whereby ensured 'places of refuge's were made in Northern Iraq to safeguard Kurds from assaults by Saddam Hussein's forces in Syria. Boyt-Barret and Rantanen, T. (2001).[1]

As a plan setting specialist, the news media have a significant occupation in characterizing issues, fundamentally to assist people in general with understanding the most up to date cluster of needs and coalitions. In these circumstances, the news inclusion can be helpful for supporting state activities by forming what individuals all throughout the planet consider it. For example, in 2003 the U.S. battle against Iraq (GULF WAR) was characterized as a conflict of freedom by the White House and created a media mission to help that thought. For this situation, present day media went as partners i.e. formed coalitions with other media houses selling the conflict and supporting public help for it of course being the players of their parent countries.

For instance, in spite of the media inclusion of Bosnian outrages and the annihilation in Rwanda, none of the major Western forces interceded for quite a long time. As the third methodology of the CNN impact, when the media go about as an obstruction entertainer, they help to spread various casings, bring outsiders into strife also, help to shape general assessment which thus influence policymakers' choices on political clashes. The resistance to

[1] The globalization of news | WorldCat.org. (n.d.). The Globalization of News | WorldCat.org. Retrieved October 28, 2022, from https://www.worldcat.org/title/globalization-of-news/oclc/1114352162

government's international strategy can be a result of the media inclusion which is sourced by the homegrown political division.

In this condition, the media's ability to disperse the response against true arrangement in public, pressing factor and vested parties can drove the difference in overall influence due to organization fizzle into control the interaction of the emergencies the executives.

In Somalia, US news media inclusion of starvation during the common conflict of the mid 1990s seemed to convince President George Bush to send 28,000 soldiers on the side of help laborers. For a few, at that point, it gave off an impression of being the situation that news media were at the focal point of an arising tenet of compassionate mediation whereby sway was not, at this point sacred. The thought that media were driving international strategy dynamic turned out to be broadly known as the CNN impact. For dissidents and those in helpful circles, normally, these advancements were heartily invited and seen as characteristic of the manner by which media could open up the generally moderate and noninterventionist (regarding compassionate emergencies) direction of international strategy networks.

(MILES, 2005; THUSSU, 2007)[2]

The CNN impact acquired huge consideration for various reasons. To begin with, the advancement of a regulation of compassionate intercession was, for certain researchers, a significant turn of events and addressed a very important move from a statist worldwide society, in which the precept of non-mediation won, to a cosmopolitan global society wherein equity was permitted to request. Since news media were being involved in this significant move, the idea was that media compel had become an awe-inspiring phenomenon. Additionally, the evolving geo-political conditions related with the death of the Cold War, which seemed to let loose the international strategy plan, combined with the fast extension of worldwide news media like CNN, seemed, by all accounts, to be introducing a time wherein international strategy plans were more liquid and open while 'removed' emergencies were interceded to a degree never seen. Be that as it may, early cases in regards to the force of media to start furnished intercession during manmade emergencies immediately offered route to a more calm evaluation of media power.

Throughout the long term, Al Jazeera TV has been figured out to commit more opportunity to covering reports from the South than those from the North. Basically, it has been viewed as a news contra-stream channel and has along these lines effectively tested the authority of western media (Seib, 2008).[3] This has empowered it to give a voice to the oppressed and the burdened, and its strategy of employing nearby rather than unfamiliar

[2] Figenschou, T. U. (2010). A voice for the voiceless?: A quantitative content analysis of Al-Jazeera English's flagship news. Global Media and Communication, 6(1), 85–107.

[3] The Al Jazeera Effect : Nebraska Press. (2008, September 1). Nebraska Press. Retrieved October 28, 2022, from https://www.nebraskapress.unl.edu/potomac-books/9781597972000/

journalists has empowered it to main stories that western news sources didn't. Al Jazeera's ability to cover questionable points in the Arab World has made it a confided in name in news to watchers in spots like Britain, significantly more so than well-established contenders like CNN and the BBC (Miladi, 2006)[4] believed that start in 2003, Al Jazeera's consistent inclusion of a large group of occasions implied that Arab watchers were not, at this point dependent on western media sources for breaking news and for data. Besides remarked that as a worldwide media player, Al Jazeera was effective in uniting an assorted arrangement of crowds from around the world to participate in conversation and discussion.

Various pundits have recognized Al Jazeera's part in supporting changes during the 2005 Arab Spring, explicitly concerning its news inclusion of Iraqi decisions and Lebanese fights. Moreover, Al Jazeera made a democratic framework in which viewers could cast a ballot web based, detailing a sort of majority rule government through satellite framework. This has been a helpful apparatus in estimating popular assessment, particularly on dubious points, in the Arab world. Because of Al Jazeera's projects, people in the Middle East have become familiar with Western majority rules system and governmental issues than from other past sources.

The Al Jazeera impact follows a comparable example to the CNN impact and incorporates the catalyst impact, hindrance impact, and plan setting effect. Seib noticed that the Al Jazeera impact can be viewed as corresponding to the CNN impact, which expresses that inclusion of global occasions can drive in any 8case uninvolved governments to produce action. Whereas the CNN results is utilized with regards to standard, conventional media organizations, for example, CNN, the Al Jazeera impact sums up this to more up to date media, for example, resident writer web journals, web radio, and satellite broadcasting. He additionally contends that new media fortify the character of and offer voice to recently minimized gatherings, which recently did not have their own news sources; taking the Kurdish individuals as an example. Many of the new media associations are partnered with such gatherings, social developments or comparative associations. The CNN impact and Al Jazeera impact colossally affect strategies and the public authority. They have both impacted international strategies of the US.

The presence of such news associations is urgent for having worldwide correspondences and is promising regarding spreading democracy to its impacts on the Arab world. In particular, the example of empowering the quieted or of course limited nations and get-togethers is called as ‘Al Jazeera sway ’mentioned in the Introduction. Thusly, this thought has been used to exhibit the effects of new transnational associations and web set up news media concerning overall relations (Seib 2012).[5] In 1996 Al Jazeera was set up by the

[4] Browse journals by subject. (n.d.). Browse Journals by Subject. Retrieved October 28, 2022, from https://www.tandfonline.com/doi/abs/10.1080/13691830600761552

[5] Hanson, F. (2013). Philip Seib (2012). Real-Time Diplomacy: Politics and Power in the Social Media Era. New York: Palgrave-Macmillan, ISBN 978-0-230-33943-9, 199 pp., US$ 25., The Hague Journal of Diplomacy, 8(2), 187-188. doi: https://doi.org/10.1163/1871191X-12341251

emir of Qatar to spread uncensored and essential incorporation of data in the Middle East with the brand name of 'the evaluation and the other appraisal'.

It planned to break the authority of the ideal for western overall news get-together of CNN and BBC World. By offering a counter hegemonic resource and power, it affirmed to give another perspective to the world came to beyond the point of convergence of the West (Herman, E.S. and Chomsky, N. (2002) Al Jazeera in 2003 got open through its site for English speakers to contact more critical group and more conspicuous effect. Al Jazeera has expected a huge part giving a phase to analyzing the issues of Arab social orders and has trigged the solicitations of lion's share rule change which suggests it has a capacity to influence and receive general appraisal as it works for the Islamic-Arab World and broke the tyranny of the Autocratic rule.

THEORETICAL FRAMEWORK

HYPODERMIC NEEDLE THEORY

The Hypodermic Needle model originates from Harold Lasswell's[6] book called the 'Propaganda Techniques in World War', in 1972. This theory believes that media has a very strong influence and it "injects" messages straight into the passive audience who are immediately affected with the bullets shot from the media gun. The "Magic Bullet Theory" or the "Hypodermic Needle Theory" of direct influence was derived from the early observations of the mass media.

In International Relations, the audience perceives the global news as broadcasted by the media houses. Stereotypically, where the western world especially the Unites States is shown as the "saviour" and the Islamic world is looked down little does the world realise about unrest in Syria, Lebanon. Israel later became the catalyst for the laymen to pick up arms and fight for their resources. The Mujahideens are another example of the non-state actors who got so caught up in the unruled affairs between the USSR and the USA that they completely forgot about their daily lives and chose violence instead of a domestic life even after the cold war ended.

MEAN WORLD SYNDROME - Gerbner in 1972[7] presented the Mean World Index, which showed that a high amount of exposure to media made the viewer paranoid and deceived. Citizens generally are lead to believe that the world is a very "mean place" and a lot of people "cannot be trusted", and many felt that they could be murdered while walking on roads. Mean World Syndrome has three concepts under it namely – Mainstreaming, Resonance and The First and Second World Oder.

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[6] Lasswell's model. (2010, January 3). Communication Theory. Retrieved October 28, 2022, from https://www.communicationtheory.org/lasswells-model/

[7] Gerbner, G., Gross, L., Morgan, M., Signorielli, N., & Shanahan, J. (2002). Growing up with television: Cultivation processes. In J. Bryant & D. Zillmann (Eds.), Media effects: Advances in theory and research (2nd ed., pp. 43-67). Mahwah, N J: Lawrence Erlbaum Associates, Inc

After the Storming of the Capital in the United States on the 6th of January 2021 a lot of Biden supporters and legislatures were disturbed and afraid thinking that they were being watched by the Trump supporters and that their lives were under possible threats. Another great example of Mean World Syndrome is 'ISLAMOPHOBIA'. Because news channels like BBC and CNN, EuroNews, BFM TV (France) triggered the 'Muslim face 'the world was lead to believe the already existing stigma regarding Islam, a lot of Americans and Europeans were frightened by the sight of Muslims which also made them exclude the ethnic minority furthermore.

SPIRAL OF SILENCE

This theory originated in 1974 [8]and was formulated by a German political scientist. It states that a social group or even an individual might submit to silence, because of the fear of exclusion and isolation. Here, media is an important factor that influences both -the dominant ideas and the people's perception of what the dominant idea is. A lot of times in International News and Relations, the viewers with alternate views are silenced by the spiral of theory often fearing exclusion for a difference in the common opinion.

CONCLUSION

Journalism after the 1950s has been an organised thread of international players, it includes governments, states, MNCs, ethnic groups which through the medium hold the ability to change the power dynamics and gain international recognition, which was fairly tough before media houses like the CNN and Al-Jazeera opened this world wide network.

Irrespective of how independent media is, news can never be unbiased or apolitical. International journalism like any other stream of media, is ancient. From the Peloponnesian War to the horrors of the Russian-Ukrainian War, media has played a very important role in delivering information and has also altered perceptions on emotional and political levels.

The Al-Jazeera and the CNN effect have had a major impact on foreign politics and relations and continue to impact state and non-state actors even in the 21st century. Other news channels like the British Broadcasting Corporation of UK and Russia Today of Russia too have established a hegemony in this urban matrix.

Even domestic media houses and conventional use of media has garnered attention from across the globe. Tribune's 2004 coverage of the tropical storms in Haiti and the state's political unrest lead states like Canada, Venezuela and Brazil in offering negotiations and peace, this continued support not only in the Americas but the world, showed the political status of the media outlets. The relationship between media coverage and political responses to international crises continues to be an area of scholarly and political interest, even more than 20 years after the concept of the "CNN effect" was first introduced. The initial focus on

[8] Spiral of Silence. (2012, March 8). Mass Communication Theory. Retrieved October 28, 2022, from https://masscommtheory.com/theory-overviews/spiral-of-silence/

CNN as a driving force behind humanitarian interventions has since expanded to include mainstream media in general.

Despite the ongoing conflicts in Iraq and Afghanistan, recent events such as the Libyan civil war and the Syrian conflict have once again raised questions about the power of media to shape political responses to international crises. In particular, the possibility of armed intervention by US and French forces in response to media coverage of atrocities in Syria highlights the continuing importance of understanding the role of media in foreign policy formulation. As such, the issue of the media's impact on political decision-making remains a relevant and important area of study for scholars and policymakers alike.

BIBLIOGRAPHY

1. Coban, Filiz. (2016). The Role of the Media in International Relations: From the CNN Effect to the Al – Jazeere Effect. Journal of International Relations and Foreign Policy. 4. 10.15640/jirfp.v4n2a3.

2. What is the CNN Effect and why is it relevant today? (n.d.). Al Jazeera Media Institute. Retrieved October 27, 2022.

3. Zingarelli, M. E. (2010, January 1). The CNN effect and the Al Jazeera effect in global politics and society. The CNN Effect and the Al Jazeera Effect in Global Politics and Society. Retrieved October 27, 2022, from https://repository.library.georgetown.edu/handle/10822/553423

4. Media Effects and Society | Elizabeth M. Perse, Jennifer Lambe | Taylo. (n.d.). Taylor & Francis. Retrieved October 28, 2022, from https://www.taylorfrancis.com/books/mono/10.4324/9780203854693/ media-effects-society-jennifer-lambe-elizabeth-perse

5. Marshall, T. (2016). Prisoners of geography. Elliott & Thompson.

6. Kennedy, P. M. (1988). The rise and fall of the great powers. New York, NY, Random House

7. Marshall, T. (n.d.). book The Power of Geography pdf by Tim Marshall. Download a Book the Power of Geography Pdf by Tim Marshall - Ysk Library.

8. The Gutenberg galaxy : the making of typographic man | WorldCat.org. (n.d.). The Gutenberg Galaxy :

9. The Making of Typographic Man | WorldCat.org.

RAMSAR CONVENTION AND THE PALLIKARANAI MARSH: A BIODIVERSITY REFUGIUM MODEL OF CONSERVATION*

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ABSTRACT

A citizen survey-based[1] qualitative assessment of the state of the world's wetlands by the World Wetland Network 2020 shows that anthropogenic activities have adverse impacts on the ecological health of wetlands across the world. This paper identifies the causes behind such quantitative and qualitative deterioration of wetlands from a microcosmic perspective with the help of a case study on the Pallikaranai Marsh Reserve Forest, a recently designated Ramsar site in Chennai, Tamil Nadu. The premise within which the research operates is a refugia science-backed model of conservation, attempting to study the problem both scientifically and through the lens of the local community hoping to address the perils of dysfunctional ecosystems and effective strategies for their preservation and restoration at large.

Key words: *Ramsar Convention, Wetlands, Refugia Science, Ecosystems, Citizen Science, Conservation, Biodiversity*

INTRODUCTION:

From 2018 to 2020, over 21% of world wetlands have decreased in area and when calculated in the long term, this amounts to over a third of the world's wetland area[2]. The survey reveals that despite the additional protection they get, more Ramsar sites (39.5%) recognized as wetlands of international importance have experienced an alarming decrease in wetland areas compared to non-Ramsar sites (33%). One such area is the Pallikaranai Marsh Reserve Forest, a recently designated Ramsar site in Chennai, Tamil Nadu.

The core argument of the paper is that a reinvented outlook towards understanding wetlands as biodiversity refugia spaces highlighting the need for conservation at the local levels rather than through conventional perspectives characterized by a top-down approach is the need of the hour in the face of pressing environmental challenges. It is argued that the spur of linear-fashioned efforts based on the traditional discourse is accompanied by

***This research project was undertaken with funding provided by Women's Christian College through the Faculty Seed Grant for the period of 2021-2022.**

[1] Report created by a group of scientists, conservationists and concerned citizens, Survey Report, World Wetland Network, 2020 accessed at www.worldwetland.network
[2] Survey Report, World Wetland Network, 2020, accessed at www.worldwetland.network

logistical constraints that impede substantial changes at ground levels. This is the premise within which the research operates, attempting to study the problem through the lens of Refugia Science and Citizen Science, both nascent and fledgling discourses addressing the perils of dysfunctional ecosystems and their revival. A conscious effort towards community awareness and participation in wetland ecology and biodiversity is suggested for sustained results that stem from a bottom-to-top approach. While these discourses have caught academic attention, their policy and praxis translations have been relatively unexplored, especially in the context of wetlands. Even though wetlands easily qualify to be potential biodiversity refugium given their association with looming environmental threats such as climate change, resource depletion, biodiversity loss and natural disaster, there is a theoretical gap in establishing their correlational relevance.

In this backdrop, the research operates within the scope of recent methodological and theoretical advances in refugia science and connects them to natural resources management strategies for a viable, feasible, cost-efficient and sustainable application-based approach rather than a rhetoric-based, theoretically elegant but practically cumbersome, conventional approach. To this end, this baseline research project seeks to take stock of the current situation, study the existing policies and management strategies put in place to conserve the Pallikaranai Marsh, and ascertain the barriers to successful restoration of its ecological health. The study will further attempt to devise strategies in line with internationally adopted conservation methods to develop and manage it as a biodiversity refugium, given its rich and unique biodiversity.

The first part of the research attempts to illustrate the importance of wetlands in the ecosystem by highlighting their ecological role and functions in the temporal context. It will also critically address the efficacy of the Ramsar Convention in the conservation and restoration of wetland ecology. The second part will enumerate the adverse effects of anthropogenic activities in the Pallikaranai Marsh and the third part will be a critical examination of the significance, relevance and necessity of refugia science in perceiving wetland ecology, its conservation and restoration to address human-induced environmental vagaries that are threatening the mere survival of humanity and the other species, at large.

WETLANDS: AN INTRODUCTION

Some of the most naturally diverse and productive ecosystems of the world also called the kidneys of the environment, are wetlands, found both inland and in coastal regions. These provide habitat to a wide and unique range of flora and fauna. The Ramsar Convention on wetlands defines wetlands as “areas of marsh, fen, peat, and or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six meters.” These are dynamic systems that occupy transitional zones across multiple habitats and include marine, estuarine, lacustrine, riverine, palustrine and human-made wetlands such as

reservoirs, fish ponds, flooded mineral workings, saltpans, sewage farms, and canals[3] (Phil Benstead, Paul Jose, 2001).

Apart from being reservoirs of biodiversity, they perform other important functions in the ecosystem that range from water quality management at the local level to climate change mitigation at the global level. The health of these wetlands strongly impacts our global and local water cycles directly, thus playing a key role in determining water availability and water quality.

Various methods for assessing wetland ecological health have been developed in many regions of the world and these methods have contributed to successful wetland conservation in quite some cases.

The Ramsar Convention on Wetlands signed at Ramsar, Iran in 1971 is the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources. It aims to develop and maintain an international network of wetlands for the conservation of global biological diversity and for sustaining human life through the maintenance of their ecosystem components, processes, and benefits[4]. Under the guidelines of the convention, various measures are undertaken to protect wetlands that are declared as Ramsar sites across the world. More than 2400 wetlands have been identified as Ramsar sites, covering over 2.5 million square kilometers[5]. The inclusion in the list embodies a governmental commitment to maintaining their ecological character and lays out measures to respond to detrimental threats. India being a signatory to the convention since the year 1982 has a total of 75 designated Ramsar sites that are bound by the regulatory guidelines aimed at the protection of the listed wetlands.

Under the Ramsar convention, an area can be designated as a Ramsar Site if it meets one of the nine qualifying criteria listed in the Ramsar Convention. The criteria include sites containing representative, rare or unique wetland types, and sites of international importance for conserving biological diversity including species, ecological communities, fish, water birds, and other taxa[6].

The convention lays down three pillars for the contracting parties to commit to:

1. work towards the wise use of all their wetlands;
2. designate suitable wetlands for the list of Wetlands of International Importance and ensure their effective management
3. Cooperate internationally on transboundary wetlands, shared wetland systems and shared species.[7]

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[3] Phil Benstead, Paul Jose, encyclopedia of biodiversity, Wetlands Restoration, 2001, pages 805 – 822, Accessed at https://www.sciencedirect.com/topics/earth-and-planetary-sciences/ramsar-convention

[4] About the Convention on Wetlands, Ramsar Website, https://www.ramsar.org/about-the-convention-on-wetlands-0

[5] Data accessed at ramsar.org

[6] Data accessed at https://www.ramsar.org/sites/default/files/documents/library/ramsarsites_criteria_eng.pdf

[7] Data accessed at ramsar.org

While these are commitments on the part of the governments of the respective states, the convention also sponsors and hosts a number of wetland-related projects, campaigns and activities.

The initiatives of the Ramsar Convention include:

1. Ramsar Advisory Mission - the mechanism of requesting a team of visiting experts are nominated to apply global expertise and advice to local problems and threats;

2. Wetland City Accreditation – A voluntary scheme that helps in urban spaces with wetlands gain international recognition and visibility for their exceptional initiatives towards wetland conservation. It is important to note that there are no Indian cities among the 43 accredited cities so far.

3. CEPA Programme - The Convention on Wetlands' Programme on communication, capacity building, education, participation and awareness helps in bringing local stakeholders and framing context-specific approaches to address issues.

4. Celebration of World Wetlands Day on February 2nd of every year to help raise public awareness about wetlands, with annual themes such as Wetlands Action for People & Nature (2022), Wetland Restoration (2023), Wetlands and Human wellbeing (2024).

5. The Ramsar Wetland Conservation Award (constituted in 1996) to honour contributions towards the conservation of wetlands at local, national, and organizational levels across the world.[8] The Chilika Development Authority of India received the award in 2002 for their contribution to restoring the Chilika Lake Ramsar site in Orissa.

6. Ramsar Regional Initiatives to support cooperation and capacity building at regional levels.

The above-mentioned initiatives have helped in either slowing down the deterioration, conservation of present wetland areas and/or the partial restoration of wetland regions across countries. While the findings of a quantitative study of interventions might seem considerable in terms of numbers, a qualitative impact analysis warrants an in-depth examination of particular contexts, both horizontally and vertically. The World Wetland Network's 2020 citizen survey that uses both methods to examine the health and status of wetlands flags two staggering findings.

The findings of the report include the following:

1. Firstly, the quality of wetlands in African, Latin American and Caribbean regions is drastically low, compared to wetlands in North America and Oceania. Most wetlands in North America are in a good state while Africa has most of its wetlands in a poor state (Refer to Figure A). This observation triggers a debate on the differential equation to development and environment in the Global North and Global South.

[8] Refer to see the other awardees - https://ramsar.org/activity/the-ramsar-awards

2. Secondly, the survey discusses an accelerating as well as alarming trend that persists where the designated Ramsar Sites might be doing worse than the non-designated wetlands. This raises the question of the efficacy of the Convention and its practices and strategies on conservation despite decade-long planning and implementation in many cases.

These findings are incongruous with the objectives of the Ramsar Convention and reveal a gap between the numerical estimations of efforts and the grave ground realities that include a decrease in the wetland area, loss of livelihoods of the population dependent on wetlands and their resources, biodiversity loss and declining water quality to name a few. The aforementioned issues characterize most wetlands across the world. For example, in Asia, about 5000 square km of wetlands are vanishing annually due to such anthropogenic activities[9] (E.B. Barbier, 2013).

However, the paper argues that these problems can be addressed efficiently if more focus was directed towards local community/citizen awareness and engagement in tandem with good management practices at international, national and local levels. With this background, the next part of the research is a contextual analysis of the status and health of the Pallikaranai Marsh in Tamil Nadu to study the scope and shortfalls in the implementation of Ramsar initiatives.

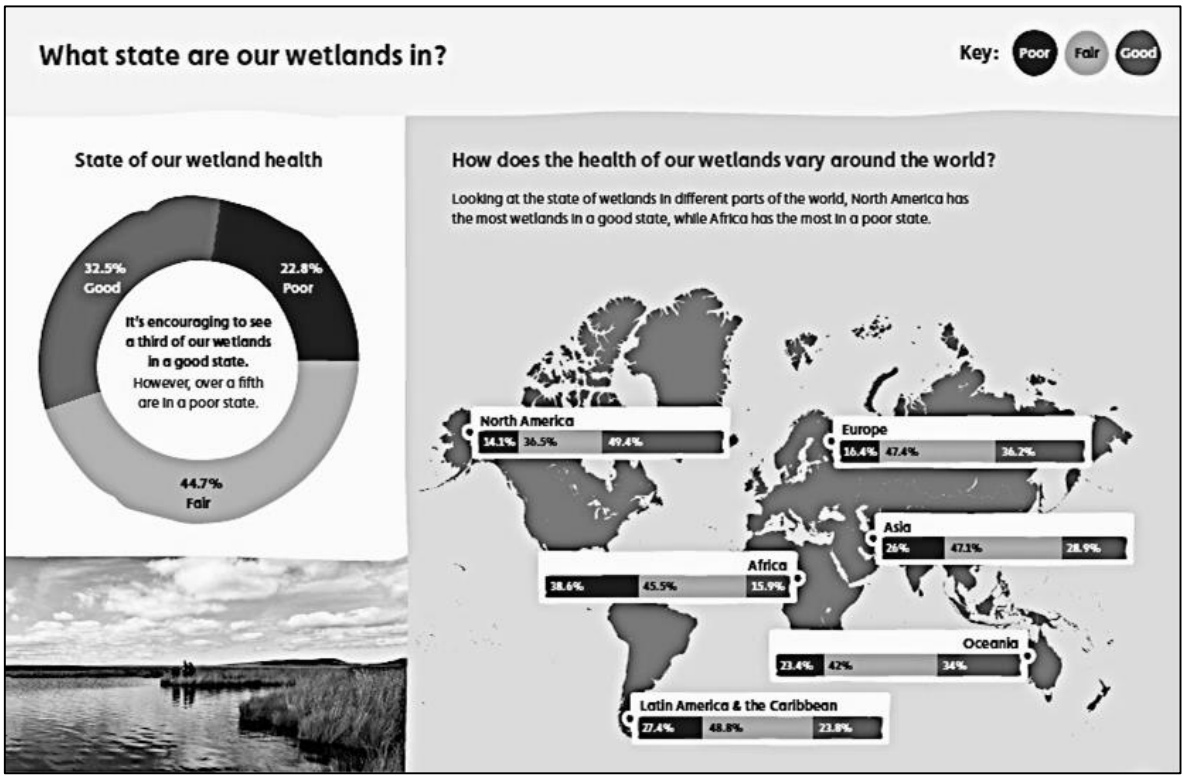

Fig A: Status of Wetland Health across the World
Image Source: Survey Report of World Wetland Network, 2020

[9] Encyclopedia of Energy, Natural Resource, and Environmental Economics, Accessed at https://www.sciencedirect.com/topics/earth-and-planetary-sciences/ramsar-convention

THE PALLIKARANAI MARSH

According to the Ministry of Environment, Forest and Climate Change[10], India harbours a total of 757060 wetlands including inland and coastal wetlands. The state-wise distribution of wetlands shows that they are found across most States and Union Territories in India, of which Tamil Nadu has 6.92% of its total geographical area covered by wetlands. The state's first internationally recognized Ramsar Site is Point Calimere, also known as Kodiakkarai, located in Nagapattinam[11].

Among the 24,684 wetlands in Tamil Nadu, the Pallikaranai Marsh in Chennai is one of the last remaining natural wetlands of the city. Recently, the Madras High Court issued a direction in the public interest to protect these marshlands and explore the feasibility of declaring them as a bird sanctuary under the Wildlife Protection Act. The court had directed the State of Tamil Nadu to expedite the application to include Pallikaranai in the Ramsar list and the declaration to be completed at the earliest[12].

As a result of such initiatives, on 8th April 2022, the marshland (Pallikaranai Marsh Reserve Forest) received the Ramsar recognition as a wetland of international importance, along with the Karikili bird sanctuary near Vedanthangal and the mangrove forests of Pichavaram, Tamil Nadu. The other designated wetlands were Pala in Mizoram and Sakhya Sagar in Madhya Pradesh totaling 54 sites. In the subsequent months, 21 other sites from across India were given Ramsar recognition, taking the total to 75 sites. This addition makes Tamil Nadu the state with the maximum number of Ramsar sites (14), followed by Uttar Pradesh with 10 designated sites[13].

The Pallikaranai Marsh Reserve Forest is considered one of the most diverse natural habitats of the country because of its unique ecosystem and hydrological features and it supports around 115 bird species, ten mammals, 21 reptiles, ten amphibians, 46 fish, nine molluscs, five crustaceans and seven butterfly species[14]. Some noteworthy species include Russell's viper, the glossy ibis, the grey-headed lapwings and the pheasant-tailed jacana. The topographic features of the Marsh are such that it always retains some water storage, forming a typical wetland ecosystem that helps in groundwater recharge, as an aquatic buffer of the Chennai and Chengalpattu districts and as a vehicle of flood mitigation system by soaking excess water during wet seasons and releasing water during dry periods in Chennai. Around seven villages in and around the region are dependent on the wetland for their livelihood and sustenance.

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[10] National Wetland Statistics, Data accessed at https://indianwetlands.in/wetlands-overview/national-wetlands-statistics/

[11] Source: The News Minute, accessed at https://www.thenewsminute.com/article/why-wetlands-chennai-s-pallikaranai-are-key-mitigating-flood-and-drought-142636

[12] Source: DT Next, accessed at https://www.dtnext.in/News/City/2021/09/24054009/1319658/Declare-Pallikaranai-marsh-as-Ramsar-site-Madras-HC.vpf

[13] Press Information Bureau, India

[14] Ramsar Sites Information Service, Data accessed at rsis/ramsar.org/ris/2481

ANTHROPOGENESIS: ALLIES OR ANTAGONISTS?

The Pallikaranai marsh meets seven out of the Ramsar's nine criteria. Despite this, Pallikaranai does not figure prominently in most surveys undertaken concerning the ecological health of wetlands conducted by the Ramsar Convention (Global Wetland Outlook, 2021) and organizations such as the World Wetland Network (2020 citizen survey) that help in the functional assessment of wetland loss and deterioration. This exhibits the gap between policy-making and implementation.

Non-realization of the marsh's ecological importance and non-recognition of the marshland as a wetland of international importance, has led to it being over-utilized "for many anthropogenic activities ranging from the development of residential and industrial settlements and institutions to using it as disposal sites of municipal solid waste and sewage, changes in water dynamics of rivers, siltation, threats of poaching, grazing etc."[15]. This has resulted in the decline of the water spread area and water holding capacity of the wetland leading to a marked reduction in its role and effectiveness in the city's flood mitigation, especially during monsoons. The natural threat to its biodiversity is in the form of non-native and invasive species of flora and fauna that has adversely affected the quintessential nature of the wetland that is home to even migratory birds that come once a year from as far as Siberia, Russia and other Tundra regions. Large tracts[16] of land have been lost due to the above-mentioned reasons destroying 90% of the Marsh, leaving behind the 10% which is the only ray of hope for a city like Chennai. This twin conundrum has been responsible for rendering the situation vulnerable for the dependent species, human and otherwise. This compounding of problems affects the existing practices put in place to address the aforementioned issues, of natural and anthropogenic origins.

While this is the case with most unrecognized wetlands across the world, their contextual significance cannot be underplayed in the face of looming environmental threats to species living within and around these wetlands. This, combined with a lack of awareness at the local level renders these hotspots vulnerable to detrimental anthropogenic activities, indifference, and, inaction toward their protection and conservation. The resulting deterioration in wetland ecological health can have both short-term and long-term impacts across the spatial and temporal dimensions. This, in turn, leads to a rapid decline in wetland areas affecting critical services ranging from availability and access to food, raw materials, fisheries, habitats, water, coastal protection, erosion control, tourism and recreation-based livelihoods, flood mitigation, and carbon sequestration resulting in dysfunctional ecosystems. The next part of the research will suggest relevant perspectives that can be incorporated at both theoretical and practical levels to navigate the difficulties faced in the process of conservation and restoration of wetlands by synthesizing the core tenets of refugia and citizen science.

[15] Data accessed at https://www.pallikaranaimarsh.org/
[16] Tamilnadu State Wetland Authority, Data accessed at https://www.tnswa.org/pallikaranai-marsh

WETLANDS AND THE REFUGIUM MODEL OF CONSERVATION

A survey of literature in the relevant areas of research reveals the gaps in connecting the ecological health of wetlands to efficient conservation and management strategies. The climate change refugia model helps in bridging this gap by suggesting the conduct and translation of relevant research in inter-disciplinary fields and adopting strategies to minimize the impact of anthropogenic activities on climate change, biodiversity loss and humanity as a whole. One of the strategies is to focus on the conservation of buffer zones that are relatively resilient to climate change and characterized by their stronghold on retaining both tangible and non-tangible resources. If we apply these to particular contexts, a promising pattern of conservation emerges. If one considers wetlands as potential climate change refugia/ buffer zones with ecological persistence, it can be understood that they cut across tangible dimensions such as natural and ecological resources and intangible ones such as valued but also almost extinct sociocultural resources. This is the central premise on which the research is built, as this discipline is scientifically sound enough to explore ecosystem dynamics such as wetlands and their ecological persistence at their smallest levels, and at the same time connect them to larger but vital foundations of climate change adaptation.

The application of the refugia model yields the following strategies which when applied to the likes of the Pallikaranai marsh, can provide effective solutions to contemporary ecological challenges:

1. Given the resilience of the wetlands, they can serve as refugia / buffer zones and protect native and unique species and ecosystems thereby ensuring biodiversity conservation and preventing ecosystem dysfunctioning and acting as long-term havens from the impacts of climate change.

2. Refugia science enables an in-depth and systematic study of the identification, management and evaluation of the ecological complexity, geographical, topographic and climactic factors as well as species traits, in the case of unique geographical features such as wetlands. The uniqueness of the wetland landscape and biodiversity will facilitate the collection, collation and maintenance of pertaining data.

3. Notwithstanding its relative age, refugia science provides theory, guidance and a variety of examples to put the concept to practice and experience the difference in impact.

Although primarily restricted to scientific literature at the given moment, the potential of the discipline in unleashing possibilities of conservation in an unprecedented fashion is promising to both nature and human beings alike. This combined with a citizen-centric, self-motivated and knowledge-based set of efforts at the local levels seeking to understand the significance of wetlands across economic, social, cultural and ecological dimensions will provide a middle ground to work from and bridge the gap between intentions and deeds. The dichotomy of a scientifically backed understanding of ecosystems and their functioning and a

local community-level awareness and engagement driven by citizen science[17] might be the sustained, multi-faceted, network-based approach the environment has been waiting for (Morelli et al, 2020).

WAY FORWARD:

This research could serve as a starting point against which future progress can be assessed/monitored concerning the preservation of the marsh, conservation of biodiversity, regulation of development, water management, and solid waste management. The arguments provide grounds to assess earlier policy and management initiatives and discuss outcomes and barriers to promoting conservation. An assessment of the cost of linear developmental policies over adaptation of green growth policies, especially in a developing economy such as India will help better understand the logistical impediments to conservation in the Global South. A microcosmic study of the wetland helps in correlating larger interconnected issues in a macrocosmic setting in light of climate change induced threats such as floods, earthquakes, etc making the solutions universally applicable. As there are currently very limited studies that have specifically assessed the outcome of Ramsar recognition vis-a-vis improvement in wetland ecological health in the Indian context and none have been developed taking into account the impediments in community awareness and participation regarding detrimental practices that affect habitat and ecology among key stakeholders, this research hopes to bridge the gap between the potential of the Ramsar tag, policy-making and conservation strategies in bringing about concrete changes.

From a policy perspective, it proposes a renewed and holistic standpoint on the issue at hand, viewed from the lens of refugia science that has the potential to provide multi-pronged, sensitive, cost-efficient, sustainable, and long-term solutions as discussed above. Thus, the findings of the research will be instrumental in addressing the current problems in the region and managing future ecological challenges replete with suggestions with for contingency strategies.

While humanity has been dealing with numerous existential questions, answers to which are difficult to arrive at, conscious conversations on environmental conservation at local, national and global levels can be a first step towards initiating actions on increasing wetland ecological resilience and reinforcing our commitments, both old and new, towards our role and relationship with nature and its benefactions upon us.

[17] 2020 citizen survey, World Wetland Network

REFERENCES:

1. Davidson NC, 2014, How much wetland has the world lost? Long Term and recent trends in global wetland area, Marine and Freshwater Research
2. Jayanthi Murali, 2021, Wetlands: A case study of Pallikaranai marshland, Notion Press
3. Maltby E 1986, Waterlogged wealth: why waste the world's wet places? International Institute for Environment and Development.
4. Megan H reed et al; 2012, Why wetlands matter, 2019, National Science Teachers Association, Accessed at JSTOR
5. Milton W, 1999, Wetland Birds: Habitat resources and conservation implications, Cambridge University Press
6. Neil F Payne, 1992, Wildlife habitat management of wetlands, McGraw Hill
7. Niladri Das, 2019, Wetlands hydrology and its impact on society and economy, Bluerose Publishers, India
8. Paul A Keddy, 2010, Wetland Ecology: Principles and Conservation, 2nd Edition, Cambridge University Press
9. PP Mitra, 2019, Birds, Wetlands and the Law, Thomson Reuters
10. Pradeep Sharma, Jaideep Barua et al; 2019, Harnessing Wetlands for Sustainable Livelihood, Notion Press
11. Ralph W Tiner, 2013, Tidal Wetlands Primer, University of Massachusetts Press
12. Rebecca Sharitz et al, 2019, Ecology of Fresh water and Estuarine Wetlands: An Introduction, University of California Press
13. Thomas R Biebighauser, 2007, Wetland Drainage, Restoration and Repair, University Press of Kentucky
14. Toni Lyn Morelli et al, 2020, "Climate Change Refugia: biodiversity in the slow lane", Front Ecology and the Environment, 18(5): 228

ONLINE RESOURCES:

15. 2020 citizen survey, State of the World's Wetlands, www.worldwetland.network
16. www.thehindu.com
17. www.unep.org
18. Official Page of the Ramsar Convention - www.ramsar.org

19. www.pallikaranaimarsh.org
20. www.tnswa.org
21. Press Information Bureau of India – www.pib.nic.in
22. www.dtnext.in
23. www.indianwetlands.in
24. www.thenewsminute.com
25. www.sciencedirect.com
26. www.wetlands.org
27. www.worldwildlife.org
28. www.wetlands-initiative.org
29. Society of Wetland Scientists - www.sws.org

AGE DIFFERENCES IN SOCIAL EMOTIONAL COMPETENCE AMONG ADOLESCENTS

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"We cannot always build a future for our youth,
but we can always build our youth for the future."

— Franklin D. Roosevelt

INTRODUCTION

Social Emotional Learning is defined as an integral part of education and human development. It is the process through which young adults and adults procure and exercise the gained knowledge and skills to control emotions and achieve personal and group objectives, to feel and express empathy for others, to build and sustain supportive relationships, and to make responsible and caring decisions (CASEL, 2021). Social Emotional Learning is aimed at enhancing the ability of students to form and sustain healthy associations by creating a safe, positive and beneficial environment. (CASEL, 2021)

The following are the major facets of SEL, Self-awareness, which is a reflective state of self-focused attention in which a person evaluates himself or herself and attempts to attain correctness and consistency in beliefs and behaviors. Self-management, which describes an individual's control of his or her behavior, particularly regarding the pursuit of a specific objective, Social awareness, is the ability to understand and empathize with others, particularly with people from different backgrounds than one's own, Relationship skills is the ability pertaining to actions, events, and feelings between two or more individuals, Responsible decision making, is the ability to make constructive choices about personal behavior and social interactions based on ethical standards, safety concerns, and social norms. (CASEL, 2021)

Adolescents, in particular, require social and emotional support. They're learning how to deal with increasing demands in school and social life, as well as new, intense emotions (both positive and negative), and they're more convinced that they can do it without parental guidance. One method to assist children in navigating these obstacles is through social and emotional learning (SEL) programmes. (Yeager, 2017). Research studies revealed that SEL is related to academic improvement; more prominent outcomes for students with early-distinguished issues have better social interaction, enhanced classroom behavior and less aggressive and/or disruptive behavior. (Cheng & Li, 2014). Hence it is crucial to ensure that the social emotional competencies of adolescents are properly developed. This will help them face the changing challenges of the world.

Erik Erikson’s theory of psychosocial development in adolescents involves a stage called identity vs. Role confusion, wherein they regard their social and cultural contexts, a person learns about who they are as a person. This can be fully achieved only when they are exposed to the different social contexts with different dynamics. The pandemic has robbed these adolescents of their exposure and participation in diverse social situations. Therefore it can be concluded that this stage might not be completely achieved by these individuals and hence calls for a reparation in the form of an intervention.

Schools play a vital role in enhancing students' SEL, considering that they spend most of their day in the classroom. Studies show that incorporating social and emotional learning into the classroom benefits pupils in both the short- and long-term. Through SEL, students may learn to recognize and understand their emotions as well as grow in empathy, self-control, and stress management. Additionally, it aids in the development of stronger interpersonal connections and interpersonal abilities that will help them flourish as adults.

Students are taught SEL in schools by including it into the curriculum, exercises, games, play etc. This fosters a sense of community, care, and compassion for one another as well as for oneself. Students are empowered by social emotional learning to be kind, sympathetic, and resilient not just in the present, but also to face the unpredictability of the future. These abilities give today's children better, more helpful interventions for the future.

Social Emotional Learning is pivotal in the life of an adolescent**.** The various dimensions of SEL competence including Self-Awareness, Self-Management, Social Awareness, Relationship Skills, and Responsible decision making are acquired in this stage. There is a deprivation of different social skills due to their isolation from a plethora of social situations, owing to the pandemic. This study aims to identify the differences in Social Emotional competence between early and late adolescents, and provide SEL training programs that will help compensate for the temporary loss of social emotional learning during online schooling, for those individuals who are deprived of their social skills and competencies.

PROBLEM AND HYPOTHESES

Research question

1. Will there be a difference in social-emotional competence between early and late adolescents?

Objectives

The present study is a need assessment and its objective is to identify the group of adolescents - early / late that lack social-emotional competence and need SEL training program.

Main hypothesis

1. There will be no significant difference in social-emotional competence between early and late adolescents.

Sub hypotheses

1a. There will be no significant difference in self-awareness between early and late adolescents.

1b. There will be no significant difference in social awareness between early and late adolescents.

1c. There will be no significant difference in self-management between early and late adolescents.

1d. There will be no significant difference in relationship management between early and late adolescents.

1e. There will be no significant difference in decision-making between early and late adolescents.

METHOD OF INVESTIGATION

Research Design

Ex post facto design has been used for this study.

Variables

Independent variable

Groups under study - early adolescents and late adolescents.

Dependent variables

Social-Emotional competence - self-awareness, social awareness, self-management, relationship management, decision making.

OPERATIONAL DEFINITIONS

1. **Adolescence** is defined as "the developmental stage that lies between childhood and adulthood ranging between ages 12 to 19". The early adolescent age range is 12-15, the late adolescent age range is 16-19. (Feldman, 2017)

2. **Social emotional competence (SEC)** is defined as "an outcome of SEL is believed to enable learners to acquire the ability to self-monitor their behaviors and self-regulate their learning" (Wilson, Gottfredson, & Najaka, 2001; Zins, Weissberg, Wang, & Walberg, 2004).

3. **Self-awareness** is defined as “recognizing and identifying one’s own strengths and weaknesses, feelings and emotions, and understanding how they may affect one’s performance” (Zins & Elias, 2006).

4. **Social awareness** is defined as “the ability to read other persons’ cues and to understand, and appropriately respond to their feelings” (Frey, Hirschstein, & Guzzo, 2000).

5. **Self-management** is defined as “the ability to manage one’s own impulses and emotions” (Hubbard and Coie, 1994).

6. **Relationship management**is defined as “using your awareness of your own emotions and those of others to manage interactions successfully”. ("Understanding the four attributes of EI – Relationship management," 2019)

7. **Responsible decision-making** is defined as “the ability to consider ethical, safety, and societal factors in making decisions, such that individuals can deal responsibly with daily academic and social situations and contribute to the well-being of one’s school and community” (CASEL, 2003).

TOOL USED

Social-emotional competence Questionnaire developed by Zhou., Ee (2012). It measures the dimensions of Social-Emotional competence- self-awareness, social awareness, self-management, relationship management, decision making. The instrument has 25 items in total and the rating scale ranged from 1 (not at all true of me) to 6 (very true of me). The scores are totaled for all the dimensions. The higher the score, the higher the dimension for the student.

RELIABILITY

All of the subscales demonstrated acceptable levels of internal consistency. For self-awareness, social awareness, self-management, relationship management and responsible decision-making, the Cronbach’s alpha were .62, .72, .68, .62 and .72, respectively. (Zhou., Ee.,2012)

VALIDITY

The significant correlations among the five SEC components and academic performance provided evidence for the predictive validity of the instrument. (Zhou., Ee., 2012)

SAMPLE

The sample consists of adolescents from private schools and colleges in Chennai. The sample size is 64 adolescents aged 12-19.

SAMPLING TECHNIQUE

Purposive sampling technique was used.

INCLUSION CRITERIA

Adolescent boys and girls aged 12-19 from private schools and colleges in Chennai.

PROCEDURE OF DATA COLLECTION

Private schools were approached, consent from parents and teachers was obtained. Questionnaires were administered to early and late adolescents.

STATISTICAL ANALYSIS

Independent sample t-test was used to identify the difference in social-emotional competence between early and late adolescents.

RESULTS AND DISCUSSION

TABLE - 1

Table 1 represents the results of the t-test for the mean differences in self-awareness between early and late adolescents.

	Early adolescents		**Late adolescents**		**t**	***p***
	M	**SD**	**M**	**SD**		
Self – awareness	22.48	5.19	22.57	4.20	-0.76^{NS}	0.17

NS – not significant

From Table 1, it can be inferred that the mean score of self-awarenessin early adolescents is M=22.48 and the mean score of self-awarenessin late adolescents is M=22.57. The result of the t-test was not significant. Hence, the null hypothesis, which states that there will be no significant difference in self-awareness between early and late adolescents fails to be rejected.

TABLE – 2

Table 2 represents the results of the t-test for the mean differences in social awareness between early and late adolescents.

	Early adolescents		**Late adolescents**		**t**	***p***
	M	**SD**	**M**	**SD**		
Self - awareness	20.38	4.92	20.03	4.13	0.310^{NS}	0.35

NS - not significant

From Table 2, it can be inferred that the mean score of social awarenessin early adolescents is M=20.38 and the mean score of social awarenessin late adolescents is M=20.03. The result of the t-test was not significant. Hence, the null hypothesis, which states that there will be no significant difference in social awareness between early and late adolescents fails to be rejected.

TABLE - 2

Table 3 represents the results of the t-test for the mean differences in Self-management between early and late adolescents.

	Early adolescents		**Late adolescents**		**t**	***p***
	M	**SD**	**M**	**SD**		
Self-management	16.31	5.96	18.63	5.33	-1.642^{NS}	0.52

NS - not significant

From Table 3, it can be inferred that the mean score of self-management in early adolescents is M=16.31 and the mean score of self-managementin late adolescents is M=18.63. Although a mean difference is present in self-management between early and late adolescents, the result of the t-test was not significant. Hence, the null hypothesis, which states that there will be no significant difference in self-management between early and late adolescents fails to be rejected.

TABLE - 4

Table 4 represents the results of the t-test for the mean differences in relationship management between early and late adolescents.

	Early adolescents		**Late adolescents**		**t**	***p***
	M	**SD**	**M**	**SD**		
Relationship management	23.79	4.25	25.14	3.99	-1.308^{NS}	0.77

NS - not significant

From Table 4, it can be inferred that the mean score of relationship management in early adolescents is M=23.79 and the mean score of relationship managementin late adolescents is M=25.14. Although a mean difference is present in relationship management between early and late adolescents, the result of the t-test was not significant. Hence, the null hypothesis, which states that there will be no significant difference in relationship management between early and late adolescents fails to be rejected.

TABLE - 5

Table 5 represents the results of the t-test for the mean differences in decision-making between early and late adolescents.

	Early adolescents		**Late adolescents**		**t**	***p***
	M	**SD**	**M**	**SD**		
Decision-making	23.41	3.53	22.66	4.48	0.739^{NS}	0.17

NS - not significant

From table 5, it can be inferred that the mean score of decision making in early adolescents is M=23.41 and the mean score of decision makingin late adolescents is M=22.66. Although a mean difference is present in decision-making between early and late adolescents, the result of the t-test was not significant. Hence, the null hypothesis, which states that there will be no significant difference in decision making between early and late adolescents fails to be rejected.

DISCUSSION OF FINDINGS

The study was a need assessment aimed to see if there's a difference in the components of social emotional competence between early and late adolescents to see which group requires SEL training. Results showed that there are no significant differences in the components of social emotional competence between early and late adolescents. The means of all the components of social emotional competence were almost similar for both early and late adolescents.

The mean scores of self-awareness and Social awareness are similar for both early and late adolescents. The scores of self-awareness and Social awareness are low for both groups indicating the need for SEL training. Self-awareness is the ability to see yourself clearly and objectively through reflection and introspection. Adolescents can go about their day without giving their inner self any extra thought, merely thinking and feeling and acting as they will; or, they also can focus their attention on that inner self, an ability highly valued by Duval and Wicklund (1972). So the fact that it is lower for both the groups indicates that they might not be aware of the benefits of being self-aware or the fact that they aren't self-aware. Both reasons indicate a need for the training program. The lack of social awareness could be attributed to the pandemic and the lack of social interaction which led to the depletion of social skills. Erik Erikson 's theory of psychosocial development states that every adolescent goes through a phase of development where they understand the dynamics of social interactions as a result of which they form an identity to themselves in relation to the world, which he termed as identity vs. role confusion. Pandemic resulted in lockdown and adolescents both early and late were deprived of exposure to any social settings which has resulted in a lesser understanding of social cues paving the way to lesser social skills. Social skills are an integral part of psychosocial development in adolescents. The world getting back

to normalcy and the social world slowly gaining momentum it is the time and need to teach adolescents the necessary social skills so that their development becomes holistic.

There is a mean difference between early and late adolescents in Self-management and relationship management though not statistically significant. It could be because of smaller sample size or lesser variability in the sample groups. It can be seen that late adolescents are higher on self and relationship management. The high score found in late adolescents could be because of the age gap, pre pandemic social exposure or the expected autonomy from people around them. Awareness of self and one's emotions and the capability to manage the self better is key to developing and maintaining healthy social relationships. As adolescence is the time when the social self of a person develops and the social world expands this could be the right time for a training to enhance social emotional competence.

The mean difference of decision making is not significant between early and late adolescents but it can be seen from table 5 that the mean score of decision making is higher for early adolescents than late adolescents. As children move from middle childhood to adolescence and as they develop into late adolescence their brain functions more on the socioemotional network rather than the cognitive control network (Papalia, 2008). Because socioemotional network is active during late adolescence, they are more sensitive to emotional cues as their amygdala is more active. Cognitive control network is active during early adolescence and matures only during early adulthood (Papalia, 2008). This could be a reason as to why early adolescents might have reported higher scores on decision making.

From the above results it can be concluded that the components of social emotional competence are lower for both early and late adolescents. Hence both the age groups can be considered for SEL training programs

CONCLUSION

1. The components of social emotional competence are similar for both early and late adolescents.

Implications

The results of this need assessment is useful to identify the sample groups in need of SEL training program. The equal need for SEL training in both early and late adolescents seen in the need assessment results will be helpful in designing a module comprehensive for both the groups. Future research could extend beyond a need assessment and to develop a training module for social emotional competence, inclusive of both early and late adolescents.

Limitations

The cross-sectional nature of this study does not permit the establishment of a cause-and-effect relationship between the variables. Considering the nature of the variables and

questions, social desirability may have limited adolescents' responses. Additionally, the study did not account for intricate school-specific influences that may have played a role.

References

1. Cheng, C., & Li, A. Y. (2014). Internet addiction prevalence and quality of (Real) life: A meta-analysis of 31 nations across seven world regions. *Cyberpsychology, Behavior, and Social Networking*, *17*(12), 755-760. doi: 10.1089 / cyber 2014.0317

2. Collaborative for Academic, Social and Emotional Learning [CASEL]. (2003). Safe and sound: An educational leader's guide to evidence-based social and emotional learning (SEL) programs.

3. Duval, S., & Wicklund, R. A. (1972). A theory of objective self awareness.

4. Feldman, R. S. (2017). Development across the life span (8^{th} ed.). Pearson.

5. Frey, K. S., Hirschstein, M. K., & Guzzo, B. A. (2000). Second step: Preventing aggression by promoting socialcompetence. Journal of Emotional and Behavioral Disorders, 8, 102 – 112.

6. Hubbard, J. A., & Coie, J. D. (1994). Emotional correlates of social competence in children's peer-relationships. Merrill-Palmer Quarterly, 40, 1–20.

7. Papalia, D. E., Olds, S. W., & Feldman, R. D. (2008). *Human development*. McGraw-Hill.

8. Wilson, D. B., Gottfredson, D. C., Najaka, S. S. (2001). School-based prevention of problem behaviors: A meta-analysis. Journal of Quantitative Criminology, 17, 247–272.

9. Yeager, D. S. (2017). Social and emotional learning programs for adolescents. *The Future of Children*, *27*(1), 73-94. doi: 10.1353 / foc. 2017.0004

10. Zins, J. E., Weissberg, R. P., Wang, M. C., & Walberg, H. J. (2004). Building academic success on social and emotional learning: What does the research say? NY: Teachers College Press.

ANTIMAGIC LABELING ON SUPER SUBDIVISION OF CROWN GRAPH

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Abstract

Hartsfield and Ringel introduced the concept of an antimagic labeling in 1990. A graph with q edges is called antimagic if its edges can be labeled with 1, 2, ..., q without repetition such that the sums of the labels of the edges incident to each vertex is distinct. A graph which admits an antimagic labeling is called an antimagic graph. Several results on antimagic labeling are given in the Gallian survey. In this paper, we prove that the super subdivision of crown graph admits antimagic labeling.

Keywords: Antimagic labeling, super subdivision, crown graph.

1. INTRODUCTION

Graph theory is a branch of Mathematics, concerned with network of points called vertices which are connected by the lines called edges. In graph theory [3], Network theory is the study of graphs as a representation of either symmetric or asymmetric relation. It is useful for analysing complex data by converting them intoa network graph.

A labeling [4] of a graph is any mapping that sends some set of graph elements to a set of numbers (usually positive integers). Specially, if we have bijections$g$: $V \to \{1,2,\dots,p\}$ or $h: E \to \{1,2,\dots,q\}$ then the labelings are called a vertex labeling or an edge labeling respectively, where $p = |V(G)|$ and $q = |E(G)|$. The first graph labeling was given by Rosa [8] in 1967 termed as β-valuation. In 1972, Golomb renamed β-valuation as *graceful labeling*.

Labeled graphs serve as useful models for a broad range of applications such as coding theory, x-ray crystallography, radar, astronomy, circuit design, communication network addressing and data base management.

Hartsfield and Ringel [5] introduced the concept of an antimagic labeling in 1990. A graph with q edges is called antimagic if its edges can be labeled with $1, 2, \ldots, q$ without repetition such that the sums of the labels of the edges incident to each ver-tex are distinct. A graph which admits an antimagic labeling is called an antimagic graph. Hartsfield and Ringel [5] conjectured that every tree other than K_2 is an- timagic and more strongly, that every connected graph other than K_2 is antimagic. Alon *et.al* [1] use probabilistic methods and analytic number theory to show that this conjecture is true for all graphs with n vertices and minimum degree Ω(log n). Hartsfield and Ringel [5] showed that paths $P_n(n \geq 3)$, cycles, wheels and complete graphs $K_n(n \geq 3)$ are antimagic.

Nistyawati and Martini [7] has showed that the gear corona cycle graph admit super $C_4 \odot C_n$-antimagic. Nicholas *et.al* has proved a cycle with m pendant edges attached at each vertex is (a,d)-antimagic if and only if m=1. Himayat Ullah *et.al* [6] has investigated on the super-edge-antimagic total labeling of special types of crown graph. Basher M [2] has found the k-Zumkeller labeling of super subdivision of some graphs. Antimagic labeling is widely used in the model of security systems or surveillance, electrical switchboards, developing a cipher block chain, circuit designs, cryptography, communication networks etc.

2. DEFINITIONS

In this section, we provide all the fundamental notations and definitions which serve as prerequisites for the advancement of the topic.

Definition 2.1. A **crown graph** is the graph obtained by the corona product of C_n and K_1 i.e, $(C_n \odot K_1)$. The corona product of two graphs G and H is defined as the graph obtained by taking one copy of G and $|V(G)|$ copies of H and joining the i^{th} vertex of G to every vertex in the i^{th} copy of H.

Definition 2.2. The **super subdivision of G** denoted by *SSD*(*G*) is obtained from *G* by replacing every edge of *G* by a complete bipartite graph $K_{2,t}$ (where *t* is an integer).

3. MAIN RESULTS

In this section, we prove that the super subdivision of crown graph admits antimagic labeling.

Theorem 1. *The super subdivision of crown graph* $(SSD(C_n \odot K_1))$ *admit antimagic labeling for* $t \geq 2$ *in* $K_{2,t}$.

Proof. Let C_n denote the cycle and pendant edges are attached to each vertex of cycle C_n which forms the crown graph.

Let E $(SSD(C_n \odot K_1))$ and $V(SSD(C_n \odot K_1))$ denote the edge set and vertexset of the graph respectively, where

$$E(SSD(Cn \odot K_1)) = \{E_1 \cup E_2 \cup F_1 \cup F_2\}$$
$$V(SSD(C_n \odot K_1)) = \{V_1 \cup V_2 \cup V_3 \cup V_4 \cup V_5 \cup V_6\}$$

Let the vertex set of the cycle of the crown graph ($C_n \odot K_1$) be denoted by $V_1 = \{x_1, x_2, \ldots, x_n\}$ in clockwise direction and the pendant vertices of the crown graph are denoted by $V_2 = \{y_1, y_2, \ldots, y_n\}$ in anticlockwise direction.

Let $V_3 = \{u_{i,1}, u_{i,2}, \ldots, u_{i,t}\}$ denote the vertices obtained by the super subdivision of the edges $x_i x_{i+1}$ of the cycle C_n of the crown Graph for $1 \leq i \leq n-1$ and $V_4 = \{u_{n,1}, u_{n,2}, \ldots, u_{n,t}\}$ denote the vertices obtained by the super subdivision of the edge $x_n x_1$ of the cycle C_n of the crown graph.

Let $V_5 = \{v_{n,1}, v_{n,2}, \ldots, v_{n,t}\}$ denote the vertices obtained by the super subdivision of the pendant edge $x_1 y_1$ of the crown Graph and let $V_6 = \{v_{i,1}, v_{i,2}, \ldots, v_{i,t}\}$ denote the vertices obtained by the super subdivision of the pendant edges $x_{n-(i-2)} y_i$ of the crown Graph for $1 \leq i \leq n-1$.

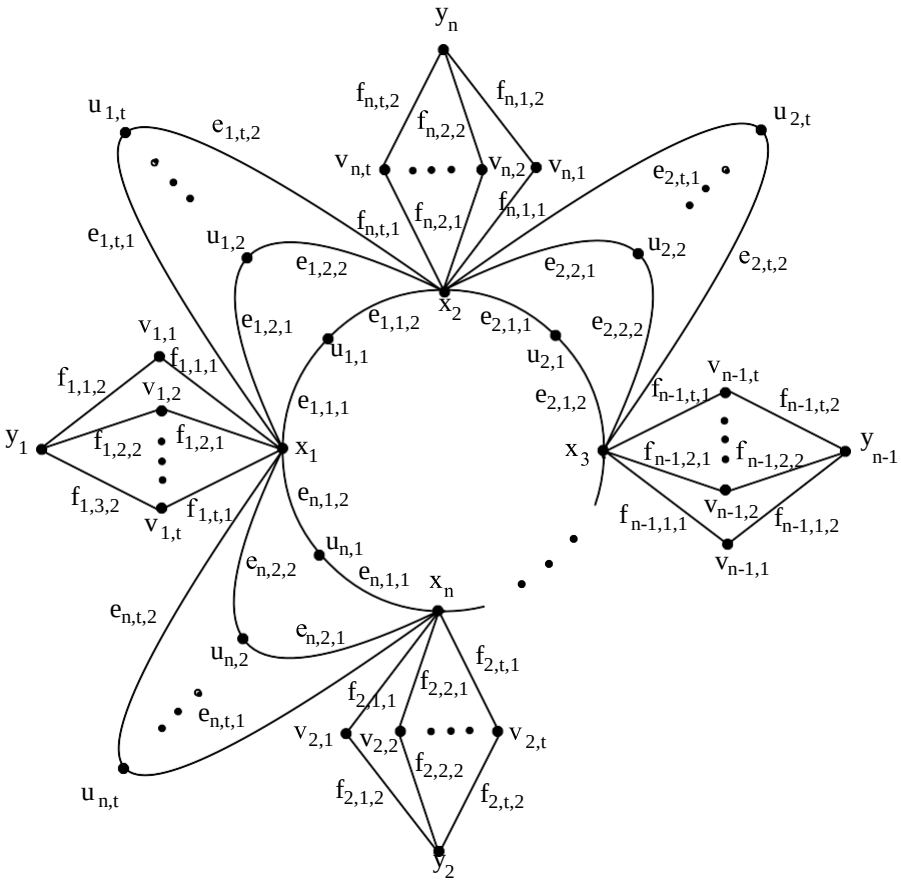

Figure 1: Super Subdivision of Crown Graph $C_n \odot K_1$

The edges obtained by the super subdivision of the edges $x_i x_{i+1}$ and $x_n x_1$ of the cycle C_n of the crown graph for $1 \leq i \leq n-1$ are denoted by

$$E_k = \{e_{i,j,k} : k = 1 \text{ and } 2, \quad 1 \leq i \leq n-1, \quad 1 \leq j \leq t\}.$$

The edges obtained by the super subdivision of the pendant edges $x_1 y_1$ and $x_{n-(i-2)} y_i$ of the crown graph for $2 \leq i \leq n$ are denoted by

$$F_k = \{f_{i,j,k} : k = 1 \text{ and } 2,\ 1 \leq i \leq n-1,\ 1 \leq j \leq t\}.$$

The edge labels are defined as $\varphi : (E(SSD(C_n \odot K_1))) \rightarrow \{1, 2, 3, \ldots, |E(SSD(C_n \odot K_1))|\}$ for $1 \leq i \leq n, 1 \leq j \leq t$ as follows:

$$\phi(e_{i,j,k}) = \begin{cases} j + t(i-1), & k = 1 \\ j + t(n+i-1), & k = 2 \end{cases}$$

$$\phi(f_{i,j,k}) = \begin{cases} j + t(2n+i-1), & k = 1 \\ 3nt + j + t(i-1), & k = 2 \end{cases}$$

Thus the entire edge set is labeled with distinct integers from 1 to $|E(SSD(C_n \odot K_1))|$.

The induced vertex labels $\psi : V(SSD(C_n \odot K_1)) \to Z^+$ are as follows:

$$\psi(u_{i,j}) = 2j + t(n + 2i - 2), \qquad for\ 1 \le i \le n\ and\ 1 \le j \le t$$

$$\psi(v_{i,j}) = 5nt + 2j + 2t(i - 1), \qquad for\ 1 \le i \le n\ and\ 1 \le j \le t$$

$$\psi(x_i) = \left\{\frac{1}{2}\ (3t + t^2(8n + 2i - 1)\ )\ , \qquad for\ 1 \le i \le n\right.$$

$$\psi(y_i) = \left\{\frac{t}{2} + t^2(3n - \frac{1}{2} + i\ )\ , \qquad for\ 1 \le i \le n\right.$$

So we observe that all the vertex labels are distinct and hence the Super subdivision of crown graph $(SSD(C_n \odot K_1))$ admit antimagic labeling.

An Illustration for the above theorem is in Figure 2.

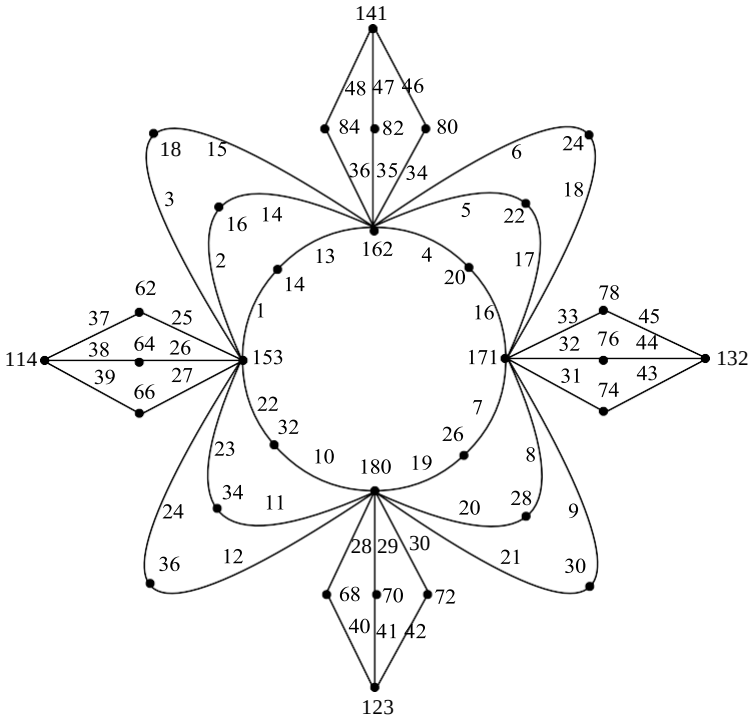

Figure 2: Super subdivision of crown $C_4 \odot K_1$

4. Conclusion

In this paper we have obtained the antimagic labeling for the Super Subdivision of Crown graph.

5. Acknowledgement

I would like to express my heartfelt gratitude to the Principal, the Bursar, the College Management, and the Deans of Research of Women's Christian College for their support in granting me with the Student Research Seed Grant to carry out my project.

References

[1] Alon N, Kaplan G, Lev A, Roditty Y, and Yuster R, Dense graphs are antimagic, Journal of Graph Theory, 297-309, 2004.

[2] Basher M, k-Zumkeller labeling of super subdivision of some graphs, Journal of the Egyptian Mathematical Society , 2021.

[3] Frank Harary, Graph Theory, Addison Wesley series in Mathematics, Addison-Wesley, 1971.

[4] Gallian J A, A dynamic survey of graph labeling, The Electronics Journal ofCombinatorics, 2013.

[5] Hartsfield N and Ringel G, Pearls in Graph Theory, Academic Press, San Diego, 1990.

[6] Himayat Ullah, Gohar Ali, Murtaza Ali, Andrea Semaničová-Feňovčíková, On Super-Edge-Antimagic Total Labeling of Special Types of Crown Graphs, Journal of Applied Mathematics, 2013.

[7] Nistyawati R and Martini T S, Super (a,d) - H-Antimagic Total Labeling of Edge Corona Product and Corona Product of Gear Graph with Path and Cycle, Journal of Physics, Conference Series, 1306, 2019.

[8] Rosa A, On certain valuations of the vertices of a graph, Theory of Graphs,(International Symposium, Rome, July 1966), Gordon and Breach, N. Y. and Dunod Paris, 349-355, 1967.

ODD GRACEFUL LABELING OF JELLYFISH GRAPHS WITHOUT THE MEDIAL EDGE

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Abstract

Gnanajothi [3] in 1991 introduced the odd graceful labeling of a graph. An odd graceful labeling of a graph G with q edges is obtained by injecting a function $h: V(G) \rightarrow \{0, 1, 2, \ldots, (2q-1)\}$ such that when each edge ab is specified the label $|h(a) - h(b)|$, the resultant edge labels are $\{1, 3, 5, \ldots, (2q-1)\}$. In this paper, we prove that the jellyfish graph without the medial edge admits odd graceful labeling.

Key words: Odd graceful labeling, Jellyfish graph without medial edge.

2010 Mathematics Subject Classification: 05C78

1. INTRODUCTION

Graph labeling is a disciplinary sub field of graph theory that deals with the problem of assigning labels to the vertices, or edges or both subject to specific conditions. The origin of most graph labeling techniques can be traced down to a method pioneered by Rosa [7] in 1967. For a graph G with q edges, Rosa [7] defined a function h as a β-valuation of G, if h is a function of injection from $V(G)$ to the $\{0, 1, \ldots, q\}$ such that, when each edge ab is specified the label $|h(a) - h(b)|$, the resultant edge labels are distinct. Later, Golomb [4] renamed β-valuation as graceful labeling. A graceful graph is one which satisfies graceful labeling conditions.

Many graph labeling techniques, including variations of graceful labeling have been studied. One such labeling is the odd graceful labeling introduced in 1991 by Gnanajothi [3]. An odd graceful graph G with q edges is obtained by a function of injection $h: V(G)\ to\ \{0, 1, 2, \ldots, (2q-1)\}$ such that, when each edge ab is specified the

label $|h(a) - h(b)|$, the resultant edge labels are $\{1, 3, 5, \ldots, (2q - 1)\}$. She proved that the class of odd graceful graphs lie between the class of α-graphs and the class of bipartite graphs by showing that every graph with an α - labeling has an odd graceful labeling. Gnanajothi [3] proved that the cycle C_n cycle is odd graceful if and only if n is even, combs $P_n \odot K_1$ obtained by joining single pendant edge to each vertex of P_n. She demonstrated that every graph with an odd cycle is not odd graceful and proposed a conjecture that all trees are odd graceful and proved the conjecture for all trees of order up to 10 [3]. Christian Barrientos [1] verified this conjecture to all trees of order up to 12. Moussa [5] gave an algorithm for odd gracefulness of the union of paths and cycles. Shah and Vaidya [8] proved that the shadow graph and splitting graph of bistar are odd graceful. We refer to the dynamic survey by Gallian [2] for an elaborate survey on odd graceful labeling.

Graph labeling is a prominent area of research in graph theory which find its applications in various field disciplines such as optimal circuit design, astronomy, data base management, DNA sequencing problems, artificial intelligence and graph decomposition. Odd graceful labeling has its applications[6] in x-ray crystallography, coding theory and communication network addressing.

2. Main Results

In this section, we establish the odd gracefulness of jellyfish graph without the medial edge.

Definition 2.1

The **jellyfish graph** $\boldsymbol{JF(\alpha, \beta)}$ is the graph, which is obtained from a cycle C_n with $n = 4$ having its vertices denoted as a_1, a_2, a_3, a_4 with an edge $e = a_1 a_3$ and α pendent edges affixed to a_2 and β pendent edges affixed to a_4. The jelly fish graph $JF(\alpha, \beta)$ is shown in Figure 1. The edge $e = a_1 a_3$ is termed as the medial edge in a jelly fish graph. Figure 2 shows the jellyfish graph without the medial edge.

Theorem 2.1

Jellyfish graph $JF^*(\alpha, \beta)$ without the medial edge is odd graceful.

Proof:

Let $JF^*(\alpha, \beta)$ be the jellyfish graph without the medial edge. Let $|V(JF^*(\alpha, \beta))| = p$ and $|E(JF^*(\alpha, \beta))| = q$. The description of the graph $JF^*(\alpha, \beta)$ is as follows. Let a_1, a_2, a_3, a_4 be the vertices of the cycle C_4 in the clockwise direction and let $b_1, b_2, \ldots, b_\alpha$ be the pendant

vertices of the α pendent edges affixed at the vertex a_2 and let $c_1, c_2, \ldots, c_\beta$ be the pendant vertices of the β pendent edges affixed at the vertex a_4 .

The graph $JF^*(\alpha, \beta)$ has $p = \alpha + \beta + 4$ vertices and $q = \alpha + \beta + 4$ edges as shown in Figure 2.

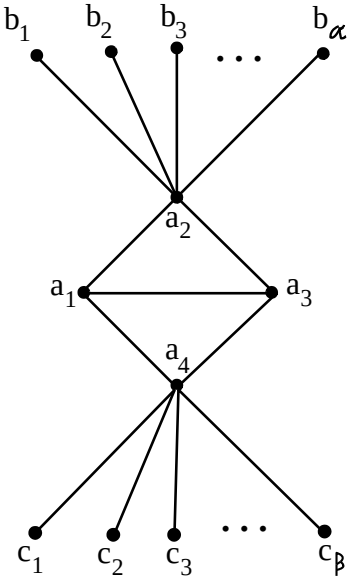

Figure 1: Jellyfish graph $J(\alpha, \beta)$

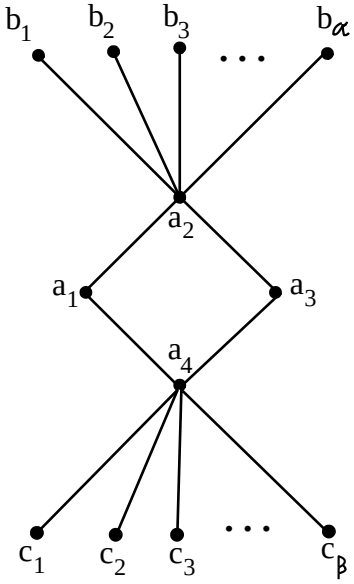

Figure 2: Jellyfish graph $JF^*(\alpha, \beta)$ without the medial edge.

The **vertices** of $JF^*(\alpha, \beta)$ are labeled as follows,

$$f(a_i) = \begin{cases} 2(\alpha + \beta - i) + 9, & for\ i = 1,3 \\ i - 2, & for\ i = 2, 4 \end{cases}$$

$$f(b_j) = 2(\alpha - j) + 1, \qquad for\ 1 \le j \le \alpha$$

$$f(c_k) = 2(\alpha + \beta - k) + 3, \qquad for\ 1 \le k \le \beta$$

The **edges** of $JF^*(\alpha, \beta)$ are computed as follows,

$$|f(a_i) - f(a_j)| = 2(\alpha + \beta) - 2i - j + 11, \qquad for\ i = 1,3,\ j = 2,4$$

which yields the edge labels $E_1 = \{2q - 1,\ 2q - 3,\ 2q - 5,\ 2q - 7\}$.

$$|f(a_i) - f(b_j)| = 2\alpha - i - 2j + 3, \qquad for\ i = 2,\ 1 \le j \le \alpha$$

which yields the edge labels $E_2 = \{1, 3, \ldots, (2q + 2\beta - 9)\}$.

$$|f(a_i) - f(c_k)| = 2(\alpha + \beta) - i - 2k + 5, \qquad for\ i = 4,\ 1 \le k \le \beta$$

which yields the edge labels $E_3 = \{2q-9,\ 2q-11, \ldots, (2q-2\beta-7)\}$.

Therefore,

$$E_1 \cup E_2 \cup E_3 = \{2q-1,\ 2q-3,\ 2q-5,\ 2q-7\}$$
$$\cup\ \{1,3,\ldots,\ (2q+2\beta-9)\}$$
$$\cup \{2q-9, 2q-11, \ldots, (2q-2\beta-7)\}$$
$$= \{1, 3, 5, \ldots, (2q-1)\}$$

It is clear from the edge labels computed above that the edge labels produced are distinct odd integers from the set $\{1, 3, 5, \ldots, (2q-1)\}$. Both vertex and edge labels satisfy the required conditions of odd graceful labeling. Hence the jellyfish graph $JF^*(\alpha, \beta)$ without the medial edge is odd graceful.

Illustration for the above theorem is shown in Figure 3.

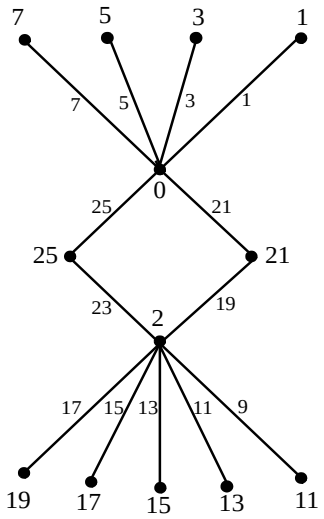

Figure 3: The jellyfish graph $JF^*(4, 5)$ without the medial edge.

3. CONCLUSION

In this paper, we have shown that the jellyfish graph without the medial edge admits odd graceful labeling.

4. ACKNOWLEDGEMENT

I would like to express my sense of gratitude to the Principal, the WCC Management, the Bursar and the Deans of Research of Women's Christian College, Chennai for providing the Students Research Seed Grant, to carry out my research project. I also acknowledge the Deans of Research, WCC for enabling a part work of my project work to be published in the Eleanor Journal.

5. REFERENCES

[1] Barrientos C., *Odd graceful labelings of trees of diameter 5*, AKCE International Journal of Graphs and Combinatorics, (2009), 307-313

[2] Gallian J. A., *A dynamic survey of Graph labeling*, The Electronic Journal of Combinatorics, (2020), 77-81.

[3] Gnanajothi R. B., *Topics in Graph Theory*, Ph. D. Thesis, Madurai Kamaraj University, 1991.

[4] Golomb S. W., *How to number a graph in graph theory and computing, R.C. Read(ed*), Academic Press, New York, (1972),23-27.

[5] Moussa M, I., *An algorithm for odd graceful labeling of the union of paths and cycles*, International Journal on Applications of Graph Theory in Wireless ad hoc Networks (Graph Hoc), (2010), 112-119.

[6] Moussa M I, Badr E. M, *Odd graceful labelings of Crown graphs*, 1st Int Conference On Computer Science from Algorithms to Applications (CSAA-2009), 8-10, 2009, Cairo, Egypt.

[7] Rosa A., *On certain valuations of the vertices of a graph*, Theory of Graphs (International Symposium, Rome, July 1966), Gordon and Breach, N. Y. and Dunod Paris (1967) 349-355.

[8] Vaidya S. K. and Shah N. H, *Graceful and odd graceful labeling of some graphs*, International Journal of Mathematics and Soft Computing, (2013), 61-68.

2-EDGE EVEN GRACEFUL LABELING OF FROCK GRAPH

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Abstract In 2021, Zeen El Deen et al introduced the r-edge even graceful labeling. A function f is called r-edge even graceful labeling of the graph G if f: $E(G) \to \{2, 4, \ldots, 2q+2r-2\}$ is an injective function such that the induced mapping f^*: $V(G) \to \{0, 2, 4, \ldots, 2q+2r-2\}$, given by $f^* = \sum \{f(xy)|xy \in E(G)\}$ $(mod 2k + 2r - 2)$, is an injective function, where $k = max(p, q)$. In this paper we prove that the frock graph is 2-edge even graceful graph.

1 Introduction

Graph labeling is an assignment of integers to the vertices or edges or both, subject to certain conditions[2]. Graph labeling has huge application in many disciplines such as coding theory, radar, crystallography, circuit design, graph decomposition and so on.

In 1961, Rosa has introduced graph labeling[3].There are two main types of graceful labeling in graph theory,the oldest type is vertex graceful labeling and the recent type of graceful labeling is the edge even graceful labeling.

A graph G is called edge odd graceful if there is a bijection $f : E(G) \to \{1, 3, ..., 2q-1\}$ and the induced function $f^* = V(G) \to \{0, 1, 2, 3, \ldots, 2q-1\}$, defined as $f^*(u)=\sum \{f(xy)|xy \in E(G)\}$ $(mod 2q)$, is bijective.

Elsonbaty and Daoud [1] in 2017 introduced the new type of labeling called the edge even graceful labeling. A graph G with p vertices and q edges is edge even graceful labeling if a bijective f from the set of edges $E(G)$ to the set of positive integers $\{2, 4, \ldots, 2q\}$ such that all the vertex labels $f^*[V(G)]$, given by $f^*(u)=\sum \{f(uv)|uv \in E(G)\}$ $(mod 2k)$, where $k = max(p, q)$, are pairwise distinct.

The extension of the definition of edge even graceful labeling to r-edge even graceful labeling was introduced by Mohamed Zeen El Deen et al[4] in 2021. A function f is called r-edge even graceful labeling of the graph G if $f = E(G) \to \{2, 4, \ldots, 2q + 2r - 2\}$ is an injective function such that the induced mapping $f^* = V(G) \to \{0, 2, 4, \ldots, 2q + 2r - 2\}$, given by : $f^*=\sum\{f(xy)|xy \in E(G)\}(mod 2k + 2r - 2)$, is an injective function, where $k = max(p, q)$.

A graph that admits r-edge even graceful labeling is called an r-edge even graceful graph. They have proved that tortoise graphs, double star graph, ladder and diagonal ladder graphs, helm graph, crown graph, sunflower graph, sunflower planar graph admit an r-edge even graceful labeling.

1.1 Definition 1.1.1

The frock graph is obtained from 3 - cycle u_1, u_2, v_0 by adjoining v_0 with a fan graph F_n in such a way that v_0 is an apex of F_n. We denote the frock graph by FG_n, where $n \geq 5$. See Figure 1.

2 Main Results

In this section, we prove that the frock graph FG_n admits $2-$*edge even graceful labeling.*

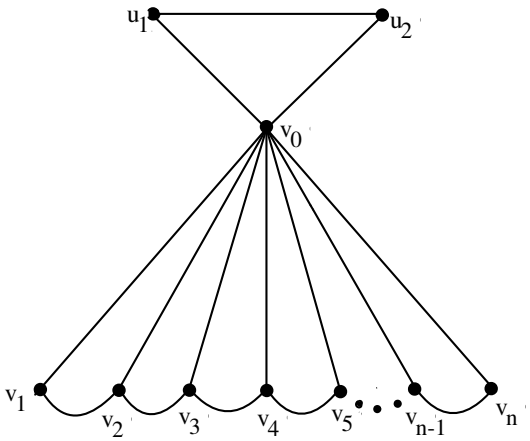

Figure 1: Frock graph of FG_n

Theorem 1. *The frock graph FG_n admits 2-edge even graceful labeling.*

Proof. Let FG_n be a frock graph with p vertices and q edges. Let the apex of frock graph be v_0. We denote the other two vertices of 3- cycle by u_1 and u_2 as shown in Figure 2 and the vertices of fan graph F_n by $v_1, v_2, ..., v_n$. The number of vertices and edges of G be $p = |V(G)| = n + 3$, $q = |E(G)| = n^2 - n + 3$, $k = max(p, q) = mn$

Case 1. *:**When** $n \equiv$ **0**(**mod 3**)*

Let $f : E(G) \to \{2, 4, \ldots, 2q + 2r - 2\}$ be defined by

$$f(v_0v_i) = 2i; \qquad 1 \leq i \leq n \tag{1}$$

$$f(v_iv_{i+1}) = 4n–2i; \qquad 1 \leq i \leq n-1 \tag{2}$$

$$f(u_1v_0) = 4n \tag{3}$$

$$f(u_2v_0) = 4n + 6 \tag{4}$$

$$f(u_1u_2) = 4n + 4 \tag{5}$$

The vertex labels of Case (i) are computed as follows

$$f^*(u_1) = f(v_iv_{i+1}) \tag{6}$$

$$f^*(u_2) = f(u_1u_2) \tag{7}$$

$$f^*(u_2) = f(u_1u_2) \tag{8}$$

$$f^*(v_{i+1}) = f(v_1) - 8; \qquad i = 1 \tag{9}$$

$$f^*(v_{i+2}) = f(v_{i+1}) - 2; \qquad 1 \leq i \leq n-3 \tag{10}$$

$$f^*(v_n) = f(u_1v_0) + 2 \tag{11}$$

$$f^*(v_0) = \sum_{i=1}^{n} f(v_0v_i) + \sum_{i=1}^{n} f(u_iv_o) + \sum_{i=1}^{n} f(u_{i+1}v_0)[mod(4n+6)] \tag{12}$$

An illustration of the above Case is given below,

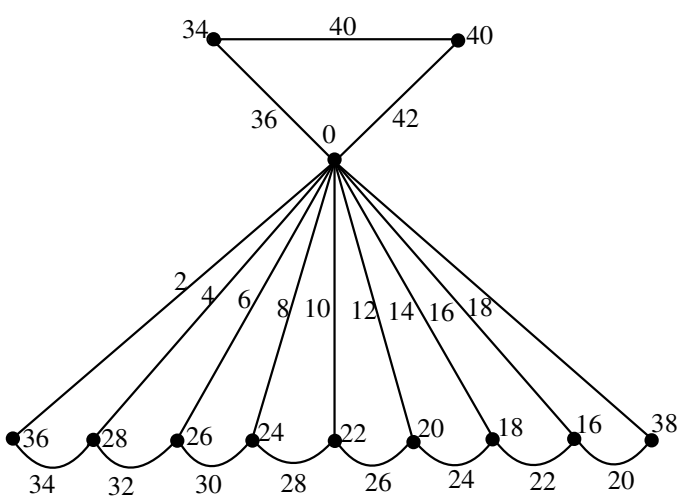

Figure 2: 2-edge even graceful labeling of Frock graph FG_9

Case 2. *:When* $n \equiv 2(mod\ 3)$

Let $f : E(G) \to \{2, 4, \ldots, 2q + 2r - 2\}$ be defined by

$$f(u_1v_0) = 4n + 2 \tag{13}$$

$$f(u_2v_0) = 4n + 6 \tag{14}$$

$$f(u_1u_2) = 4n \tag{15}$$

$$f(v_0v_{i+1}) = 2i; \qquad 1 \le i \le n - 1 \tag{16}$$

$$f(v_iv_{i+1}) = 4n - 2(i + 1); \qquad 0 \le i \le n - 1 \tag{17}$$

The vertex labels of Case (ii) are computed as follows

$$f^*(u_1) = f(u_2) - 4 \qquad i = 1 \tag{18}$$

$$f^*(u_2) = f(u_1u_2) \qquad i = 1 \tag{19}$$

$$f^*(v_1) = f(v_n)\text{–}10 \tag{20}$$

$$f^*(v_{i+1}) = f(v_i)\text{–}2 \qquad 1 \le i \le n - 1 \tag{21}$$

$$f^*(v_n) = f(u_1) + 2 \tag{22}$$

$$f^*(v_0) = \sum_{i=1}^{n} f(v_0v_i) + \sum_{i=1}^{n} f(u_iv_o) + \sum_{i=1}^{n} f^*(u_{i+1}v_0)[mod(4n + 6)] \tag{23}$$

An illustration of the above Case is given below,

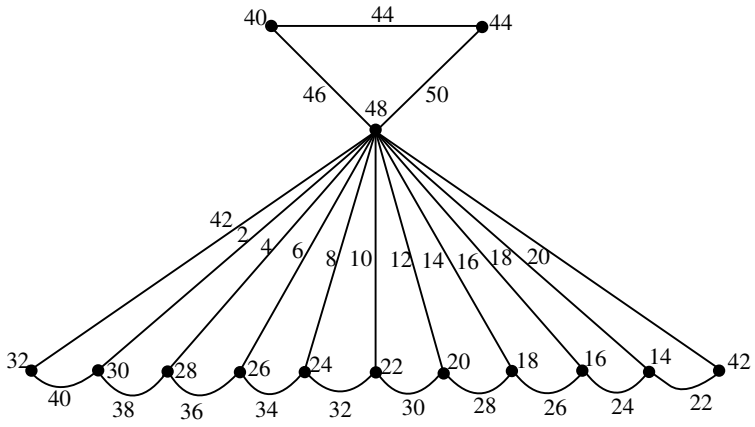

Figure 3: 2-edge even graceful labeling of Frock graph FG_{11}

From the above equations (3.1.1) - (3.1.23) we see that the edges and vertices are distinct, therefore the frock graph FG_n is 2-edge even graceful graph. Hence the Frock graph satisfies 2-edge even graceful labeling.

□

3 CONCLUSION

r-edge even graceful labeling is a recent time research, and it is open for more interesting graphs to be found. In this paper, we have proved the frock graph is 2-edge even graceful graph.

4 Acknowledgement

We appreciate and acknowledge the support provided by the Principal, Deans of Research and the Management of Women's Christian College through the Student's Research Seed Grant.

References

[1] Elsonbaty.A and Daoud S.N (2017) "Edge even graceful labeling of some path and cycle-related graphs," Ars Combinatoria, Vol.130, pp. 79-96.

[2] Gallian J.A (2021) A dynamic survey of graph labeling, 24th edition, December 9.

[3] Rosa A (1966) "On certain valuations of the vertices of a graph", In Theory of graphs (International Symposium, Rome), pp.349 – 355.

[4] Zeen El Deen M.R. and Omar N.A (2020) "Further results on edge even graceful labeling of the join of two graphs," Journal of Egyptian Mathematical society, Vol.28, pp.21.

VARIATION ON SUM LABELING FOR NEW CLASSES OF GRAPHS

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Abstract

Let G be a graph with p vertices and q edges. A square sum labeling of a graph G is bijection $f : V(G) \to \{0, 1, 2, ..., (p-1)\}$, such that the induced function $f^* : E(G) \to N$ defined by $f^*(uv) = [f(u)]^2 + [f(v)]^2$ for every edge $uv \in E(G)$ are all distinct. A graph which admits square sum labeling is called a square sum graph. A cube sum labeling of a graph G is bijection $f : V(G) \to \{0, 1, 2, ..., (p-1)\}$, such that the induced function $f* : E(G) \to N$ defined by $f^*(uv) = [f(u)]^3 + [f(v)]^3$ for every edge $uv \in E(G)$ are all distinct. A graph which admits cube sum labeling is called a cube sum labeling graph. In this paper we investigate square sum labeling for jelly fish graph $J(n, n)$ and cube sum labeling for fish bone graph F_nT_m , extended kusudama flower graph KF_n.

Keywords: Square sum labeling, Cube sum labeling, Jelly fish graph, Fish bone graph Extended Kusudama Flower graph.

1 Introduction

Graph labeling is the assignment of integers to the vertices and edges or both of a graph subject to certain conditions. The origin of graph labeling can be attributed to Rosa[2]. Graphs serves as mathematical models of many concrete real – world problems and it can be used to represent any physical situations involving discrete objects and relationships among them. In this paper, we consider only simple, finite, undirected and

non – trivial graph $G = (V(G), E(G))$ with the vertex set $V(G)$ and the edge set $E(G)$. A dynamic survey on graph labeling is regularly updated by Gallian[1] and it is published by Electronic Journal of Combinatory.

The square difference labeling and cube difference labeling was first introduced by Shiama. J. Sharon Philomena. V and K. Thirusangu[3] have proved that Square and Cube Difference Labeling for Cycle Cactus, Special Tree and a New Key Graphs. Shiama. J[4] has obtained square difference labeling for many standard graphs like complete graphs, ladder, lattice grids and quadrilateral snakes. Shiama. J[5] has proved that Cube Difference Labeling for some graphs like cycles, fan graphs, wheel graphs, crown graphs, helm graphs, dragon graph and shell graphs.

We define a graph as a binary relation on a set of objects. The study of graphs has recently emerged as one of the most important areas of research. Labeled graphs serve as useful models for a broad range of applications such as Coding theory, Circuit design, Mobile telecommunication, Medical field and database management. The application of square difference labeling is automatic channel allocation and used to represent global data structure.

1.0.1 Definition 1.2.1

The **Jelly fish graph** $J(n, n)$ is a graph obtained from a 4 - cycle w_1, w_2, w_3, w_4 by joining w_2 and w_3 with an edge and appending n pendent edges to $w_1$and n pendent edges to w_4.

1.1 Definition

A **Fish bone graph** F_nT_m is the graph obtained by attaching fan graph with a twig graph by attaching an edge in between them.

1.2 Definition

Let v_0 be the apex vertex and v_1, v_2, v_3, ..., v_{2n-1}, v_{2n} be consecutive $2n$ rim vertices of wheel graph w_{2n}, $n \geq 3$. Subdivide spoke edge v_0v_{2i-1} with vertex w_i and at each w_i,

join two copies of path of length 2; $P_2^l = v_0$, u_{2i-1},w_i and $P_2^r = v_0, u_{2i}, w_i$, for each $i \in [n]$. The resulting graph is called **kusudama flower graph** KF_n.

2 Main Result

Theorem 2.1

The jelly fish graph, $J(n, n)$ $n \geq 1$ admits square sum labeling.

Proof. Let the jelly fish graph $J(n, n)$ $n \geq 1$ be the graph with p vertices.

Let q be the number of edges in the jelly fish graph $J(n, n)$.

Denote the vertices of the jelly fish graph $J(n, n)$ as $\{u_1, u_2, \ldots, u_n, w_1, w_2, \ldots, w_n, v_1, v_2, \ldots v_n$: where m = 4 $\}$.

The edges between the vertices u_i and w_1 are denoted as e_i for $1 \leq i \leq n$.

The edges between the vertices w_i, and w_{i+1} are denoted as h_i.

The edges between the vertices w_m and v_i are denoted as d_i for $1 \leq i \leq n$.

The total number of vertices in Jelly fish graph $J(n, n) = 2n + 4$.

The total number of edges in Jelly fish graph $J(n, n) = 2n + 5$.

Without loss of generality we initiate the labeling from the apex vertex w_1 and proceed in the anti - clockwise direction.

The vertex labeling for the Jelly fish graph $J(n, n)$ is defined as follows:

$$f(w_1) = 0 \tag{1}$$

$$f(w_i) = i + (n - 1) \qquad 2 \leq i \leq m. \tag{2}$$

$$f(u_i) = i \qquad 1 \leq i \leq n. \tag{3}$$

$$f(v_i) = i + (n + 3) \qquad 1 \leq i \leq n. \tag{4}$$

Clearly the vertex labels are distinct.

The edge labels are obtained as follows,

f is called square sum labeling if $f^*(uv) = [f(u)]^2 + [f(v)]^2$ for every $uv \in E(G)$ are all distinct where $u, v \geq 0$.

The Jelly fish graph $J(n,n)$ is shown in Figure 1.

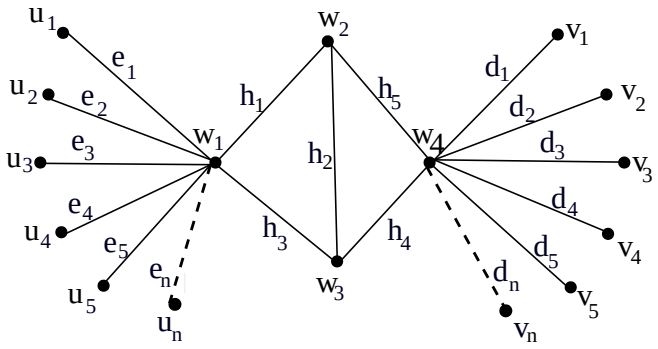

Figure 1: Jelly Fish $J(n,n)$

Compute the edge labels of Jelly fish graph $J(n,n)$ as follows:

$$f^*(u_i w_1) = i^2 + (i-1)^2 \quad ; 1 \le i \le n \tag{5}$$

$$f^*(w_m v_i) = (n+i-1)^2 + (n+i+3)^2 \quad ; 1 \le i \le n \tag{6}$$

$$f^*(w_1 w_2) = n^2 + 2n + 1 \tag{7}$$

$$f^*(w_1 w_3) = n^2 + 4n + 4 \tag{8}$$

$$f^*(w_2 w_3) = 2n^2 + 6n + 5 \tag{9}$$

$$f^*(w_2 w_4) = 2n^2 + 8n + 10 \tag{10}$$

$$f^*(w_3 w_4) = 2n^2 + 10n + 13 \tag{11}$$

The edge labels of the Jelly fish graph $J(n,n)$ are distinct.

Hence f admits sqaure sum labeling.

Therefore, Jelly fish graph $J(n,n)$ is a Square sum labeling.

An illustration of Generalized Jelly fish graph $J(5,5)$ is shown in Figure 2. □

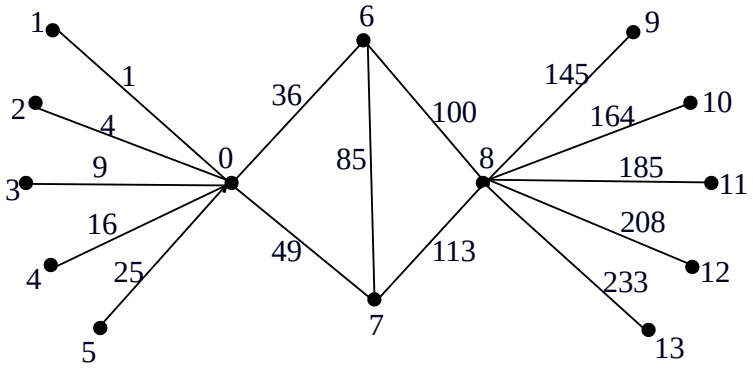

Figure 2: Jelly Fish $J(5,5)$

3 CUBE SUM LABELING FOR FISH BONE AND EXTENDED KUSUDAMA FLOWER GRAPH

Theorem 3.1

The Fish bone graph F_nT_m admits cube sum labeling when $n \geq 3$ and $m \geq 1$.

Proof. Let Fish bone graph F_nT_m be the graph with p vertices.

Let q be the number of edges in the Fish bone graph F_nT_m. Denote the vertices of Fish bone graph F_nT_m as $\{u, u_1, u_2, ..., u_n, v_1, v_2, ..., v_m, w_1, w_2, ..., w_m, w_1^{'}, w_2^{'}, ..., w_m^{'}\}$. The edges between the vertices u and u_i are denoted as e_i for $1 \leq i \leq n$. The edges between the vertices u_i and u_{i+1} are denoted as h_i for $1 \leq i \leq n-1$. The edges between the vertex $\lfloor u_{n/2+1} \rfloor$ and v_1 for $i =$ odd are denoted as d_i for $1 \leq i \leq m$. The edges between the vertex $\lfloor u_{n/2} \rfloor$ and v_1 for $i =$ even are denoted as d_i for $1 \leq i \leq m$. The edges between the vertices v_i and v_{i+1} are denoted as d_{i+1} for $1 \leq i \leq m-1$. The edges between the vertices v_i and w_i are denoted as s_i for $1 \leq i \leq m$ and the edges between the vertices v_i and are $w_i^{'}$ denoted as t_i for $1 \leq i \leq m$.

The total number of vertices in fish bone graph $F_nT_m = 2(m+n-1)$

The total number of edges in fish bone graph $F_nT_m = 5(m+1)$

Without loss of generality we initiate the labeling from the apex vertex u and proceed in the clockwise direction.

Let $V(F_nT_m) = \{u, u_i : 1 \leq i \leq n\} \cup \{v_i, w_i, w_i^{'} : 1 \leq i \leq m\}$ and

Let $E(F_nT_m) = \{uu_i : 1 \leq i \leq n\} \cup \{u_3v_1\} \cup \{v_iv_{i+1} : 1 \leq i \leq m-1\} \cup \{v_iw_i : 1 \leq i \leq m\}$ $\cup \{v_iw_i{}' : 1 \leq i \leq m\}$

Define the vertex labels of Fish bone graph F_nT_m as follows,

$$f(u) = 0 \tag{12}$$

$$f(u_i) = i \qquad ;1 \leq i \leq n. \tag{13}$$

$$f(v_i) = m + 3i \qquad ;1 \leq i \leq m. \tag{14}$$

$$f(w_i) = m + 1 + 3i \qquad ;1 \leq i \leq m. \tag{15}$$

$$f(w_i') = m + 2i + 3i \qquad ;1 \leq i \leq m. \tag{16}$$

Clearly the vertex labels are distinct.

The general structure of fish bone graph $FnTm$ is shown in Figure 3.

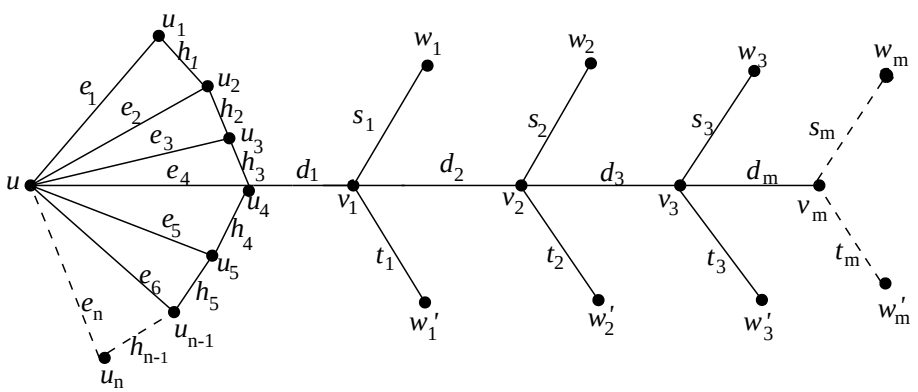

Figure 3: Fish Bone graph F_nT_m

Define the edge labels of Fish bone graph F_nT_m as follows,

$$e_i = u_i^3 \quad for \quad 1 \le i \le n \tag{17}$$

$$h_i = u_i^3 + u_{i+1}^3 \quad for \quad 1 \le i \le n-1 \tag{18}$$

$$d_1 = \lfloor u_{n/2+1}^3 \rfloor + v_1^3 \quad for \quad n = odd \tag{19}$$

$$d_1 = \lfloor u_{n/2}^3 \rfloor + v_1^3 \quad for \quad n = even \tag{20}$$

$$d_{i+1} = v_i^3 + v_{i+1}^3 \quad for \quad 1 \le i \le m-1 \tag{21}$$

$$s_i = v_i^3 + w_i^3 \quad for \quad 1 \le i \le m \tag{22}$$

$$t_i = v_i^3 + w_i'^3 \quad for \quad 1 \le i \le m \tag{23}$$

Then f induces a function $f^* : E(G) \to N$ given by $f^*(uv) = [f(u)]^3 + [f(v)]^3$ and for any edge $f^*(e_i) \neq f^*(e_j)$, $i \neq j$.

Compute the edge labels of Fish bone graph F_nT_m as follows,

$$f^*(uu_i) = i^3 \quad ; 1 \le i \le n \tag{24}$$

$$f^*(u_iu_{i+1}) = i^3 + (i+1)^3 \quad ; 1 \le i \le n-1 \tag{25}$$

$$f^*(\lfloor u_{n/2+1} \rfloor v_1) = i^3 + (n+i)^3 \quad for \;\; n = 0dd \tag{26}$$

$$f^*(\lfloor u_{n/2} \rfloor v_1) = (n/2)^3 + (n+1)^3 \quad for \;\; n = even \tag{27}$$

$$f^*(v_iv_{i+1}) = [n + (3i-2)]^3 + [n + (3i+1)]^3 \quad ; 1 \le i \le m-1 \tag{28}$$

$$f^*(v_iw_i) = [n + (3i-2)]^3 + [n + (3i-1)]^3 \quad ; 1 \le i \le m \tag{29}$$

$$f^*(v_iw_i') = [n + (3i-2)]^3 + [n + 3i]^3 \quad ; 1 \le i \le m \tag{30}$$

The edge labels of the graph G are distinct. Hence f admits square sum labeling.

An illustration of Fish bone graph F_6T_4 is shown in Figure 4. □

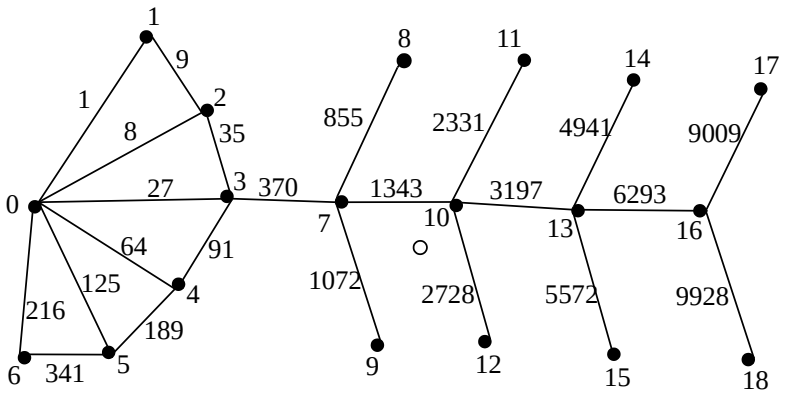

Figure 4: Fish Bone graph F_6T_4

Theorem 3.2

The extended Kusudama flower graph, KF_n $n \geq 3$ admits cube sum labeling.

Proof. Let KF_n $n \geq 3$ be extended Kusudama flower graph formed with n copies of F_n. Let p and q be the number of vertices and the number of edges in the extended Kusudama flower graph KF_n respectively.

The total number of vertices in extended Kusudama flower graph $\mid V(KF_n) \mid = n(n+2)+1$

The total number of edges in extended Kusudama flower graph $\mid E(KF_n) \mid = n(3n+2)$.

Denote the apex vertex of the extended Kusudama flower graph be v_0 and the vertices of the outer layer KF_n be v_iv_{i+3} for $1 \leq i \leq n$ and the vertices of inner layer of KF_n be $u_{3i-2}, u_{3i-1}, u_{3i}$.

Denote the edges of the outer layer of extended Kusudama flower graph be $E_1 = \{e_1^1, e_1^2\}$ and $E_2 = \{e_2^1, e_2^2\}$ and $E_3 = \{e_3^1\}$

The edges of the inner layer of the extended Kusudama flower graph be $E_4 = \{e_4^1, e_4^2\}$, $E_5 = \{e_5^1, e_5^2, e_5^3, e_5^4, e_5^5, e_5^6 e_5^7, e_5^8, e_5^9\}$, $E_6 = \{e_6^1, e_6^2, e_6^3\}$, $E_7 = \{e_7^1, e_7^2, e_7^3\}$, $E_8 = \{e_8^1, e_8^2\}$, $E_9 = \{e_9^1, e_9^2, e_9^3, e_9^4, e_9^5\}$.

Define the vertex labels as follows,

$V(KF_n) = v_0\ v_i; 1 \leq i \leq 2n \cup u_i; 1 \leq i \leq n^2$

Define the edge labels as follows,

$E(KF_n) = \ v_i v_{n+i}; 1 \leq i \leq n\ \cup v_{n+i}v_{i+1}; 1 \leq i \leq n-1 \cup v_n v_1 \cup\ v_0 v_{n+i}; 1 \leq i \leq n\ \cup$ $v_0 u_i; 1 \leq i \leq n^2\ \cup v_i u_j; 1 \leq i \leq n, 1 \leq j \leq n^2 \cup u_i u_j\ ;\ 1 \leq \mathrm{i} \leq n^2 - 1,\ 2 \leq \mathrm{j} \leq n^2\ .$

The vertex labeling for the graph Kusudama flower graph KF_n is defined as follows,

$$f(v_0) = n(n+2) \tag{31}$$

$$f(v_i) = 2i - 2 \qquad 1 \leq i \leq n. \tag{32}$$

$$f(v_{n+i}) = 2i - 1 \qquad 1 \leq i \leq n. \tag{33}$$

$$f(u_i) = 2n + i - 1 \qquad 1 \leq i \leq n^2. \tag{34}$$

Clearly the vertex labels are distinct.

The edge labels are obtained as follows,

f is called cube sum labeling if $f^*(uv) = [f(u)]^3 + [f(v)]^3$ for every $uv \in E(G)$ are all distinct where $u, v \geq 0$.

The Kusudama flower graph KF_n is shown in Figure 5.

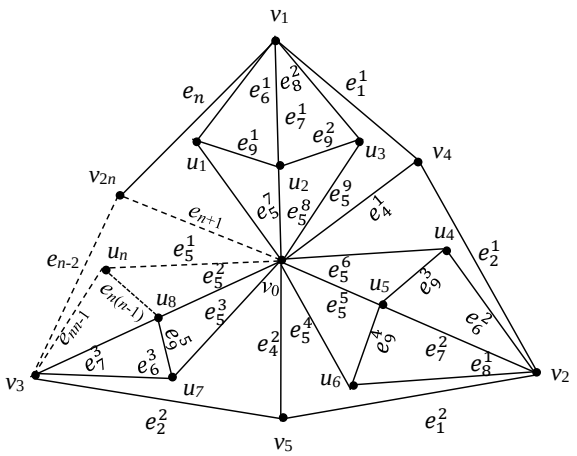

Figure 5: Kusudama Flower graph KF_n

Define the edge labels be

$$e_1 = v_i v_{n+i} \quad ; 1 \leq i \leq n \tag{35}$$

$$e_2 = v_{n+i} v_{i+1} \quad ; 1 \leq i \leq n-1 \tag{36}$$

$$e_3 = v_n v_1 \tag{37}$$

$$e_4 = v_0 v_{n+i} \quad ; 1 \leq i \leq n \tag{38}$$

$$e_5 = v_0 u_i \quad ; 1 \leq i \leq n^2 \tag{39}$$

$$e_6 = v_i u_{ni-(n-1)}; 1 \leq i \leq n \tag{40}$$

$$e_7 = v_i u_{ni-(n-j)}; 1 \leq i \leq n, \quad 2 \leq j \leq n-1 \tag{41}$$

$$e_8 = v_i u_{ni} \quad ; 1 \leq i \leq n \tag{42}$$

$$e_9 = u_i u_j \quad ; 1 \leq i \leq n^2 - 1, \quad 2 \leq j \leq n^2 \tag{43}$$

$$E_1 = \{e_1^1, e_1^2\} \tag{44}$$

$$E_2 = \{e_2^1, e_2^2\} \tag{45}$$

$$E_3 = \{e_3^1\} \tag{46}$$

$$E_4 = \{e_4^1, e_4^2\} \tag{47}$$

$$E_5 = \{e_5^1, e_5^2, e_5^3, e_5^4, e_5^5, e_5^6 e_5^7, e_5^8, e_5^9\} \tag{48}$$

$$E_6 = \{e_6^1, e_6^2, e_6^3\} \tag{49}$$

$$E_7 = \{e_7^1, e_7^2, e_7^3\} \tag{50}$$

$$E_8 = \{e_8^1, e_8^2\} \tag{51}$$

$$E_9 = \{e_9^1, e_9^2, e_9^3, e_9^4, e_9^5\} \tag{52}$$

where $E = E_1 \cup E_2 \cup E_3 \cup E_4 \cup E_5 \cup E_6 \cup E_7 \cup E_8 \cup E_9$.

Compute the edge labels of Kusudama flower graph KF_n as follows,

$$f^*(v_iv_{n+i}) = [f(v_1)]^3 + [f(v_{n+i})]^3$$
$$= (2i-2)^3 + (2i-1)^3 \qquad ;1 \le i \le n \tag{53}$$
$$f^*(v_{n+i}v_{i+1}) = [f(v_{n+i})]^3 + [f(v_{i+1})]^3$$
$$= (2i-1)^3 + (2i)^3 \qquad ;1 \le i \le n-1 \tag{54}$$
$$f^*(v_nv_1) = [f(v_n)]^3 + [f(v_1)]^3$$
$$= (2n–1)^3 \tag{55}$$
$$f^*(v_0v_{n+i}) = [f(v_0)]^3 + [f(v_{n+i})]^3$$
$$= [n(n+2)]^3 + [2i–1]^3 \qquad ;1 \le i \le n \tag{56}$$
$$f^*(v_0u_i) = [f(v_0)]^3 + [f(u_i)]^3$$
$$= [n(n+2)]^3 + [2n+i–1]^3 \qquad ;1 \le i \le n^2 \tag{57}$$
$$f^*(v_iu_{ni-(n-1)}) = [f(v_i)]^3 + [f(u_{ni-(n-1))}]^3$$
$$= [n(i+1)]^3 + [2i–2]^3 \qquad ;1 \le i \le n \tag{58}$$

$$f^*(v_iu_{ni-(n-j)}) = [f(v_i)]^3 + [f(u_{ni-(n-j)})]^3$$
$$= [(ni+n+1)]^3 + [2i–2]^3 \qquad ;1 \le i \le n,\ \ 2 \le j \le n-1 \tag{59}$$
$$f^*(v_iu_{ni}) = [f(v_i)]^3 + [f(u_{ni})]^3$$
$$= [(ni+2n-1)]^3 + [2i–2]^3 \qquad ;1 \le i \le n \tag{60}$$
$$f^*(u_iu_j) = [f(u_i)]^3 + [f(u_j)]^3$$
$$= (4n-2) + i + j \qquad ;1 \le i \le n^2-1, 2 \le j \le n^2 \tag{61}$$

The edge labels of the Kusudama flower graph KF_n are distinct.

Hence f admits cube sum labeling.

Therefore Kusudama flower graph KF_n is a cube sum graph.

An illustration of Kusudama flower graph KF_3 is shown in Figure 6.

□

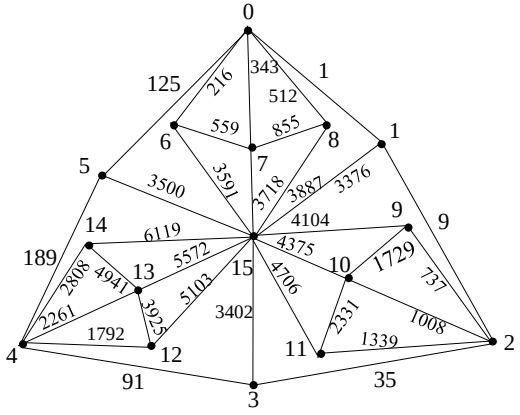

Figure 6: Kusudama Flower graph KF_3

4 Conclusion

It is very fascinating to study graphs which admit square sum and cube sum labeling. In this paper Jelly fish $J(n, n)$ admits square sum labeling and the fish bone F_nT_m ,the extended kusudama flower graph KF_n admits cube sum labeling. Square sum labeling can be applied in areas of communication network. The application of square sum labeling is automatic channel allocation and used to represent global data structure. Fish bone diagram mainly represents a model of suggestive presentation for the correlations between an event and its multiple happening causes.

5 Acknowledgement

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References

[1] Joseph A. Gallian (2018), "A Dynamic Survey of Graph Labeling", The Electronic Journal of Combinatorics, Vol. 7, pp. 310-312.

[2] Rosa A. (1967), "On certain valuations of the vertices of a graph", Theory of Graphs (Inter-Nat Symposium, Rome, July 1966), Gordon and Breach, N.Y. and Dunod Paris, pp. 349-355.

[3] Sharon Philomena V and K. Thirusangu,(2014) "Square cube Difference Labeling of cycle cactus, special tree and a new Key Graphs", Annals of pure and Applied Mathematics, 8, 115-121.

[4] Shiama J. (2012), International Journal of Computer Applications, Vol. 37, pp. 6-8.

[5] Shiama, J. "Cube Difference Labeling Of Some Graphs",(2013) International Journal of Engineering Science and Innovative Technology,Vol.2(6).

EDGE VERTEX PRIME LABELING ON CYCLE RELATED GRAPHS

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Abstract

A graph G is said to have edge vertex prime labeling if there exists a bijection $f : V(G) \cup E(G) \to \{1, 2, ..., |V(G) \cup E(G)|\}$ with the property that given any edge $uv \in E(G)$, the numbers $f(u), f(v)$ and $f(uv)$ are pairwise relatively prime. In this paper, we prove edge vertex prime labeling of graphs such as Frock graph and (n, t) - Kite graph.

Key words: Edge vertex prime labeling, Frock graph, (n, t) - Kite graph.

1 Introduction

The notation of prime labeling originated with Roger Entringer and was introduced in a paper by Taut, Dabboucy and Howalla [8]. A graph with vertex V is said to have prime labeling if there exist a bijection $f : V(G) \to \{1, 2, ..., |v|\}$ such that each edge $xy \in E(G)$, $f(x)$ and $f(y)$ are relatively prime. In other words the greatest common divisor of $f(x), f(y)$ denoted by gcd $(f(x), f(y)) = 1$.

R. Jagadesh and J. Baskar Babujee introduced the concept of edge vertex prime

labeling in [1] and proved the existence for the following graphs : paths, cycles and star-$K_{1,n}$. A graph G is said to have edge vertex prime labeling if there exists a bijection $f : V(G) \cup E(G) \to \{1, 2, ..., |V(G) \cup E(G)|\}$ with the property that given any edge $uv \in E(G)$, the numbers $f(u)$, $f(v)$ and $f(uv)$ are pairwise relatively prime. A graph G is said to be edge vertex prime if it admits edge vertex prime labeling. In [2] and [3] Parmar proved that wheels, fans, friendship graphs, and $K_{2,n}$ are edge vertex prime. Simaringa and Muthukumaran [5] proved that following graphs have edge vertex prime labelings: triangular and rectangular books, butterfly graphs, $K_n \cup K_{1,m}$, $K_{1,m} + K_1$, $K_m \cup K_n$, Jahangir graphs $J_{n,3}$ and $J_{n,4}$. In [6] Simaringa and Muthukumaran investigated the existence of edge vertex prime labelings for crowns, unions of cycles, and wheel related graphs. Shrimali and Parmar [7] proved that the following graphs have edge vertex prime labelings : bistars , n-centipede trees, coconut trees obtained from the path P_n by appending m new pendent edges at an end vertex of P_n), double coconut trees (graphs obtained by attaching $n > 1$ pendent vertices to one end of the path P_r and $m > 1$ pendent vertices to the other end of path P_r), and special classes of banana trees and fire crackers.

2 Preliminary definitions

In this section, we give the basic definitions that are necessary for establishing the results in this paper.

Definition 2.1 [1] A graph G is said to have Edge vertex prime labeling if there exists a bijection $f : V(G) \cup E(G) \to \{1, 2, ..., |V(G) \cup E(G)\}$ with the property that given any edge $uv \in E(G)$, the numbers $f(u)$, $f(v)$ and $f(uv)$ are pairwise relatively prime.

Definition 2.2 A Frock graph FG_n,$n \geq 2$ is obtained from a 3 cycle - u, v_1, v_2 by adjoining with a fan graph in such a way that u is the apex of F_n. The Frock graph is shown in Figure 1.

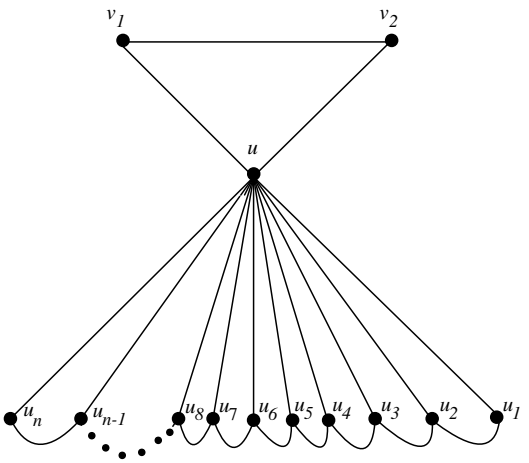

Figure 1: Generalized Frock graph FG_n

Definition 2.3 An (n, t) - Kite graph consists of a cycle of length n with a t-edge path (the tail) attached to one vertex of a cycle. The (n, t) - Kite graph is given in Figure 2.

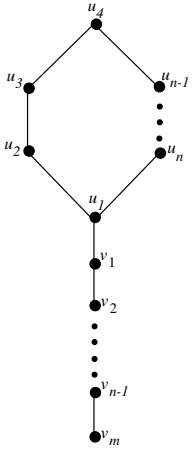

Figure 2: Generalized (n, t)- Kite graph

3 Main results

In this section, we deduce two theorems which are the main results developed in this paper.

Theorem 3.1. *For any integer $n \geq 2$, the Frock graph FG_n is an edge vertex prime graph.*

Proof. Let $G(V, E) = FG_n, n \geq 2$. Then G has $n + 3$ vertices and $2n + 2$ edges. The frock graph is desccribed as follows: Let u be the apex of the cycle graph C_3 and the fan graph F_n. Label the vertices of the cycle C_3 as u, v_1, v_2 where u is the apex. Label the vertices of the fan F_n as $u, u_1, u_2, ..., u_n$ where u is the apex. The labeling is done in the clockwise direction from the apex u.
The Vertex set for the graph is given by,

$$V = \{u \cup v_j \cup u_i\}, \quad i = 1, 2, \ldots, n \quad j = 1, 2$$

The Edge set for the graph is given by,

$$\begin{aligned} E &= E_1 \cup E_2 \cup E_3 \cup E_4 \\ E_1 &= uv_j, \qquad j = 1, 2 \\ E_2 &= v_j v_{j+1}, \quad j = 1 \\ E_3 &= uu_i, \qquad i = 1, 2, ..., n \\ E_4 &= u_i u_{i+1}, \quad i = 1, 2, ..., n-1 \end{aligned}$$

Define a bijective function $f : V \cup E \to \{1, 2, ..., 3n + 5\}$ as follows

$$\begin{aligned} f(u) &= 1 \\ f(v_j) &= 2j + 1, j = 1, 2 \\ f(u_i) &= \begin{cases} 3i + 4, \ i \ is \ odd \\ 3i + 5, \ i \ is \ even \end{cases} \end{aligned} \tag{3.1}$$

$$
\begin{aligned}
f(uv_j) &= 2(2j–1), j = 1, 2 \\
f(v_jv_{j+1}) &= 2j + 2, j = 1 \\
f(uu_i) &= \begin{cases} 3i + 5, \ i \ is \ odd \\ 3i + 4, \ i \ is \ even \end{cases} \\
f(u_iu_{i+1}) &= 3i + 6, i = 1, 2, ..., n - 1
\end{aligned} \tag{3.2}
$$

The conditions for the cycle are as follows,

$f(v_j), f(v_{j+1})$ and $f(v_jv_{j+1})$ are pairwise relatively prime.

$f(u), f(v_j)$ and $f(uv_j)$ are pairwise relatively prime for $j = 1, 2$.

For $j = 1, 2$

$$
\begin{aligned}
gcd\{f(v_j), f(v_{j+1})\} &= \ gcd\{2j + 1, 2j + 3\} \ = 1 \\
gcd\{f(v_j), f(v_jv_{j+1})\} &= \ gcd\{2j + 1, 2j + 2\} \ = 1 \\
gcd\{f(v_{j+1}), f(v_jv_{j+1)}\} &= \ gcd\{2j + 3, 2j + 2\} \ = 1
\end{aligned} \tag{3.3}
$$

For $j = 1, 2$

$$
\begin{aligned}
gcd\{f(u), f(v_j)\} &= gcd\{1, 2j + 1\} = 1 \\
gcd\{f(u), f(uv_j)\} &= gcd\{1, 2(2j - 1)\} = 1 \\
gcd\{f(v_j), f(uv_j)\} &= gcd\{2j + 1, 2(2j - 1)\} = 1
\end{aligned} \tag{3.4}
$$

The conditions for the fan are as follows,

$f(u), f(u_i)$ and $f(uu_i)$ are pairwise relatively prime.

$f(u_i), f(u_{i+1})$ and $f(u_iu_{i+1})$ are pairwise relatively prime.

$$
gcd\{f(u), f(uu_i)\} = \begin{cases} gcd(1, 3i + 5), \ i \ is \ odd \\ gcd(1, 3i + 4), \ i \ is \ even \end{cases} \quad = 1 \tag{3.5}
$$

$$gcd\{f(u_i), f(uu_i)\} = \begin{cases} gcd(3i+4, 3i+5),\ i\ is\ odd \\ gcd(3i+5, 3i+4),\ i\ is\ even \end{cases} = 1 \tag{3.6}$$

$$gcd\{f(u_i), f(u_iu_{i+1})\} = \begin{cases} gcd(3i+4, 3i+6),\ i\ is\ odd \\ gcd(3i+5, 3+6), i\ is\ even \end{cases} = 1 \tag{3.7}$$

$$gcd\{f(u_{i+1}), f(u_iu_{i+1})\} = \begin{cases} gcd(3i+8, 3i+6),\ i\ is\ odd \\ gcd(3i+7, 3i+6),\ i\ is\ even \end{cases} = 1 \tag{3.8}$$

Therefore, for any edge $uv \in E(G)$, the numbers $f(u), f(v)$ and $f(uv)$ are pairwise relatively prime. Hence, the Frock graph FG_n is an edge vertex prime graph. An illustration of the theorem is given in Figure 3.

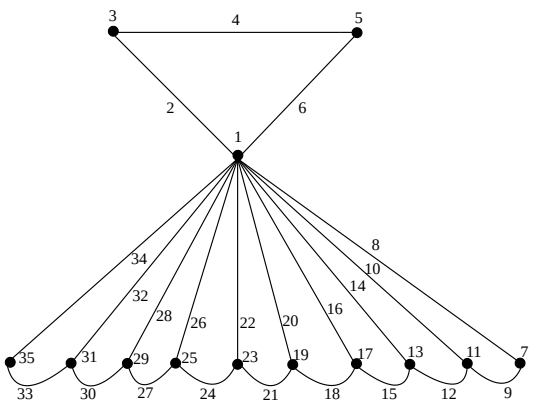

Figure 3: Edge vertex prime labeling of FG_{10}

Theorem 3.2. *An (n,t)- Kite graph admits edge vertex prime labeling where $n \geq 3$ and $t \geq 1$*

Proof. Let $G(V,E)$ be an (n,t)- Kite graph, where $n \geq 3$, $t \geq 1$ Then G has $n+t$ vertices and $n+t$ edges.The graph G is described as follows : Let u_1 be the apex of the cycle of length n and the t - edge path. Let $u_1, u_2, ..., u_n$ be the vertices of C_n labeled in the clockwise direction from u_1, which is the apex vertex. Let $v_1, v_2, ..., v_m$ be the vertices of the t - edge path attached to the apex vertex u_1 which is also a vertex of the t - edge path.

The Vertex set for this graph is given by,

$$V = \{u_1 \cup u_j \cup v_i\}; \quad 1 \leq i \leq t, \quad 2 \leq j \leq n$$

The Edge set for this graph is given by,

$$E = E_1 \cup E_2 \cup E_3 \cup E_4$$

$$E_1 = u_1 v_1$$

$$E_2 = \begin{cases} 2j - 2t - 2, & j = 2 \\ 2j + 2t, & j = n \end{cases}$$

$$E_3 = 2i + 2, \quad 1 \leq i \leq t-1$$

Define a bijective function $f : V \cup E \to \{1, 2, ..., 2(n+t)\}$ as follows

$$\begin{aligned} f(u_1) &= 1 \\ f(v_i) &= 2i + 1, 1 \leq i \leq t \\ f(u_j) &= 2j + 2t, j = 2, ..., n \end{aligned} \tag{3.9}$$

$$f(u_1 v_i) = 2i, i = 1$$

$$f(u_1 u_j) = \begin{cases} 2j + 2t - 2, & j = 2 \\ 2j + 2t, & j = n \end{cases} \tag{3.10}$$

$$f(v_i v_{i+1}) = 2i + 2, 1 \leq i \leq t-1$$

$$f(u_j u_{j+1}) = 2j + 2t, 2 \leq j \leq n-1$$

The conditions for the graph are as follows,

$f(u_1), f(v_i)$ and $f(u_1v_i)$ are pairwise relatively prime.

$f(u_1), f(u_j)$ and $f(u_1u_j)$ are pairwise relatively prime.

$f(u_j), f(u_{j+1})$ and $f(u_ju_{j+1})$ are pairwise relatively prime.

For $i = 1$

$$\begin{aligned} gcd\{f(u_1), f(v_i)\} &= gcd\{1, 2i+1\} = 1 \\ gcd\{f(u_1), f(u_1v_i)\} &= gcd\{1, 2i\} = 1 \\ gcd\{f(v_i), f(u_iv_i)\} &= gcd\{2i+1, 2i\} = 1 \end{aligned} \tag{3.11}$$

For $j = 2, n$

$$gcd\{f(u_1), f(u_j)\} = gcd\{1, 2j+2t-1\} \ = 1$$

$$gcd\{f(u_1), f(u_1u_j)\} = \begin{cases} gcd(1, 2j+2t-2), & j = 2 \\ gcd(1, 2j+2t), & j = \text{n} \end{cases} = 1 \tag{3.12}$$

$$gcd\{f(u_j), f(u_1u_j)\} = \begin{cases} gcd(2j+2t-1, 2j+2t-2), & j = 2 \\ gcd(2j+2t-1, 2j+2t), & j = \text{n} \end{cases} = 1$$

For $1 \leq i \leq t-1$

$$\begin{aligned} gcd\{f(v_i), f(v_{i+1})\} &= gcd\{2i+1, 2i+3\} = 1 \\ gcd\{f(v_i), f(v_iv_{i+1})\} &= gcd\{2i+1, 2i+2\} = 1 \\ gcd\{f(v_{i+1}), f(v_iv_{i+1})\} &= gcd\{2i+3, 2i+2\} = 1 \end{aligned} \tag{3.13}$$

For $2 \leq j \leq n-1$

$$\begin{aligned} gcd\{f(u_j), f(u_{j+1})\} &= gcd\{2j+2t-1, 2j+2t+1\} = 1 \\ gcd\{f(u_j), f(u_ju_{j+1})\} &= gcd\{2j+2t-1, 2i\} = 1 \\ gcd\{f(u_{j+1}), f(u_ju_{j+1})\} &= gcd\{2j+2t+1, 2j+2t\} = 1 \end{aligned} \tag{3.14}$$

Therefore, for any edge $uv \in E(G)$, the numbers $f(u), f(v)$ and $f(uv)$ are pairwise relatively prime. Hence an (n,t) - Kite graph is an edge vertex prime graph. An illustration of the above theorem is given in Figure 4.

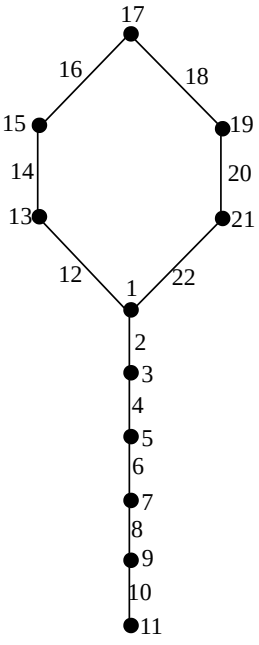

Figure 4: Edge vertex prime labeling of $(6,5)$ - Kite graph

□

4 Conclusion

In this paper, we have proved that the Frock graph and (n,t) - Kite graph admits Edge vertex prime labeling.

5 Acknowledgement

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References

[1] R. Jagadesh and J. Baskar Babujee (2017), Edge vertex prime labeling for some class of graphs, National Conference on Recent Trends in Mathematics and its Applications, pp. 24-25.

[2] Y. Parmar (2017), Edge vertex prime labeling for wheel, fan and friendship graph, International Journal of Mathematics and Statistics Invention (IJMSI), Vol.5(8), pp. 23-29.

[3] Y. Parmar (2018), Edge vertex prime labeling for $K_{2,n}$ and $K_{3,n}$ graphs, Mathematical Journal of Interdisciplinary Sciences, Vol.6(2), pp. 167-180.

[4] A. Rosa (1967), "On certain valuations of the vertices of a graph, Theory of Graphs", International Symposium, Rome, July 1966, Gordon and Breach, N. Y. and Dunod Paris, pp.349-355.

[5] M. Simaringa and S. Muthukumaran, (2019), Edge vertex prime labeling of some graphs, Malaya Journal of Matematik, Vol.7(2), pp. 264-268.

[6] M. Simaringa and S. Muthukumaran, (2019), Edge vertex prime labeling of graphs, Malaya Journal of Matematik, Vol.7(3), pp. 572-578.

[7] N. P. Shrimali and Y. M. Parmar, (2019), Edge vertex prime labeling for some trees, JASC: Journal of Applied Science and Computations, Vol.VI(I), pp.1236-1249.

[8] A. Tout, A.N. Dabboucy, K. Howalla, (1982), Prime labeling of Graphs, National Academy Science Letters, Vol. 11, pp. 365- 368.

Edge Odd Graceful Labeling of Circus Tent and Frock graphs

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Abstract: In 2009, Solairaju and Chithra [10] introduced a new type of labeling of a graph G called *edge odd graceful labeling*(EOGL). A graph G with p vertices and q edges is said to be an *edge odd graceful graph*, if there exists is a bijection f from E to $\{1, 3, 5, \ldots, (2q-1)\}$ so that the induced mapping f^* from V to $\{0, 1, 2, 3, \ldots, (2q-1)\}$ is given by $f^*(u) = \sum\{f(uv)|uv \in E(G)\}(mod 2q)$. The edge labels and vertex labels are distinct. In this paper, we prove that circus tent and frock graphs are edge - odd graceful.

Keywords: Edge-Odd graceful labeling, Circus Tent graph, Frock graph.

1 Introduction

Graph labeling is an assignment of integers to the vertices or edges or both, subject to certain conditions. Based on the Gallian Survey[5], graph labeling has been introduced since the middle of 1960. From the survey we know that there are many kind of labelings. Some of the labelings are *graceful labeling*, *harmonious labeling*,*magic labeling*, *antimagic labeling*, *geometric labeling*, *mean labeling*, *irregular labeling* and so on.

Most graph labeling methods trace their origin to β- valuation introduced by

Rosa[7], later on Solomon W. Golomb[3] called as *graceful labeling.*The graceful labeling of a graph G with q edges is an injection from the vertices of G to the set $\{0, 1, 2, \ldots, q\}$ such that when each edge xy is assigned the label $|f(x)–f(y)|$, the resulting edge labels are distinct.

In 1985, Lo[6] introduced a labeling for the graph G called edge graceful labeling, which is a bijection f from the set of edges $E(G)$ to the set $\{1, 2, \ldots, q\}$ such that the induced map f^* from the set of vertices $V(G)$ to $\{0, 1, 2, \ldots, (p-1)\}$ given by $f^*(u) = \sum_{uv \in E(G)} f(uv)$ $(mod\ p)$ is a bijection. A graph which admits edge graceful labeling is called an edge graceful graph.

In 1991, Gnanojothi[2] introduced odd graceful labeling as an injection f from $V(G)$ to the set $\{0, 1, 2, \ldots, (2q-1)\}$ such that when each edge xy is assigned the label $|f(x)–f(y)|$, the resulting edge labels are in the set $\{1, 3, 5, \ldots, (2q-1)\}$.

In 2009, Solairaju and Chithra[10] introduced a labeling of G called *edge odd graceful labeling.* A graph G with p vertices and q edges is said to have edge - odd graceful labeling if there is a bijection f from the edges of the graph to the set $\{1, 3, \ldots, (2q-1)\}$ such that, where each induced vertex is assigned the sum of all the edges incident to it mod $2q$, the resulting vertex labels are distinct. The graph G that admits edge odd graceful labeling is called edge - odd graceful graph.

Solairaju and Chithra [11] have proved the following graphs are edge - odd graceful: paths with atleast 3 vertices, odd cycles, ladders $P_n \times P_2$ $(n \geq 3)$, stars with an even number of edges, the graph $P_m \ominus Sn$, the Graph $P_m + P_n$ and crowns $C_n \odot K_1$. In [10], they have proved the following graphs have edge - odd graceful labelings: P_n $(n > 1)$ with a pendant edges attached to each vertex (Hoffman Tree), the graph obtained by appending $(2n + 1)$ pendent edges to each endpoints of P_2 or P_3, and the graph obtained by subdividing each edge of the star $K_{1,2n}$. A. Sajiya Merlin Mahizl, J. Jeba Jesintha and G. V. Saranya[8] proved that uniform n - wheel split graph admits Edge-odd graceful labeling. Jeba Jesintha and Ezhilarasi Hilda[4] proved that the shell butterfly graphs are edge - odd graceful. S.N. Daoud[1] proved the following graphs to be edge odd graceful: wheel graphs, helm graphs, web graphs, double wheel graphs, gear graphs, fan graphs, double fan graphs, polar grid graphs.Seoud and Salim[9] have shown the edge odd graceful labeling for the following families of

graph W_n for $n \equiv 1,2,3 \pmod 4$, $C_n \odot K_{2m-1}$, even helms, $P_n \odot K_{2m}$ and $K_{2,s}$.

2 Preliminaries

Definition 2.1

A circus tent graph is obtained by adjoining pendant vertex i of the comb graph C_n to the vertex i of the graph G leaving the center vertex. We denote the graph by CCT_n, when $n \geq 5$. See Figure 1

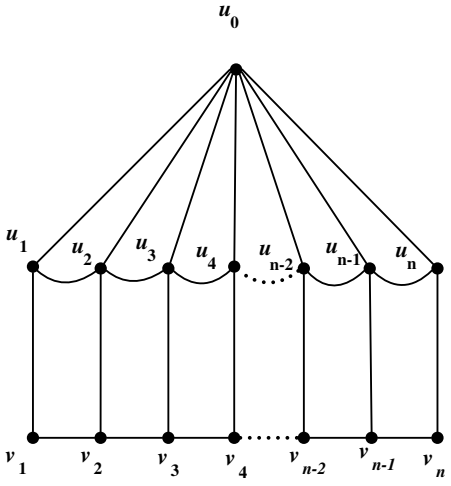

Figure 1: Circus tent graph, CCT_n

Definition 2.2

The frock graph is obtained from 3 – cycle u_0, u_1, u_2 by adjoining u_0 with a fan graph F_n in such a way that u_0 is an apex of F_n. We denote the graph by FG_n, where n$\geq$ 5. See Figure 2

3 Main results

In this section we prove that the circus tent graph and frock graph admits edge odd graceful labeling

Theorem 1. *The circus tent graph CCT_n is an edge odd graceful graph.*

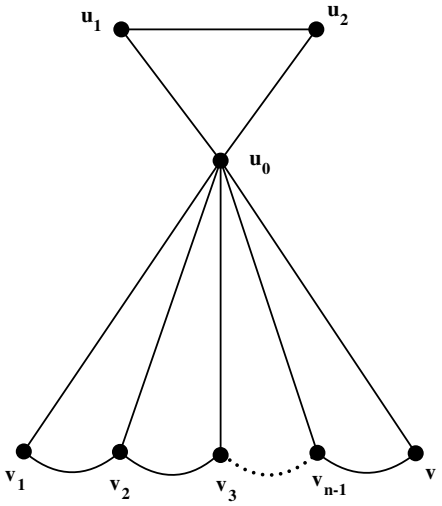

Figure 2: A frock graph,FG_n

Proof. Let G denote the circus tent graph. Let $|V(G)| = p$ and $|E(G)| = q$. Let u_1, u_2, u_3, ..., u_n adjacent to u_0 and v_1, v_2, v_3, ..., v_n respectively.
$E(CCT_n) = \{u_0u_i,\ u_iv_i \mid i = 1\ \ to\ \ n\} + \{u_iu_{i+1},\ v_iv_{i+1} \mid i = 1\ \ to\ \ n-1\}$ be the edge set of G. We first label the edges of G as follows.

$$f(u_0u_i) = 8n\text{–}2i - 3, \quad 1 \le i \le n \tag{1}$$

$$f(u_iv_i) = 6n\text{–}2i - 3, \quad 1 \le i \le n \tag{2}$$

$$f(u_iu_{i+1}) = 4n\text{–}2i - 3, \quad 1 \le i \le n-1 \tag{3}$$

$$f(v_iv_{i+1}) = 2i - 1, \quad 1 \le i \le n-1 \tag{4}$$

The induced mapping are the vertex labels given below

$$f^*(u_0) = \{\sum f(u_0u_i) \mid 1 \le i \le n\}(mod|8n-4|) \tag{5}$$

$$f^*(u_1) = 2(n-3) - 1 \tag{6}$$

$$f^*(u_n) = 4(n-3) \tag{7}$$

$$f^*(v_1) = 6(n-1) + 2 \tag{8}$$

$$f^*(v_n) = 6(n-2) + 6 \tag{9}$$

$$f^*(v_{i+1}) = f^*(v_1) + 2i - 1, \quad 1 \le i \le n-2 \tag{10}$$

$$f^*(u_{i+1}) = (22n\text{–}8i\text{–}18)(mod|8n-4|), \quad 1 \le i \le n-2 \tag{11}$$

From (1) to (4) we see that all the edge labels are odd and distinct. It is clear from

(5) to (11) that all the vertex labels $f^*(u_0)$, $f^*(u_1)$, $f^*(u_n)$, $f^*(v_1)$, $f^*(v_n)$, $f^*(v_{i+1})$ and $f^*(u_{i+1})$ are distinct. The edge odd graceful labeling for circus tent graph is given by

$$f^*(V(CCT_n)) \quad = \quad \{\sum f(uv) \mid 1 \leq i \leq n\}(mod|8n-4|).$$

Hence, the graph G admits edge odd graceful labeling.

Illustration

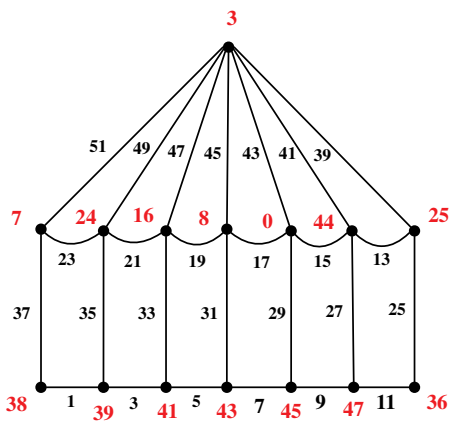

Figure 3: EOGL of circus tent graph,CCT_7

□

Theorem 2. *The frock graph FG_n is an edge odd graceful graph.*

Proof. Let G denote the frock graph. Let $|V(G)| = p$ and $|E(G)| = q$.Let u_0, u_1, u_2 be the vertices of 3 – cycle. Let the vertices of the fan graph F_n adjoining u_0 be v_1, v_2, v_3,. . . ,v_n. Here, u_0 is an apex of F_n.
$E(FG_n) = \{v_iv_{i+1},\ u_0v_i,\ v_ju_0,\ u_1u_2 \mid i = 1\ to\ n,\ j = 1\ to\ 2\}$ be the edge set of the graph G. The edge labels of G are as follows.

$$f(v_iv_{i+1}) \quad = \quad 2i-1, \quad 1 \leq i \leq n-1 \tag{12}$$

$$f(u_0v_i) \quad = \quad 4n\text{–}2i+3, \quad 1 \leq i \leq n \tag{13}$$

$$f(u_ju_0) \quad = \quad 2n\text{–}2j+3, \quad 1 \leq j \leq 2 \tag{14}$$

$$f(u_1u_2) \quad = \quad 4(n+1)-1, \quad j = 1 \tag{15}$$

The induced vertex labels of G are as follows.

$$f^*(u_j) = 2(n-j+1), \quad 1 \le j \le 2 \tag{16}$$

$$f^*(u_0) = \{\sum f(u_j u_0) + \sum f(u_0 v_j) | 1 \le j \le 2, 1 \le i \le n\} (mod|4n+4|) \tag{17}$$

$$f^*(v_1) = 4n+2 \tag{18}$$

$$f^*(v_n) = 4n \tag{19}$$

$$f^*(v_2) = f^*(v_1) + 1 \tag{20}$$

$$f^*(v_{i+2}) = 2(i+2) - 5, \quad 1 \le i \le n-3 \tag{21}$$

$$f^*(v_{i+2}) = 2(i+2) - 5, \quad 1 \le i \le n-3 \tag{22}$$

From (12) to (15) we see that all the edge labels are odd and distinct. It is clear from (16) to (21) that all the vertex labels $f^*(u_0)$, $f^*(u_j)$, $f^*(v_2)$, $f^*(v_1)$, $f^*(v_n)$ and $f^*(v_{i+2})$ are distinct. The edge odd graceful labeling for frock graph is given by

$$f^*(V(FG_n)) = \{\sum f(u_i v_j) \mid 1 \le i \le n, \ 1 \le j \le 2\} (mod|4n+4|)$$

Hence, the graph G admits edge odd graceful labeling.

Illustration

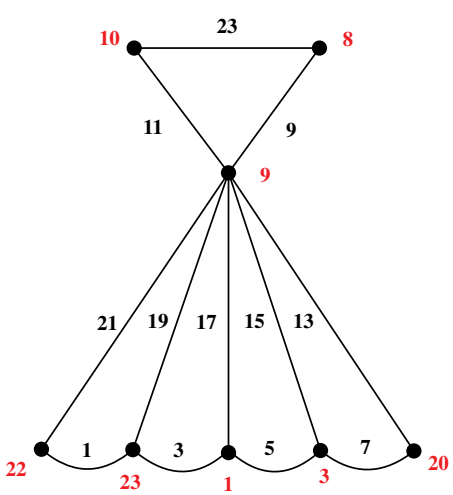

Figure 4: A frock graph,FG_5

4 Conclusion

In this paper, we have proved the edge odd gracefulness on Circus tent graph and frock graph.We intend to prove edge odd graceful labeling on Double circus tent graph and other graphs.

5 Acknowledgement

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References

[1] Daoud. S.N, "*Edge odd graceful labeling of some path and cycle related graphs*", AKCE International Journal of Graphs and Combinatorics, 14, (2017), pp. 178-203.

[2] Gnanajothi. R. B., "*Topics in Graph theory*", Ph.D thesis, Madurai Kamaraj University, (1991).

[3] Golomb S W, "*How to number a graph*". In: Read RC, editor. Graph theory and computing. New York (NY): Academic Press; (1972). pp. 23–37.

[4] Jeba Jesintha. J and Ezhilarasi Hilda. K, "*Shell butterfly graphs are edge odd graceful*", Internat. J. pure and Appl.Math., 101 Vol. 6 (2015) pp. 949 - 956.

[5] Joseph A. Gallian, " *A Dynamic Survey of Graph Labeling*", The Electronic Journal of Combinatorics, (1996-2018), pp. 73-76.

[6] Lo. S. P, "*On edge-graceful labelings of graphs*", Congr.Numer. Vol. 50 (1985) pp.231-241.

[7] Rosa. A, "*On certain valuations of the vertices of a graph*", Theory of Graphs(Inter-nat Symposium, Rome, July1966), Gordon and Breach, N.Y and Dunod Paris, (1967), pp. 349 - 355.

[8] Sajiya Merlin Mahizl A, Jeba Jesintha J, G.V. Saranya, "*Edge-odd graceful labelling of uniform n-wheel split graph*", South East Asian Journal of Math. and Math. Sci., Vol. 14, No. 3 (2018), pp. 127-132.

[9] Seoud and Salim. M. A, "*Further results on edge odd graceful graphs*", Turkish J.Math., Vol. 40, No.3 (2016), pp. 647 - 656.

[10] Solairaju. A, Chitra. K, "*Edge odd graceful graphs*", Electron. Notes Discrete Math. 33 (2009), pp.15 - 20.

[11] Solairaju. A, Chitra. K, "*Edge odd graceful labeling of some graphs*", proceedings of the ICMCS, Vol. 1 (2008) pp.101 – 107.

TOTAL COLOURING OF MIDDLE GRAPH OF KEY GRAPH

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Abstract

Total Colouring has been worked by many researchers for the past three decades. A total colouring of a graph G is an assignment of colours to the vertices and the edges such that no two adjacent and incident elements receive the same colour. In this paper, we have discussed the theorems on total colouring of middle graph of Key graph , also we have obtained the total chromatic number of middle graph of Key graph.

Keywords and Phrases : Total coloring, Middle graphs, cyclic graphs.

1 Introduction

In this paper we have considered the simple, finite and undirected graphs.Let G be a graph represented by $G = (V(G), E(G))$ where $V(G)$ is the vertex set of G and $E(G)$

is the edge set of G. The concept of total coloring was introduced by Behzad[1] in 1965.Total colouring is extensively used in match scheduling, art, network task efficiency. A total coloring of G, is a function $f : S \to C$, where $S \to V(G) \cup E(G)$. and C is a set of colors to satisfies the given conditions.

(i) no two adjacent vertices receive the same colors,

(ii) no two adjacent edges receive the same colors and

(iii) no edges and its end vertices receive the same colors.

The total chromatic number of a graph G is the minimum cardinality k such that G may have a total coloring by k colors. Behzad[1] and Vizing[2] conjectured that for every simple graph G has $\Delta + 1 \leq \chi^{''}(G) \leq \Delta + 2$, where $\Delta(G)$ is the maximum degree of G. This conjecture is called the Total Coloring Conjecture (TCC). Rosenfeld[8] and Vijayaditya[9] verified the TCC, for any graph G with maximum degree $\leq$3. Muthuramakrishnan et.al[5] proved the total chromatic number of middle graph and total graph of Path and Sunlet graph. Sudha et.al[7] obtained the toatl coloring of $S(n, m)$ graph. Vaidhya et.al computed the total chromatic number of some cycle related graphs. In this paper we obtain the total chromatic number of middle graph of $M(\mathcal{K}_{m,n})$.

2 PRELIMINARIES

Definition

The middle graph of a graph G denoted by $M(G)$ is defined as follows, the vertex set of $M(G)$ is $V(G) \cup E(G)$. Two vertices x, y in the vertex set of $M(G)$ are adjacent in G in case one of the following condition holds (i) x, y are in $E(G)$ and x, y is adjacent in G (ii) x is in $V(G)$, y is in $E(G)$ and x, y are incident in G.

Definition

The Key graph $\mathcal{K}_{m,n}$ is obtained by joining an edge between one vertex of cycle C_m and a vertex of degree two of Hoffman tree $P_n\theta K_1$.

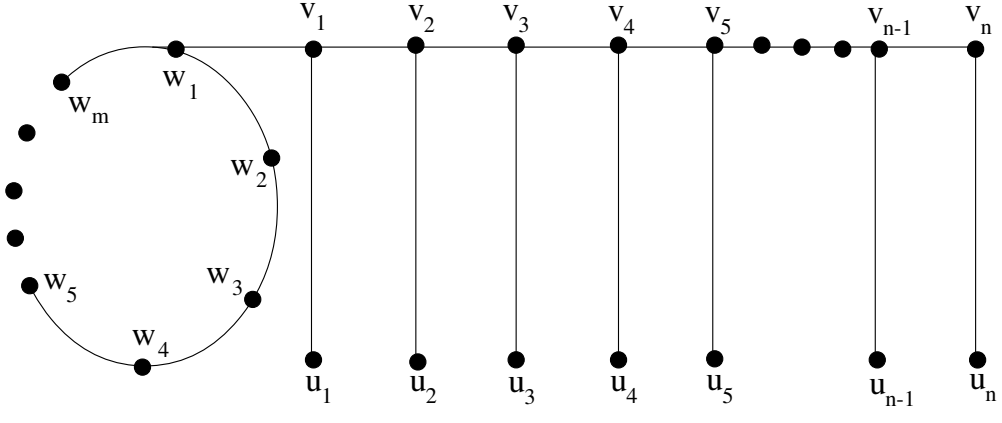

Figure 1: Key Graph $\mathcal{K}_{m,n}$

3 TOTAL COLORING OF MIDDLE GRAPH OF KEY GRAPH

Theorem3.1

Let $M(\mathcal{K}_{m,n})$ be the middle graph of Key graph $\mathcal{K}_{m,n}$ then $\chi''(M(\mathcal{K}_{m,n})) = \Delta + 1$ for $n, m \geq 3$.

Proof. Let G be the Key graph $\mathcal{K}_{m,n}$ obtained by joining a edge between one vertex of cycle C_m with m vertices and a vertex of degree two of Hoffman tree $P_n\theta K_1$ with n vertices. Let $(v_1, v_2, v_3, ..., v_n)$, $(u_1, u_2, u_3, ..., u_n)$ and $(w_1, w_2, w_3, ..., w_n)$ be the vertices of Key graph and let $(e_1, e_2, e_3, ..., e_n)$, $(e_1', e_2', e_3', ..., e_n')$ and $(e_1'', e_2'', e_3'', ..., e_n'')$ be the

edges of Key graph where $e_i = v_i v_{i+1}$ for $1 \leq i \leq n-1$, $e_i^{'} = v_i u_i$ for $1 \leq i \leq n$, $e_i^{''} = w_i w_{i+1}$ $1 \leq i \leq n-1$ and $w_n w_1$ and $v_1 w_1$ be the edge connecting the vertices v_1 and w_1. By the definition of middle graph each edges $e_i = v_i v_{i+1}$, $e_i^{'} = v_i u_i$ and $e_i^{''} = w_i w_{i+1}$ are subdivided by the vertices $v_i^{'}$, $1 \leq i \leq n$, $u_i^{'}$, $1 \leq i \leq n$ and $w_i^{'}$, $1 \leq i \leq n$ and r in $M(\mathcal{K}_{m,n})$

Therefore the vertex and edge set of $M(K_n)$ is given by

$V(M(\mathcal{K}_{m,n})) = \{(v_i,\ 1 \leq i \leq n) \cup (v_i^{'},\ 1 \leq i \leq n) \cup (u_i,\ 1 \leq i \leq n) \cup (u_i^{'},\ 1 \leq i \leq n)$
$\cup\ (w_i,\ 1 \leq i \leq m) \cup (w_i^{'},\ 1 \leq i \leq m)\}$

$E(M(\mathcal{K}_{m,n}))= \{(v_i v_i^{'},\ 1 \leq i \leq n-1) \cup (v_i^{'} v_{i+1},\ 1 \leq i \leq n-1) \cup (v_i^{'} v_{i+1}^{'},\ 1 \leq i \leq n-2)$
$\cup\ (v_i u_i^{'},\ 1 \leq i \leq n) \cup (u_i u_i^{'},\ 1 \leq i \leq n) \cup (w_i w_i^{'},\ 1 \leq i \leq m) \cup (w_i^{'} w_{i+1},\ 1 \leq i \leq m-1)$
$\cup\ (w_i^{'} w_{i+1}^{'},\ 1 \leq i \leq m-1) \cup (w_n^{'} w_1^{'}) \cup (w_n^{'} w_1) \cup (w_n^{'} r) \cup (v_1 r) \cup (v_1^{'} r)\}$.

We define the total coloring f such that $f : S \to C$ as follows, where $S = V(M(\mathcal{K}_{m,n})$ $\cup\ E(M(\mathcal{K}_{m,n}))$ and C=(1, 2, 3, 4, 5, 6, 7). The total coloring is obtained by coloring the vertices and edges as follows

Case 1 : When n,m is even

$$f(v_i) = \begin{cases} 1, if\ \ i\ \ is\ \ odd & 1 \leq i \leq n \\ 2, if\ \ i\ \ is\ \ even \end{cases} \tag{3.1}$$

$$f(w_i^{'}) = \begin{cases} 2, if\ \ i\ \ is\ \ odd & 1 \leq i \leq m \\ 3, if\ \ i\ \ is\ \ even \end{cases} \tag{3.2}$$

$$f(v_i^{'}v_{i+1}^{'}) = \begin{cases} 2, if\ \ i\ \ is\ \ odd & 1 \leq i \leq n-2 \\ 1, if\ \ i\ \ is\ \ even \end{cases} \tag{3.3}$$

$$f(v_i^{'}) = \begin{cases} 3, if\ \ i\ \ is\ \ odd & 1 \leq i \leq n-1 \\ 4, if\ \ i\ \ is\ \ even \end{cases} \tag{3.4}$$

$$f(v_i^{'}v_i) = \begin{cases} 4, if\ \ i\ \ is\ \ odd & 1 \leq i \leq n-1 \\ 3, if\ \ i\ \ is\ \ even \end{cases} \tag{3.5}$$

$$f(u_i^{'}v_i) = \begin{cases} 2, if\ \ i\ \ is\ \ odd & 1 \leq i \leq n \\ 1, if\ \ i\ \ is\ \ even \end{cases} \tag{3.6}$$

$$f(w_i^{'}w_{i+1}^{'}) = \begin{cases} 6, if\ \ i\ \ is\ \ odd & 1 \leq i \leq m-1 \\ 7, if\ \ i\ \ is\ \ even \end{cases} \tag{3.7}$$

For $1 \leq i \leq n, m$,

$$f(u_i) = 2, f(u_i^{'}) = f(w_i^{'}w_i) = 5, f(u_i^{'}u_i) = 4, f(w_i) = 1$$

For $1 \leq i \leq n-1, m-1$,

$$f(w_i^{'}w_{i+1}) = f(r) = f(w_m^{'}w_1) = 4, f(v_i^{'}v_{i+1}) = 5$$

$$f(w_m^{'}w_1^{'}) = f(rv_1^{'}) = 1, f(w_m^{'}r) = 2, f(w_1^{'}r) = 7, f(rv_1) = 5$$

Case 2 : When n,m is odd

$$f(v_i) = \begin{cases} 1, if\ \ i\ \ is\ \ odd & 1 \leq i \leq n \\ 2, if\ \ i\ \ is\ \ even \end{cases} \tag{3.8}$$

$$f(w_i^{'}) = \begin{cases} 2, if\ \ i\ \ is\ \ odd & 1 \leq i \leq m-1 \\ 3, if\ \ i\ \ is\ \ even \end{cases} \tag{3.9}$$

$$f(v_i^{'}v_{i+1}^{'}) = \begin{cases} 2, if\ \ i\ \ is\ \ odd & 1 \leq i \leq n-2 \\ 1, if\ \ i\ \ is\ \ even \end{cases} \tag{3.10}$$

$$f(v_i^{'}) = \begin{cases} 3, if\ \ i\ \ is\ \ odd & 1 \leq i \leq n-1 \\ 4, if\ \ i\ \ is\ \ even \end{cases} \tag{3.11}$$

$$f(v_i^{'}v_i) = \begin{cases} 4, if\ \ i\ \ is\ \ odd & 1 \leq i \leq n-1 \\ 3, if\ \ i\ \ is\ \ even \end{cases} \tag{3.12}$$

$$f(u_i^{'}v_i) = \begin{cases} 2, if\ \ i\ \ is\ \ odd & 1 \leq i \leq n \\ 1, if\ \ i\ \ is\ \ even \end{cases} \tag{3.13}$$

$$f(w_i^{'}w_{i+1}^{'}) = \begin{cases} 6, if\ \ i\ \ is\ \ odd & 1 \leq i \leq m-1 \\ 7, if\ \ i\ \ is\ \ even \end{cases} \tag{3.14}$$

For $1 \leq i \leq n, m$,

$$f(u_i) = 2, f(u_i^{'}) = f(w_i^{'}w_i) = 5, f(u_i^{'}u_i) = 4$$

For $1 \leq i \leq n-1, m-1$,

$$f(w_i^{'}w_{i+1}) = f(r) = f(w_m^{'}w_1) = 4, f(v_i^{'}v_{i+1}) = 5, f(w_m^{'}) = 6$$

$$f(w_m^{'}w_1^{'}) = f(rv_1^{'}) = 1, f(w_m^{'}r) = 2, f(w_1^{'}r) = 7, f(rv_1) = 5, f(w_m^{'}) = 6$$

The generalisation follows the same when n is odd and m is even as in case 1 and when n is even and m is odd as in case 2 respectively.

Hence by the above rule of total coloring the graph $M(\mathcal{K}_{m,n})$ is properly total colored with $\Delta + 1$ colors for all $n, m \geq 3$. □

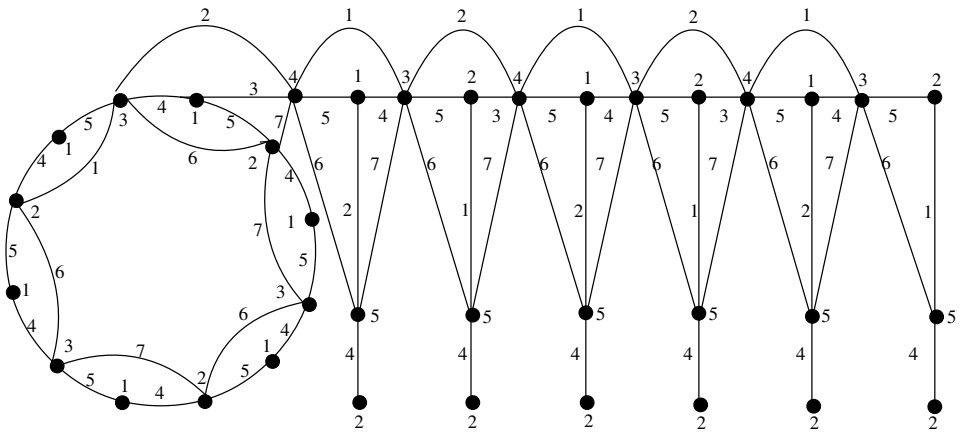

Figure 2: Total coloring of middle graph of Key Graph $\mathcal{K}_{6,6}$

4 conclusion

The total coloring of middle graph of key graph and anklet graph are discussed in the paper and found the total chromatic number to be

$\chi^{''}(M(\mathcal{K}_{m,n})) = \Delta + 1$ for $n, m \geq 3$.

Acknowledgement

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References

[1] Behzad .M, Graphs and their chromatic numbers, Doctoral Thesis, Michigan State university, (1965).

[2] Behzad .M, Total concepts in graph theory, ArsCombin. 23, (1987), 35-40.

[3] Hamada .T and Yoshimura .I, Travelsability and connectivity of middle graph of a graph, Dis. Math, 17 (1976) 247 – 255.

[4] Muthuramakrishan .D and Jayaraman .G, Total Chromatic Number of Star and Bistar graphs, International Journal of Pure and Applied Mathematics, 117 (21) (2017), 699-708.

[5] Muthuramakrishan .D and Jayaraman .G, Total Chromatic Number of Middle and Total Graph of Path and Sunlet graph graph, International Journal of Scientific and Innovative Mathematical Research, 4 (6) (2018), 1-9.

[6] Sharon Philomena. V, Manjula. M"Difference Cordial Labeling on Special Graph" ,Proceedings of National Conference on Mathematics and Computer Applications.

[7] Sudha .S and Manikandan .K, Total coloring of S(n, m) graph., International Journal of Scientific and Innovative Mathematical Research, 2(1) (2014), 16-22.

[8] Rosanfeld .M, On the total colouring of certain graphs, Israel J. Math. 9 (1972), 396-402.

[9] Vijayaditya .N, On total chromatic number of a graph, J. London Math Soc.2, 3(1971),405-408.

TOTAL COLORING OF SPLITTING GRAPH OF CHEMICAL NETWORKS

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Abstract: A total coloring for a graph G is an assignment of colors to the elements of graph G such that no two adjacent or incident elements receive the same color. Also, the splitting graph is formed by adding a new vertex v' corresponding to every other vertex that is adjoining to v in G. In this paper, we prove the total coloring of splitting graph of some chemical networks.

Keywords: Total Coloring, Total Chromatic Number, Splitting Graph.

1 Introduction and Preliminaries

Graph theory is a branch of Mathematics which is rapidly expanding and widely used in various field. Let $G = (V(G), E(G))$ be a graph with the vertex set $V(G)$ and the edge set $E(G)$, respectively. A coloring of graph is the assignment of colors to the vertices or edges or both. A graph assigned with minimum number of colors so that no adjacent element receive the same color is said to be proper coloring. There are so many different proper coloring such as a-coloring, b-coloring, star coloring, list coloring, harmonious coloring, total coloring etc. In this paper, we work on total coloring of graphs.

A **total coloring** of G is a function $f : S \to C$, where $S = V(G) \cup E(G)$ and C is a set of colors which satisfies the following conditions that no two adjacent vertices and edges receive the same color and an edges with its end vertices should not receive the same color. The total chromatic number is denoted by $\chi''(G)$ is the minimum number of colors assigned to a graph. Behzad [1] introduced the concept of total coloring and along with Vizing [8] proved that for every simple graph G has $\Delta(G) + 1 \leq \chi''(G) \leq \Delta(G) + 2$, where $\Delta(G)$ is the maximum degree of the graph G. This conjecture is called as the **Total Coloring Conjecture**(TCC). In 1989, Yap et.al [9] showed that the TCC (Total Coloring Conjecture) is true for any graph G of order n having maximum degree atleast $n - 4$. Sudha et.al [6] proved that total chromatic number of sudha grid graphs, gear and crown graphs. Rosenfeld [4] and Vijayaditya [7] verified the TCC, that for every graph G with maximum degree ≤ 3 and Kostochka [2] for maximum degree ≤ 5. Muthuramakrishnan et.al [3] prove that total total coloring of splitting graph of path, cycle and star graph. In this paper, we discussed the total coloring of silicate network and splitting graph of a silicate network.

Definition 1.1. *For a graph G, the concept of splitting graph $S'(G)$ introduced by Sampathkumar et.al [5] states that $S'(G)$ is formed by including a new vertex v' which is linked to every other vertex that is adjoining to v in G.*

Definition 1.2. *The **degree of a vertex** v, denoted $deg(v)$, is the number of edges incident on v. The **maximum degree of a graph** G, denoted $\Delta(G)$, is the maximum degree of its vertices. The **neighbourhood of a vertex** v, denoted $N(v)$, is the set of vertices that are adjacent to v.*

2 Main Result

A **Silicate network** $SL(1)$ is a cyclic silicate with six (sio_4) tetrahedron units. The corner vertices represents the oxygen ions and the centre vertex represents the silicon ion. Let us denote these vertices as $V((SL)_n)$ and edges between these vertices as $E((SL)_n)$ respectively.

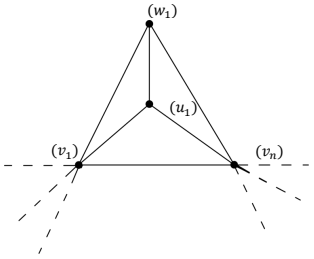

Figure 1: **Silicate structure**

Theorem 2.1. *Let $(SL)_n$ be the silicate network then*

$$\chi''((SL)_n) = \begin{cases} \Delta + 1 \ , & for \ \ n = 3 \\ \Delta + 2 \ , & for \ \ 4 \leq n \leq 6 \end{cases}$$

Proof. Let $(SL)_n$ be a silicate network with $3n$ vertices and $6n$ edges where n denotes the number of tetrahedron. We denote the vertices and edges of the silicate network as follows:

Let $\{v_1, v_2, v_3, ...\}$ be the vertex connecting the tetrahedrons and let $\{u_1, u_2, u_3....\}$ and $\{w_1, w_2, w_3, ...\}$ be the inner vertices and the outer vertices of each tetrahedron. Let $\{\{u_iv_i, u_iw_i, v_iw_i : \text{for } 1 \leq i \leq n\} \cup \{v_iu_{i+1}, v_iv_{i+1}, v_iw_{i+1} : \text{for } 1 \leq i \leq n-1\} \cup \{w_1v_n\} \cup \{u_1v_n\} \cup \{v_1v_n\}\}$ be the set of edges in the network.

Now we define the total coloring $f : S \to C$ where $S = V((SL)_n) \cup E((SL)_n)$ and $C =$ set of colors. Now we assign the total coloring to the vertices and edges as follows,

Case (1)**. When** $\boldsymbol{n} = 3$

$$f(v_i) = \begin{cases} 3 \ , \text{ for all } \ i \equiv 1 \ mod \ 3 \\ 4 \ , \text{ for all } \ i \equiv 2 \ mod \ 3 \\ 5 \ , \text{ for all } \ i \equiv 0 \ mod \ 3 \end{cases} \qquad for \ 1 \leq i \leq n \tag{1}$$

$$f(u_i) = \begin{cases} 1 \ , \text{ if } \ i = odd \\ 2 \ , \text{ if } \ i = even \end{cases} \qquad for \ 1 \leq i \leq n \tag{2}$$

$$f(w_i) = \begin{cases} 2 \ , \text{ if } \ i = odd \\ 1 \ , \text{ if } \ i = even \end{cases} \qquad for\ 1 \le i \le n \tag{3}$$

$$f(w_i v_i) = \begin{cases} 4 \ , \text{ if } \ i = odd \\ 1 \ , \text{ if } \ i = even \end{cases} \qquad for\ 1 \le i \le n-1 \tag{4}$$

$$\begin{aligned} &f(w_i u_i) = 3, \ f(u_i v_i) = 7 \qquad for\ 1 \le i \le n-1 \\ &f(v_i u_{i+1}) = 6, \ f(v_i wi+1) = 5 \end{aligned} \tag{5}$$

$$f(u_1 v_n) = 6, \ f(w_1 v_n) = 2, \ f(u_1 v_n) = 6, \ f(w_1 v_n) = 2 \tag{6}$$

Case (2)**. When** $4 \le n \le 6$

$$f(v_i) = \begin{cases} 3 \ , \text{ if } \ i = odd \\ 4 \ , \text{ if } \ i = even \end{cases} \qquad for\ 1 \le i \le n \tag{7}$$

$$\begin{aligned} &f(u_i) = 1 \qquad for\ 1 \le i \le n \\ &f(w_i) = 2 \qquad for\ 1 \le i \le n \end{aligned} \tag{8}$$

$$f(v_i v_{i+1}) = \begin{cases} 1 \ , \text{ if } \ i = odd \\ 2 \ , \text{ if } \ i = even \end{cases} \qquad for\ 1 \le i \le n-1 \tag{9}$$

$$\begin{aligned} &f(u_i w_i) = 3, \ f(w_{i+1} v_i) = 5 \\ &f(u_{i+1} v_i) = 8 \qquad for\ 1 \le i \le n-1 \\ &f(w_i v_i) = 6, \ f(u_i v_i) = 7 \\ &f(w_1 v_n) = 5, \ f(u_1 v_n) = 8 \end{aligned} \tag{10}$$

In Both the cases, vertices and edges were coloured with distinct colours. According to the conjucture, silicate network is total colorable with $\Delta + 2$ colors. The above theorem is illustrated in Figure 2 and 3. □

Illustration:

Case 1: When $n \neq 3$

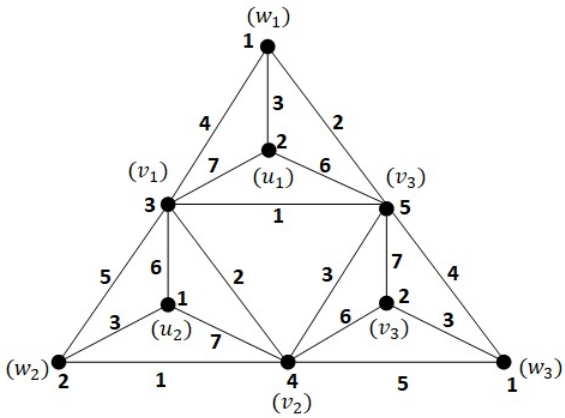

Figure 2: $\chi''(SL)_3 = \Delta((SL)_3) + 1$

Case 2: When $4 \leq n \leq 6$

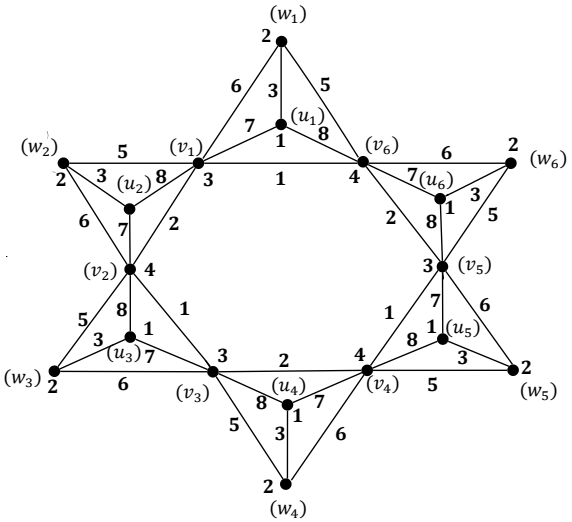

Figure 3: $\chi''(SL)_6 = \Delta((SL)_6) + 2$

Theorem 2.2. *Let $S'((SL)_n)$ be the silicate network then $\chi''(S'(SL)_n) = \Delta(S'(SL)_n) + 1$ for $n \leq 6$*

Proof. let $(SL)_n$ be a silicate network with $3n$ vertices and $6n$ edges.

By the definition of splitting graph, we introduce a new vertex $\{v_i', u_i', w_i' : for 1 \leq i \leq n\}$ corresponding to each vertex $\{v_i, u_i, w_i : for 1 \leq i \leq n\}$ in $(SL)_n$ which are added to obtain $S'((SL)_n)$ with $6n$ vertices and $12n$ edges respectively.

In $S'((SL)_n)$,the vertex set and edge set is given by

$$V(S'((SL)_n)) = \{v_i, u_i, w_i, v_i', u_i', w_i' : for 1 \leq i \leq n\}$$
$$E(S'((SL)_n)) = \{\{u_i'v_i, v_iw_i', u_iv_i', w_iv_i' : \text{for } 1 \leq i \leq n\} \cup \{u'_{i+1}v_i, v_iw'_{i+1}, u_{i+1}v_i', w_{i+1}v_i' : \text{for } 1 \leq i \leq n-1\} \cup \{w_1'v_n\} \cup \{u_1'v_n\} \cup \{v_1'v_n\} \cup \{v_1v_n'\} \cup \{u_1v_n'\} \cup \{w_1v_n'\}\}$$

Now we define the total coloring $f : S \to C$ where $S = V(S'(SL)_n) \cup E(S'(SL)_n)$ and $C =$ set of colors. Now we assign the total coloring to the vertices and edges as follows

$$f(v_i) = f(v_i') = \begin{cases} 3 \ , \text{ if } \ i = odd \\ 4 \ , \text{ if } \ i = even \end{cases} \qquad for\ 1 \leq i \leq n \tag{11}$$

$$\begin{aligned} f(u_i) &= f(u_i') = 1 \\ f(w_i) &= f(w_i') = 2 \end{aligned} \qquad for\ 1 \leq i \leq n \tag{12}$$

$$f(v_iv_{i+1}) = \begin{cases} 1 \ , \text{ if } \ i = odd \\ 2 \ , \text{ if } \ i = even \end{cases} \qquad for\ 1 \leq i \leq n-1 \tag{13}$$

$$\begin{aligned} &f(w_iv_i) = 6,\ f(u_iv_i) = 7,\ f(w_iv_i') = 8 && for\ 1 \leq i \leq n \\ &f(w_{i+1}v_i) = \ f(u_iw_i) = 3 \\ &f(v_i'w_{i+1}) = 7,\ f(u_{i+1}v_i) = 8 \\ &f(v_iw_{i+1}') = f(v_i'u_{i+1}) = 9 && for\ 1 \leq i \leq n-1 \\ &f(w_i'v_i) = f(u_iv_i') = 10 \\ &f(v_i'v_{i+1}) = 11,\ f(v_iv_{i+1}') = \ f(u_i'w_i) = 12 \end{aligned} \tag{14}$$

$$f(w_1v_n) = 5,\ f(w_iv_n') = 7\ f(u_1v_n) = 8$$
$$f(w_1'v_n) = f(u_i1v_n') = 9\ f(v_1v_n') = 11 \tag{15}$$

by using the total coloring pattern given in theorem 2 we conclude that, the total chromatic number of splitting graph of silicate network is Δ +1 colorable.

Illustration:

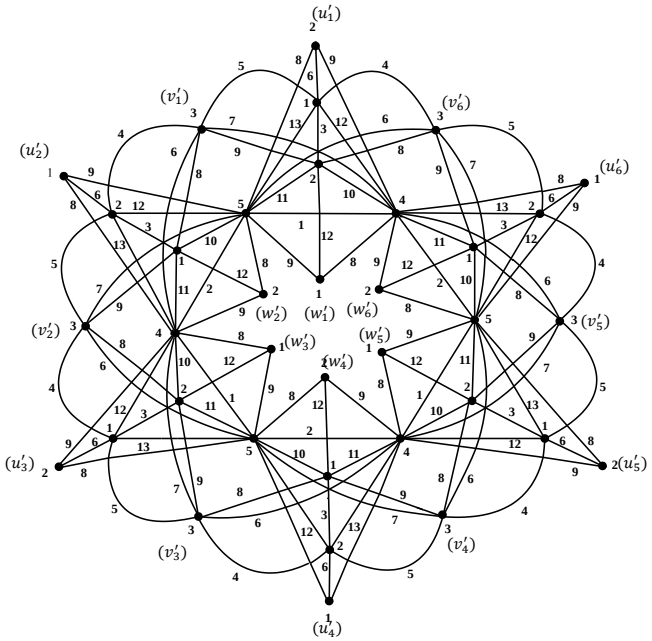

Figure 4: $\chi''(S'(SL)_6) = \Delta(S'(SL)_6)\ +\ 1$

3 Conclusion:

The Total Coloring of Splitting graph of silicate network are obtained and proved in this paper. The proof enables that the allotment of colors to any splitting graph of structural network is total colorable and has $\Delta + 1$ type. The variation of chromatic number on networks shows the speed of reaction between two molecule in the structure where the vertices are represented as molecules and bond between them as edges. Thus, we conclude that chemical networks are total colorable.

Acknowledgement

I express my sincere gratitude to the Principal, Head and Deans of Research, WCC for financial support through students seed grant.

References

[1] Bezhad, "Graphs and their chromatic numbers", Doctoral thesis, Michigan state University,(1965).

[2] Kostochka.V.A, "The total coloring of a multigraph with maximal degree 4", Discrete Math., 17(1989), 161-163.

[3] Muthuramakrishnan.D and Jayaraman.G,"Total Chromatic Number of Star and Bistar graphs", International Journal of Pure and Applied Mathematics, 117(21)(2017), 699-708.

[4] Rosenfeld.M, "On the total colouring of certain graphs", Israel J. Math., 9(3) (1971), 396-402.

[5] Sampathkumar.E and Walikar.B.H, "On spliting graph of a graph", J. Karnatak Univ. Sci., 25 and 26 (Combined) (1980- 81),13-16.

[6] Sudha.S and Manikandan.K, "Total chromatic number of Sudha grid graphs, gear and crown graphs", International Journal of Pure and Applied Mathematics, 109(8) (2016), 7-15.

[7] Vijayaditya.N, "On total chromatic number of a graph", J.London Math Soc., 3(2) (1971), 405-408.

[8] Vizing.G.V, "Some unsolved problems in graph theory", Uspekhi Mat. Nauk (in Russian), 23(6) (1968), 117-134.

[9] Yap.P.H, Wang Jian-Fang and Zhang Zhongfu, "The chromatic number of graphs of high degree", J. Austral. Math. Soc., (Series-A), 47 (1989), 445-452

PLANT MONITORING SYSTEM USING IoT FOR COLLEGE CAMPUS

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ABSTRACT - The plant monitoring system employs a variety of components to maintain the health of plants and crops by monitoring and warning the user to any issues, allowing the plants/crops to be protected and well-cared for. The number of crops grows as our campus's gardening project becomes more effective. Manual crop health management requires a lot of time and effort, and it may be very physically demanding. No single individual can personally regulate all of the variables. To quantify the problem, the notion of an automated plant monitoring system employing IoT comes into play. Using IoT (Internet of Things) technology, this device monitors moisture, temperature, and humidity levels. The sensors, which are attached to a microprocessor, collect data, which is then transferred to the microcontroller for assessment, after which it conducts the appropriate measures, such as starting the irrigation and cooling systems. People can benefit from the information provided by the soil moisture, temperature, and humidity sensors in this monitor system.

Keywords: Plant Monitoring system, IoT, Moisture, Temperature, Humidity

1. INTRODUCTION

The soil moisture, temperature, and humidity sensors in this monitoring system provide crucial information for people that can be employed in irrigation systems right away. Furthermore, due of their rapid set-up time and extended battery life, these IoT-enabled sensors have low maintenance costs. This method of monitoring will be incredibly useful for people who have little or no experience with planting and cropping. The communicator for health monitoring, for example, is beneficial to gardeners in a variety of ways. The Internet of Things (IoT) is a network of physical items, or "things," that are implanted with sensors, software, and other technologies that allow them to connect and share data with other devices and systems over the internet. The sensors on the microprocessor board capture data, which is then sent to the mobile app to be analysed. The soil moisture, temperature, and humidity sensors in this monitor system provide crucial information for people that can be used right away in irrigation systems. Furthermore, these IoT-enabled sensors have low maintenance costs due to their rapid setup time and high battery life. This method of monitoring will be highly useful for people who have little or no experience growing crops.

2. LITERATURE REVIEW

Juhi Maraskole, Shantanu Adewar, and Bhavish Urkude [1] proposed IOT-Based Smart Plant Monitoring System. Tensilica 32-bit RISC CPU Xtensa LX106, moisture sensor, DHT22, ESP8266

Wi-Fi module, and water pump are among the hardware components used in the system. This system is linked to Blynk, a piece of software. The DHT22 monitors relative humidity levels. A capacitive sensor element is used to monitor humidity. The input module comprising three sensors activates when the power supply is turned on, and it reads data from the earth and surrounds.

The motor will turn on or off depending on the values detected by the sensors. The motor will switch on if the moisture level is below the threshold value. If the moisture level is too high, the motor's water supply will be cut off. The ultrasonic sensor will detect if the water level in the tank is low. The readings acquired from the sensors are transferred to the ThingSpeak cloud server through the ESP8266 Wi-Fi module. The data obtained from the sensors via the Wi-Fi module will be used by the ThingSpeak server to produce a graph. The Blynk Android application will display the entire collection of data. The motor may also be controlled manually using the Android app.

Sambath. M, Prasanth. M, Bhargav Raghava. N, Jagadeesh. S [2] proposed IoT based Garden Monitoring System. In their system, the Arduino UNO is regarded as the brains of the operation. The Arduino UNO is linked to the soil moisture sensor, LM35 temperature sensor, LDR, and relay. LDR is also used to detect the presence of light. The complete system will function depending on the Arduino's coding instructions. The system's operation begins with the sensors detecting the environment. The sensor's acquired data will be shown on the LCD.

If the moisture level falls below the specified level, the water pump will turn on automatically with the aid of a relay. If the amount of sunshine is low, the LED will come on to alert the user. Its main goal is to help a plant grow by providing the right environment. It uses sensors like a moisture sensor to check the moisture in the soil, a temperature sensor to check the temperature across the plant, and a light sensor to test the availability of light, which is critical in the photosynthesis process. The relay will trigger automated watering if the moisture content is substantially lower than the critical threshold.

T. Thamaraimanalan, S.P. Vivekk, G. Satheeshkumar and P. Saravanan [3] proposed Smart Garden Monitoring System. The following components are used in this garden monitoring system: a NodeMCU, a moisture sensor, a temperature sensor, a humidity sensor, and an ultrasonic sensor for the water tank using IOT. A central microcontroller connects all of the components. A NodeMCU is used as a hub in the smart garden to connect various sensors such as moisture sensors, humidity sensors, temperature sensors, and ultrasonic sensors. The ultrasonic sensor is connected to a water tank and displays the tank's water level. Other sensors are connected to their appropriate locations, and these sensors provide data to the NodeMCU's built-in Wi-Fi.

The software establishes a connection between the application and Firebase. As a consequence, the user may monitor the parameters from wherever he or she is. The amount of water required in the garden is determined by the kind of soil. As a consequence, for automation purposes, the sensor values are specified within the programme. When the user needs to water the garden, a switch option in the application will automate the process.

Anusha. K, Dr U. B. Mahadevaswamy [4] proposed Automatic IoT Based Plant Monitoring and Watering System using Raspberry Pi. Raspberry Pi (Model B 3.1), LM35 Temperature sensor, Humidity sensor, Moisture sensor, Light sensor, IR sensor, Relay, motor, and power supply make up their monitoring and watering system. A server with a database and IoT allow the web-based

application are the software components of this system. When you power on the Raspberry Pi, the keyboard and mouse are automatically linked.

After logging onto the programme, the sensor gathers all data. Following that, a command path is supplied to run the script on the Raspberry Pi computer display, and the IP address established is utilised in the web application. Several metrics are displayed when accessing the programme, including temperature, humidity, light intensity, moisture sensor results, and the status of the land and surroundings. In addition, the infrared sensor detects whether an intruder has entered. The findings are instantly presented on the monitor. The programme also features a feature that allows the user to manually control the motor.

Gaurav Patil, Akash Patil and Shashank Pathmudi [5] proposed Plant Monitoring System. For their plant monitoring system, they employ a NodeMCU, a moisture sensor, a DHT11 sensor, a relay, and a motor. A capacitive soil moisture sensor was employed in this experiment. The output voltage of the sensor fluctuates in response to the soil moisture level. The output voltage drops when the soil is moist; when the soil is dry, the output voltage rises. The resistance between these electrodes, as well as the conductivity of the substrate, changes when the humidity changes. The Node MCU platform is an open-source Internet of Things platform.

The ESP8266EX provides a complete and self-contained WIFI networking solution, and it may either host or float WIFI networking functionality from another application processor. The water pump is turned on and off using the relay. The input modules for DHT11 moisture sensors start working as soon as the power is switched on. To communicate values to databases, APIs are employed. Based on the data collected by the sensors, the motor will turn on or off. The motor will turn on if the moisture and humidity levels fall below a specified threshold. The motor will stop and the water supply will be shut off if the moisture and humidity levels are too high.

3. CHALLENGES OF EXISTING SYSTEMS

- The existing models of plant monitoring systems are not user-friendly.
- They use complex mobile applications that ordinary people cannot operate.
- The mobile application has fewer features.

4. FEATURES ADDED

- The proposed system can monitor various plant types based on their requirements.
- Users can select the type of plant from an application.

5. COMPONENTS USED

Hardware components used in this project:

- Sensor – Soil Moisture sensor, DHT-11 sensor
- Control Unit – ATMega 328 microcontroller Embedded Board
- Output – LCD, Water Pump, Fan

Software components used in this project:

- Software Application
- Embedded C language

➢ **Soil Moisture sensor**

A soil moisture sensor is a low-cost electronic sensor used to monitor soil moisture in the past. This sensor can determine the volumetric amount of water inside the soil. The sensing probes and the

sensor module are the two main components of this sensor. Current may flow through the soil thanks to the sensor probes, and the resistance value is determined using the moisture content of the soil. The Sensor Module takes data from sensor probes, interprets it, and translates it into a digital or analogue output [6]. As a consequence, the soil moisture sensor may provide both digital and analogue outputs (AO).

- **DHT-11 sensor**

The DHT11 is a relative humidity sensor that may be utilized in a wide range of situations. To sense the ambient air, this sensor uses a thermistor and a capacitive humidity sensor. A capacitive humidity sensor and a thermistor for temperature sensing make up the DHT11 sensor. A moisture-holding surface acts as a dielectric between the humidity sensor capacitor's two electrodes. As the humidity level rises, the capacitance value varies. The resistance values are measured, processed, and converted into digital form by the IC. To monitor temperature, this sensor uses a Negative Temperature Coefficient Thermistor, which causes the resistance value to decrease as the temperature rises [7] . A digital signal is delivered as the output signal.

- **ATMega 328 microcontroller Embedded Board**

The ATmega328 is a microcontroller with Advanced Virtual RISC (AVR) capabilities. Embedded systems applications, such as this one, are where it's most commonly found. The ATmega328 contains a 32KB internal flash memory and supports 8-bit data processing. There are a total of 28 pins on it. Eight AC channels, six PWM pins, one comparator, and 23 input/output pins are included. The AT MEGA 328 chip can write several specified applications thanks to integrated C software downloaded from the computer into the flash memory. A wide variety of macros are included in the ATmega 328 library to make programming easy [8]. The chip is an open platform that may be utilised for a number of applications, making it more adaptive and versatile by allowing multiple transducer moduli to be employed.

- **Relay**

Relays are the most common switching device in electronics. Let's have a look at how we may use one in our circuits to meet the needs of our project. Before we proceed with the circuit to drive the relay, we need to look at two important relay properties. The Trigger Voltage is the voltage necessary to turn on the relay and flip the contact from Common->NC to Common->NO. The Load Voltage and Current is the greatest voltage or current that the NC, NO, or Common terminal of the relay can sustain in our example, 30V and 10A for DC. Check if the load you're using falls inside this range [9]. This is the load range to take into account.

- **USB/Serial Converter**

This gadget converts a typical USB connection into the 5V TX and RX signals that an Arduino requires for communication. Microcontrollers may be directly attached to a computer and communicate with it [10]. This version of the module has no soldered pins. The FTDI FT232RL chip is used.

6. ARCHITECTURE OF THE PROPOSED SYSTEM

The physical components of the proposed plant monitoring system include an ATmega 328 microcontroller, Floduino board, DHT11 temperature and humidity sensor, L293d motor driver, LCD motor, fan, and power supply. The Floduino board's power supply battery has been activated. When it gets energy, the sensor activates. It will also gather information from the environment. The soil

moisture sensor's sensor probes will always be buried in the soil. When the volumetric water content begins to fall over time and reaches the low limit, the motor driver is actuated, and water flows to the plant. The DHT11 sensor keeps track of the air's temperature and humidity. If the temperature surpasses a threshold value after a period of time, the LCD panel displays an alarm message. If the user is connected to the phone, the alerting message is sent directly to the mobile application through the Bluetooth module. Figure 1 shows the circuit diagram of the proposed system. When the relative humidity in the surrounding air falls below a certain level, a cooling fan in the system turns on. The fan pumps cooler air to the plants, replacing the hotter, denser air. On the LCD panel, the soil moisture, temperature, and relative humidity measurements are presented in real time.

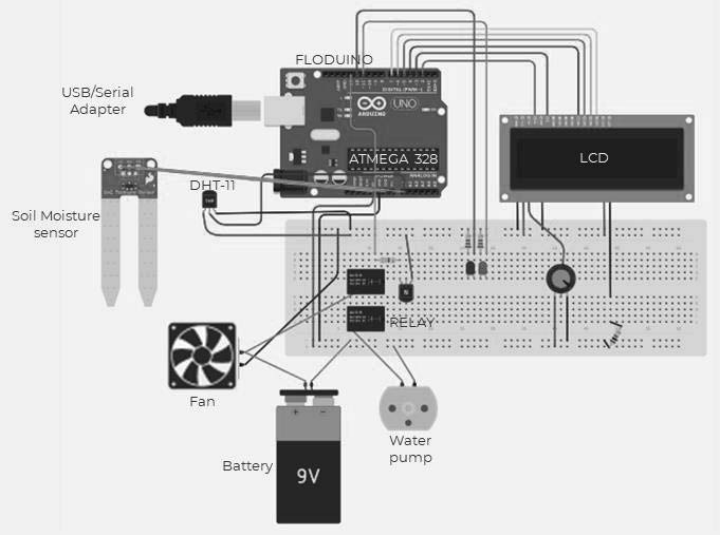

Figure 1 Circuit diagram of the proposed system

7. RESULTS AND DISCUSSION

The project's outcome accomplishes the target goal by detecting various plant factors and acting automatically without manual interference. The system was intended to make gardening and planting easier for people with plant knowledge. This automated plant monitoring system has succeeded in introducing innovative older functions by providing dynamic options for reviewing different types of plants around the college. The application offers for the initial setup of the system, the user needs to select the type of plant that is going to be monitored and the values are evaluated accordingly. A water pump is installed in the system that operated when the moisture content in the soil falls below a certain level. The water is provided to the plant until the moisture level increase and then it stops after reaching the threshold automatically. A cooling fan installed in the system operates when the temperature in the surrounding rises above a particular threshold. The fan eliminates the hotter, denser air and circulates cooler air to the plants. The soil moisture, temperature and relative humidity values are displayed on the LCD screen in real-time. Figure 2 shows the proposed plant monitoring system.

In all existing plant monitoring system it detects only soil moisture and humidity. In our proposed system we detected environmental temperature and controlling the cooling system is added. To summarise, the plant monitoring system can detect soil moisture,

humidity, and environmental temperature, and the correlating action of watering the plants and controlling the cooling system is operated accordingly. It thus substitutes manual plant monitoring in large-scale gardens; remote control via application is an additional asset for the end-user.

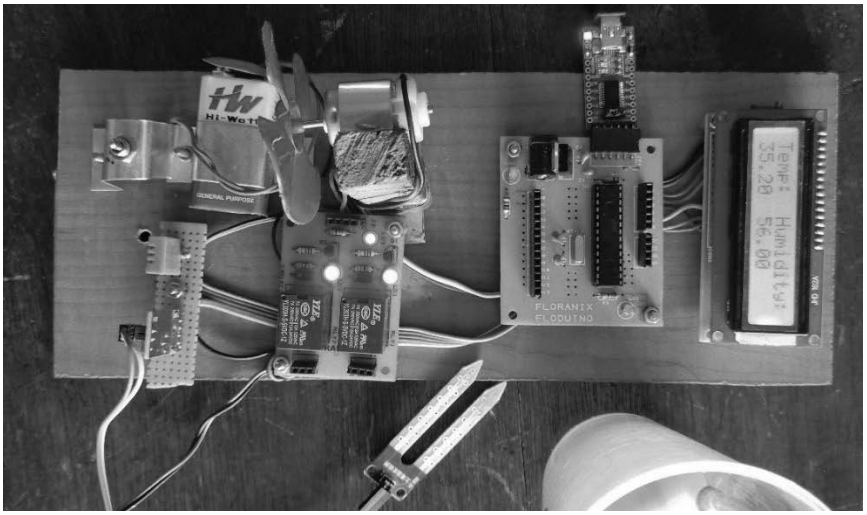

Figure 2 Proposed Plant Monitoring System

8. CONCLUSION

An IoT-based plant growth monitoring system is shown in the study. The proposed system was created and then installed for plants to monitor growth parameters such soil moisture content, temperature, and humidity. This suggested technique might be used to track plant development. The proposed method allows for real-time monitoring, which is difficult to do with manual approaches. The project included the creation of a system to monitor soil temperature, humidity, and moisture levels, as well as the study of current systems and their merits and drawbacks. One of the most water-intensive sectors is horticulture. The proposed system might be used to automate the watering process by turning the motor (on/off) based on favourable plant circumstances, i.e. sensor data. It is one of the most time-saving agricultural tasks, assisting in the reduction of soil over- or under-irrigation, and hence crop damage. The farm owner may view the operation online using the Front End Structure. This technique may well reduce water use and motor power consumption, enabling them to be conserved for future use. The use of IoT and automation in cropping might lead to major improvements, according to this research.

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REFERENCES

1) Anusha. K, U. B. Mahadevaswamy, "Automatic IoT Based Plant Monitoring and Watering System using Raspberry Pi", International Journal of Engineering and Manufacturing (IJEM), Vol.8, No.6, pp.55-67, 2018.DOI: 10.5815/ijem.2018.06.
2) Pravin, A., T. Prem Jacob, and P. Asha. "Enhancement of plant monitoring using IoT." Int. J. Eng. Technol. (UAE) 7.3 (2018): 53-55.
3) K. Lakshmi, S. Gayathri, “Implementation of IoT with Image processing in plant growth monitoring system”
4) “IoT Based Garden Monitoring System”, M Sambath et al 2019 J. Phys.: Conf. Ser. 1362 012069
5) “IoT based smart garden monitoring system using NodeMCU microcontroller”, Mubashir Ali, Nosheen Kanwal, Aamir Hussain, Fouzia Samiullah, Aqsa Iftikhar, Mehreen Qamar.
6) “Plant Monitoring System”, Gaurav Patil, Akash Patil, Shashank Pathmud, International Journal of Engineering Research & Technology (IJERT), Vol. 10 Issue 09, Sept-2021
7) “Smart Garden Monitoring System Using IOT”, T.Thamaraimanalan, S. P. Vivekk, G. Satheeshkumar and P.Saravanan, Asian Journal of Applied Science and Technology (AJAST), Vol. 02, Issue: 02, April-June 2018.
8) Kohli, Ankur, et al. "Smart plant monitoring system using IoT technology." Handbook of Research on the Internet of Things Applications in Robotics and Automation. IGI Global, 2020. 318-366.
9) Athawale, S. V., Mitali Solanki, Arati Sapkal, Ananya Gawande, and Sayali Chaudhari. "An IoT-Based Smart Plant Monitoring System." In Smart Computing Paradigms: New Progresses and Challenges, pp. 303-310. Springer, Singapore, 2020.
10) Prathamesh Pawar, Aniket Gawade, Sagar Soni, Santosh Sutar, Harshada Sonkamble. “IoT Based Smart Plant Monitoring System”, International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; Volume 10 Issue V, May 2022.

REMOVAL OF DYE FROM TEXTILE WASTEWATER USING ZERO VALENT IRON NANOPARTICLE

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ABSTRACT

Water is a precious commodity which is indispensable and is absolutely necessary for sustenance of life. Although 71% of the earth surface is covered with water which consists of nearly 97.5% salty water and 2.5% of freshwater, only 0,007% is available for drinking. The industrial wastes are a major source of the water pollution which contains various kinds of dyes and other pollutants. One of the most important serious environmental problems is the existence of harmful and toxic pollutants in the environment which are effluents from industries. Among industries, textile dyeing industries has a wide range of color dyes and bright hues. Over 70,000 tons of approximately 10,000 types of dyes and pigments are annually worldwide disposed of which 20 to 30% industrial effluents are those which are released during the textile curing and finishing process. The presence of these dyes in the hydrosphere possesses a significant source of pollution because of their visibility at very low concentration and their nature of recalcitrance which can lead to undesirable danger to the visibility of aquatic life such as sunlight penetration and resisting photochemical reaction. This waste water generated during the dyeing process increases chemical oxygen demand (COD), and Biology Oxygen Demand (BOD) levels of aquatic source. Therefore it is necessary to eliminate dye from wastewater effectively previous to their final discharge to the environment. The present study reports decolorization of textile dye by zero valent iron nanoparticle synthesized from neem extract.

Keywords : *Pollution, Industrial wastes, Textile Effluents, Decolorization, Neem and Zero Valent Iron Nanoparticle.*

INTRODUCTION

The industrial wastes are a major source of water pollution which contains various kinds of dyes and other pollutants. One of the most important serious environmental problem is the existence of harmful and toxic pollutants in the environment which are effluents from industrial or municipal source which contains thousand of chemicals out of which only a few are harmful for aquatic toxicity **[1]**. Textile industrial effluents are highly color dyes with

large amount of organic solid which is harmful to aquatic life by their ability to enhance mutagentic and carcinogenic effects. The dyestuff wastewaters are treated before discharge to minimize their threat to the environment. The common dyes includes reactive, disperse, acid and direct dyes. The discharge of wastewater without any treatment has an impact on the receiving water bodies crying out for an effluent treatment process. The releasing of dye into the surrounding water bodies has toxic effect on the human health and also marine life. Therefore removal of these dyes is necessary to protect the environment. This waste water generated during the dyeing process increases Chemical Oxygen Demand (COD), and Biology Oxygen Demand (BOD) levels of aquatic sources. Therefore it is necessary to eliminate large quantities of these dyes before they are discharged into the environment from the industries **[2]**.

DYES

Dyes are basically organic compounds that can connect themselves to the surface of fabrics to impart a color. The most commonly used dyes are classified as azo dyes, anthraquinone dyes, phthalocyanine, indigoid dyes, nitroso dyes, nitro dyes and triaryl methance dyes. The azo, anthraquinone and triaryl methane dyes are most important groups among these dyes. The reactive dyes and azo dyes usually form covalent bonds between the reactive group such as vinyl sulfone, chlorotraiazine, trichloro pyrimidine and difluro chloropyrimidline. In addition, dyes usually used in textile industry are cationic, anionic and non-ionic depending on their particle charge dissolution in aqueous solutions. The complex structure of dyes is ineffective in the presence of heat, light, microbes and even oxidizing agents which make it difficult to degrade. The presence of dyes in water affects sunlight penetration and oxygen solubility which decreases the water quality and thus creates difficulties for photosynthesis on aquatic flora and fauna **[3]**.

DYE REMOVAL TECHNIQUES

A wide range of technology has been use for the removal of dyes. They can be divided into three main categories: Biological methods, Chemical methods and Physical methods. High capital costs, low efficiency and generation of excess sludge limit their practical application. Some of these methods have been found to be more versatile and superior to other techniques and are appropriate for removing a wide range of dyes in wastewater. As a better alternative, adsorption offers the low initial cost, producing nontoxic by-products and completely removing dye even from dilution solutions **[4]**.

NEEM

Neem belongs to the family of Meliacease and its role as a health promoter is attributed because of its rich source of antioxidant. It has been widely used in Chinese, Ayurvedic and Unani medicines worldwide and especially in the Indian subcontinent in the treatment and prevention of various diseases **[5]**. The natural products show important role in disease prevention and treatment through the enhancement of antioxidant activity, inhibition of

bacterial growth and modulation of genetic pathways. Neem is used in Ayuveda, Unani, Homeopathy and Modern medicine for the treatment of many infections, metabolic and cancer diseases **[6]** (**Figure 1**).

Figure 1 : Neem Leaves

SYNTHESIS OF NANOPARTICLE

Nanoparticles can be synthesized chemically or biologically. The chemically synthesized methods are due to the presence of some toxic chemical absorbance on the surface. They are various chemical methods, physical methods and biological methods which are used. The Green synthesis of nanoparticles has been proposed as a cost effective and environmentally friendly alternative to chemical and physical methods. The plant extracts are the best option for cost efficient and require low maintenance. In traditional methods, the green method is the most effective method for the generation of NPs **[7]**.

BIOSYNTHESIS

Biosynthesis of nanoparticles using microorganisms is a green and eco-friendly technology. Microorganisms both prokaryotic and eukaryotic are used for the synthesis of metallic nanoparticles such as silver, gold, zirconium, palladium, iron, cadmium and metal oxide. The microorganisms include bacteria, fungi and *Actinomycetes* **[8]**.

ZERO VALENT IRON NANOPARTICLE

Zero valent iron is inexpensive, non - toxic and is a reducing reagent agent. The zero valent iron is capable of oxidizing organic pollutants. The ZVI have bulk iron and is of low cost, exhibits high reactivity and has good adsorption capacity **[9]**. The ZVI also possesses strong reducing power and is reactive towards a larger amount of organic and inorganic compound **[10]**. Thus the Zero valent iron nanoparticle is very useful for environmental waste water pollution remediation.

MATERIALS AND METHODOLOGY

Collection of Sample

Leaves were collected from the local farm. They were washed under running tap water to remove the dirt and were sundried. 10 grams of this dried Neem leaves were taken and washed with distilled water. The leaves were ground in a motor pestle and were put into 100ml of distilled water. The extracts were filtered using filter paper and were used for Phytochemical analysis following standard protocols.

Preparation of Zero Valent Iron Nanoparticle

The Neem leaves were collected and were washed with distilled water. 6 grams of Neem leaves were taken and were cut into small pieces with sterile knife and was boiled in 100ml water for 10 minutes. The extracts were filtered with filter paper and 30ml of ferric chloride was used to wash the leaves and 10ml of plant extract was added to the nanoparticle synthesized. Determination of immediate appearance of color changes indicates the presence of synthesized nanoparticle. The nanoparticle was further characterized by SEM and FTIR.

Decolorization of Textile Waste Water

50 ml of wastewater was taken and different concentration of ZVI nanoparticles (0.5ml,1 ml and 1.5ml) were added and suspended and was kept under stirring continuously at a required temperature for different reaction time 30 minutes, 60 minutes and 120 minutes. The pH of the samples was adjusting by adding HCL or NaOH solution. Different pH (3-7) was maintained for the reaction. Different temperatures (40, 50 and 60˚C) were also optimized. UV – Vis Spectrophotometer was used for absorbance measurements of the sample. The maximum wavelength used for determination of absorbance was 550nm and 700nm. The amount of absorbance was determined using the following decolorization formula.

Decolorization Formula

$$\text{Decolorization (\%)} = (I - F) / I \times 100$$

Where,

I = initial absorbance

F = final absorbance

RESULTS AND DISCUSSION

Qualitative Phytochemical Analysis of Neem Extract

Phytochemical analysis of the neem extract was carried out using aqueous solvent and ethanol solvent extracts. The presence of Alkaloids, Glycosides, Flavonoids, Terphenoids, Carbohydrates, Phenol, Saponins and Steroids were observed in aqueous extract and Tannins in the ethanol extract (**Table** 1).

S. No.	TESTS	AQUEOUS EXTRACT	ETHANOL EXTRACT
1	Alkaloids	+	-
2	Glycosides	+	-
3	Flavonoids	+	-
4	Tannins	-	+
5	Terphenoids	+	-
6	Phenol	+	-
7	Saponins	+	-
8	Carbohydrates	+	-
9	Steroids	+	-

Table 1 : Qualitative Phytochemical Analysis of Neem Extract

Quantitative Phytochemical Analysis of Neem Extract

Quantitative analysis was carried out for the estimation of following compounds (**Table 2).**

S. No.	TESTS	VALUE
1	Alkaloids	10.8 ± 3.0308
2	Glycosides	76.6 ± 4.7404
3	Steriods	13.7 ± 8.2398
4	Flavanoids	8.6 ± 2398
5	Carbohydrates	7.1 ± 4.9947
6	Phenols	70.0 ± 1186

Table 2 : Quantitative Phytochemical Analysis of Neem Extract

Synthesis of Zero Valent Iron Nanoparticle

Neem leaf extract was used to produce zero valent iron nanoparticle. The neem extract was mixed with the FeCl3 solution in the ration 1:2. The reduction of Fe^{3+} into Fe^{0} indicates the immediate change in the pH of the solution and color change to black or brown color. The ferric chloride solution was yellow in color in the distilled water but on mixing with plant extract it immediately changed its color indicating the synthesis of zero valent iron nanoparticle (**Figure 2**).

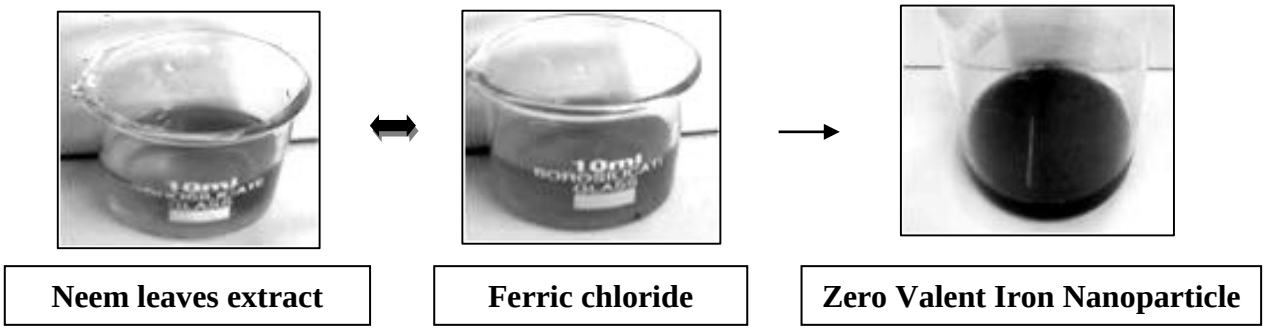


Figure 2: Synthesis of Zero Valent Iron Nanoparticle

Characterization of Zero Valent Iron Nanoparticle By Scanning Electron Microscopy

SEM analysis was carried out to observe the topology, shape and size of the synthesized ZVI nanoparticle. The SEM image of green synthesized zero valent iron revealed sphere shape nanoparticle with an average diameter of 50nm (**Figure 3**).

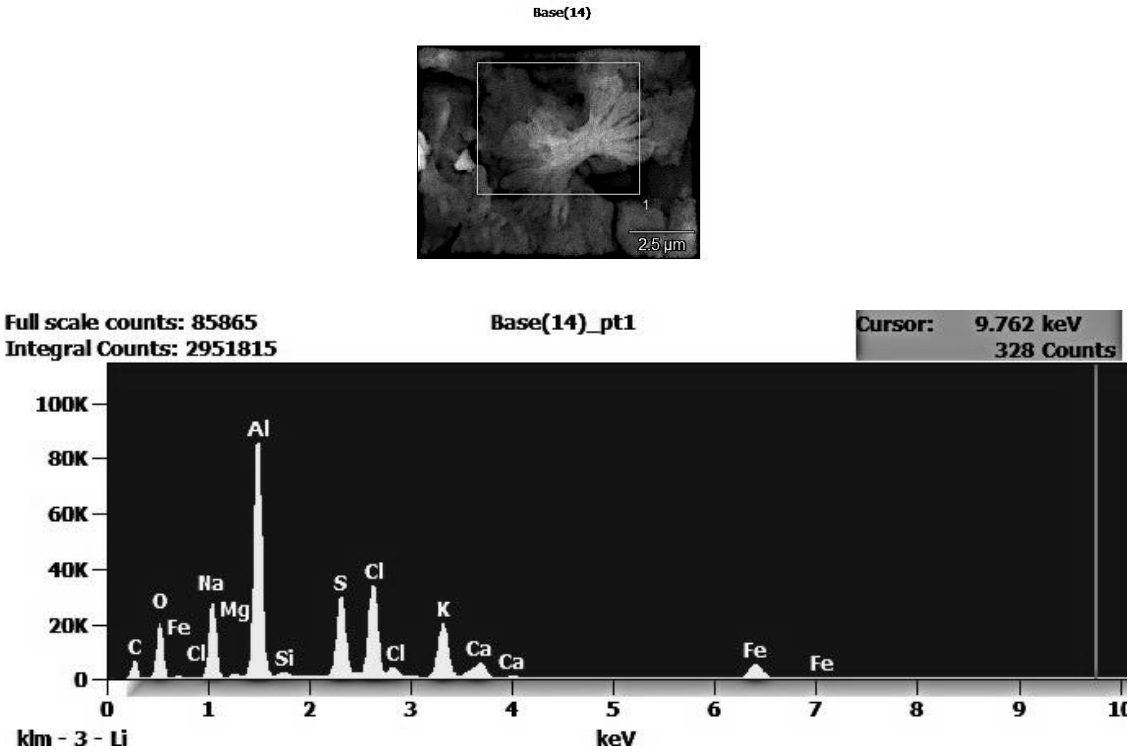


Figure 3 : SEM analysis of Zero Valent Iron Nanoparticle

Fourier Transform Infrared Spectrometer (FTIR) Analysis

FTIR analysis was carried out for Neem leaf extract and the synthesized ZVI nanoparticle. The strong bond was observed at 3336.18 and function group to be stretching in O-H of compound carboxylic acid or phenol. The bands of 2139.82 function group was stretching in N=N=N of compound carbodiamide. The function group of 637 is C=C stretching of the compound alkenes. The band of 619.47 and 570 are C-Br stretching function group of compound which is a halo compound (**Figure 4).**

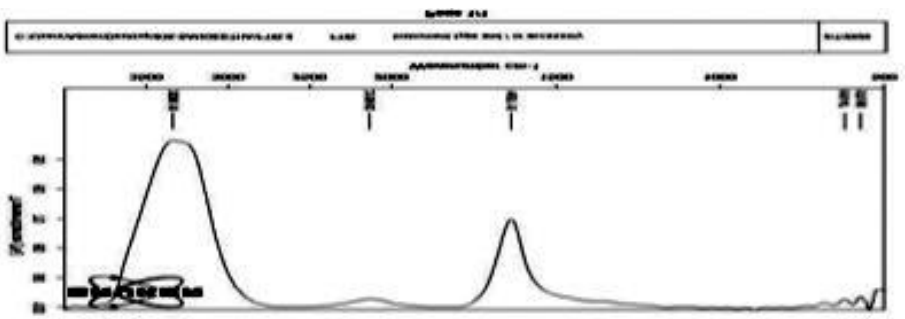


Figure 4: FTIR spectrum of Zero Valent Iron Nanoparticle

Characterization of Textile Waste Water

Textile waste water revealed high concentrations of TSS, TOD, COD, BOD, Acidity and Alkalinity (**Table 3**).

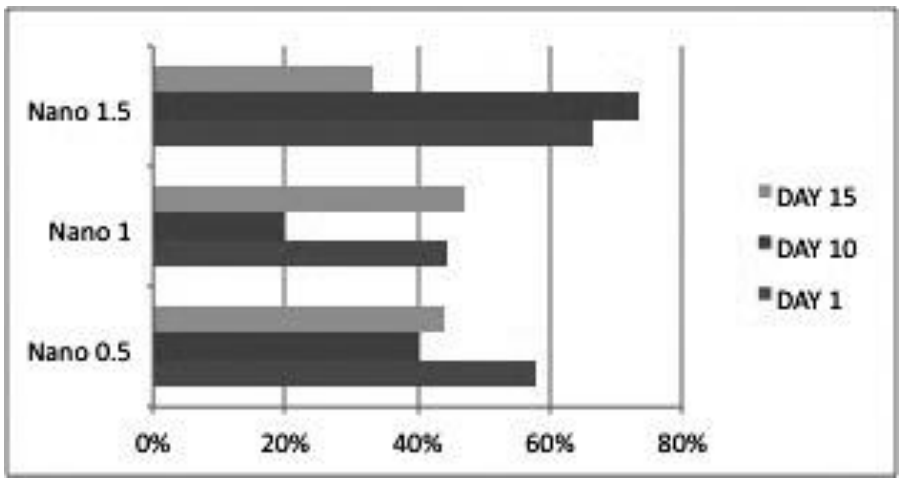
S. No.	PARAMETERS	SAMPLE – 1	SAMPLE - 2
1	TSS	1.5mg/L	0.7mg/L
2	TDS	5.052 mg	0.894mg
3	DISSOLVED OXYGEN	89mg/L	413mg/L
4	COD	89mg/L	4.313mg/L
5	BOD	919mg/L	2553mg/L
6	ACIDITY	109 N	41 N
7	ALKALINITY	Nil	Nil
8	Ph	8	10.5

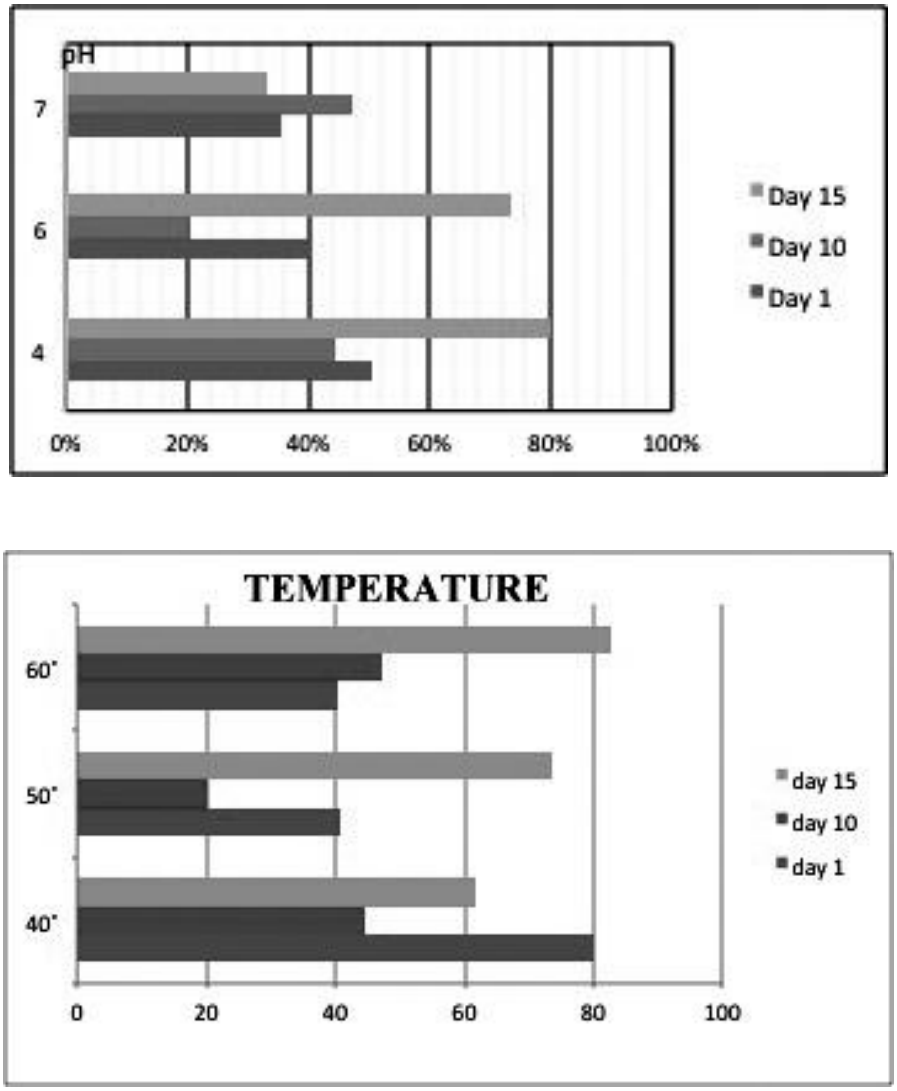
Table 3 : Characterization of Textile Wastewater

Decolorization

Sample 1 was treated with different concentrations of the nanoparticle and pH. The sample was taken in a 50 ml beaker and was treated with different concentrations of nanoparticle such as 0.5ml, 1ml and 1.5ml. The time was noted at 30 minutes, 60 minutes and 120 minutes and pH 4, 6 and 7. 1ml of nanoparticle reported the highest removal of dye in Sample 1. The high decolorization efficiency was at 73.3%, the percentage of decolorization 66.6%, 73.3% and 33.3% respectively (**Figure 5 and Graph 1)**

Figure 5 : Treatment of waste water (Sample 1) using Zero Valent Iron Nanoparticle

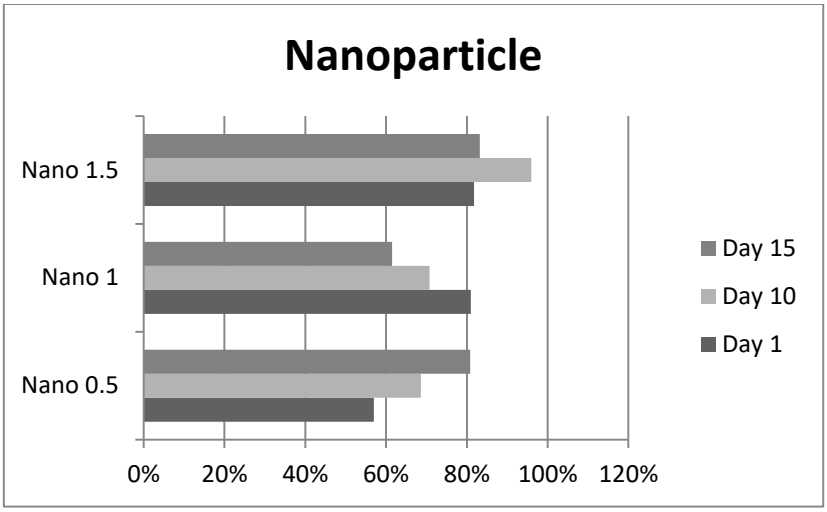


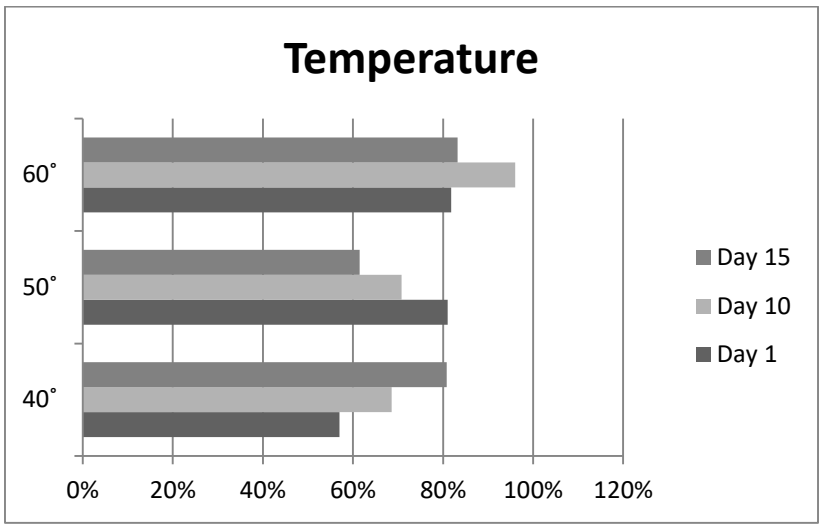


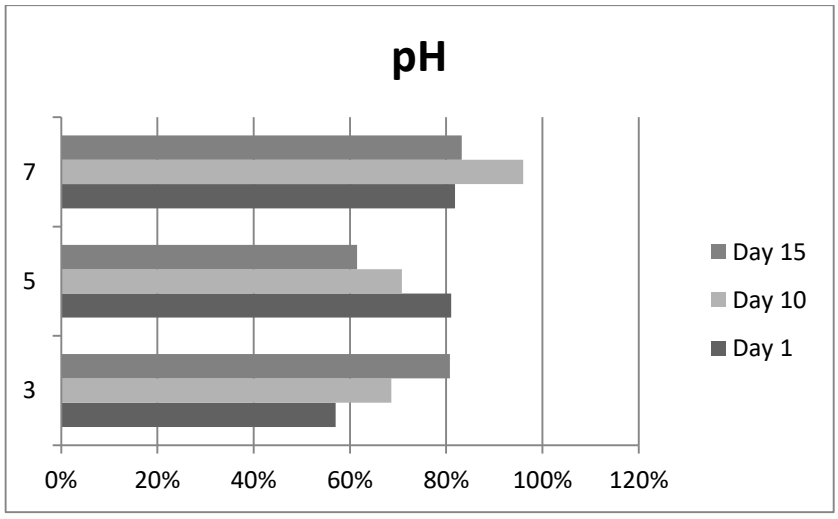
Graph 1 : Decolorization of Sample 1

Sample 2 was taken in a 50ml beaker and was treated with different concentrations of nanoparticle such as 0.5ml, 1ml and 1.5ml, temperature 40^0C, 50^0C and 60^0C and pH 3, 5 and 7. The time was noted at 30 minutes, 60 minutes and 120 minutes. 1ml of nanoparticle reported the maximum removal of dye in Sample 2. The percentage of decolorization observed was 81.8%, 96% and 85.2% respectively **(Figure 6 and Graph 2**).

Figure 6: Treatment of waste water (Sample 2) using Zero Valent Iron Nanoparticle





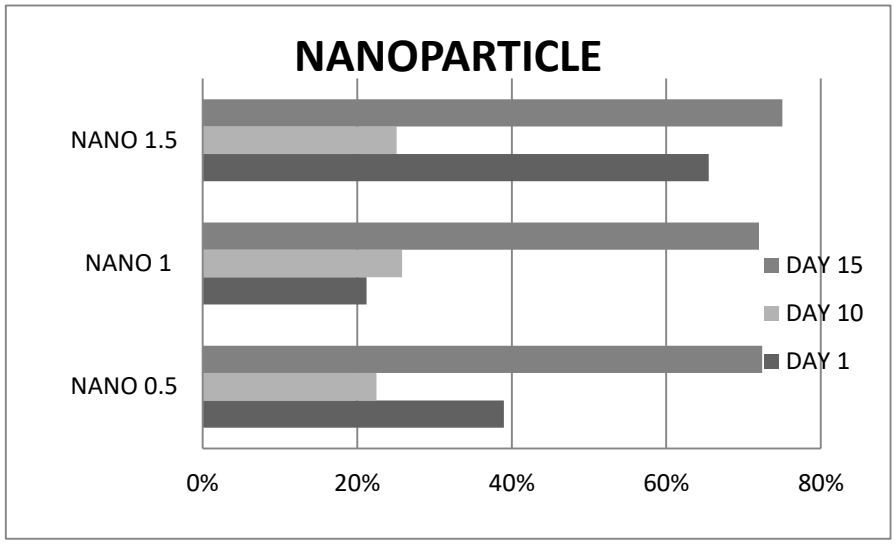


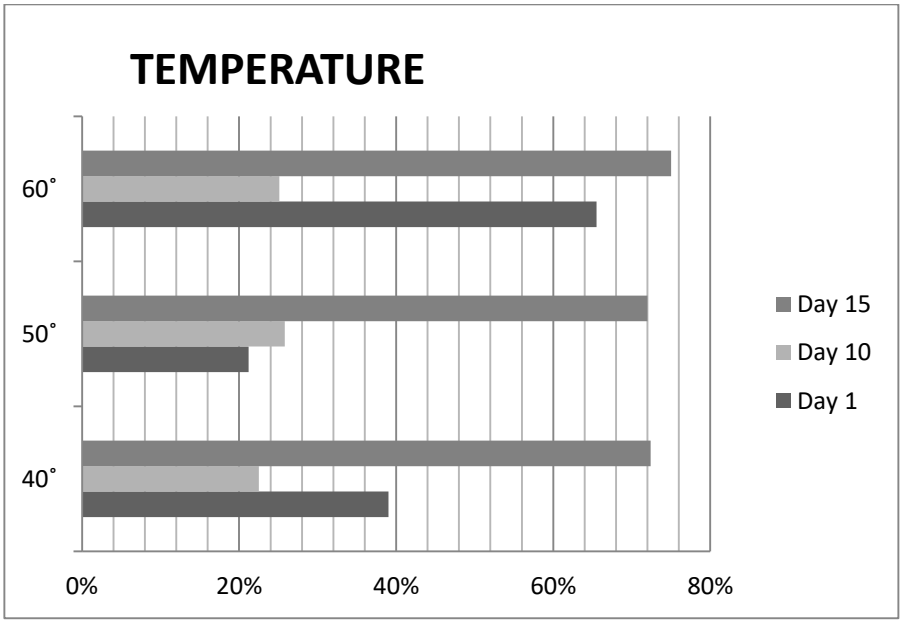
Graph 2 : Decolorization of Sample 2

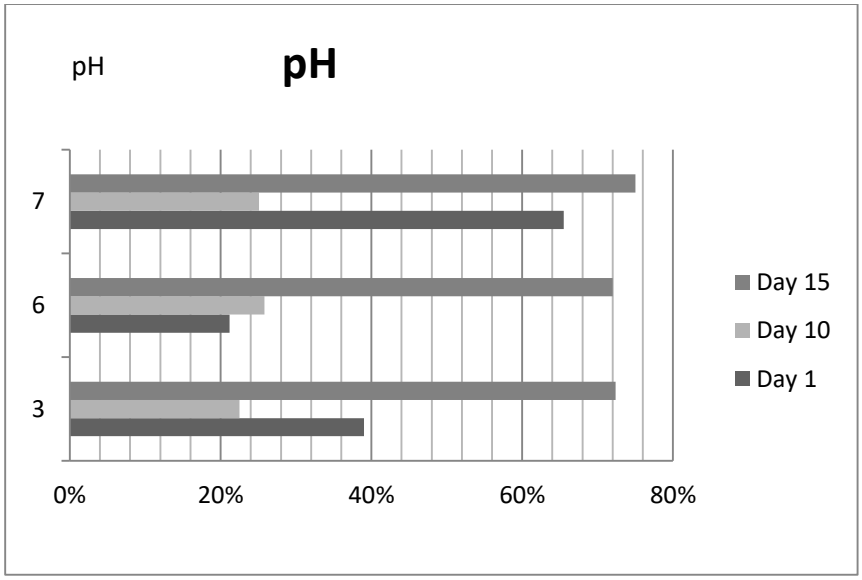
Sample 3 was treated with different concentrations of nanoparticle, temperature and pH. The sample was taken in a 50 ml beaker and was treated with different concentrations of nanoparticle such as 0.5ml, 1ml and 1.5ml, temperature 40^0C, 50^0C and 60^0C and pH 3, 6

and 7. The time was noted at 30 minutes, 60 minutes and 120 minutes. 1.5ml of nanoparticle reported the maximum removal of dye Sample 3. The percentage of decolorization was 72%, 72.7% and 75% respectively **(Figure 7 and Graph 3).**

Figure 7 : Treatment of waste water (Sample 3) using Zero Valent Iron Nanoparticle







Graph 3 : Decolourization of Sample 3

TREATMENT OF TEXTILE WASTE WATER WITH NANOPARTICLE

The textile waste water sample treated with the Zero Valent Iron Nanoparticle reported a reduction in Chemical Oxygen Demand (COD) and Dissolved Oxygen (DO) with an increase in the reaction time from 30 to 120 minutes **(Table 4).**

PARAMETER	SAMPLE 1	SAMPLE 2	SAMPLE 3
COD	0.32 mg/L	85 mg/L	405 mg/L
DISSOLVED OXYGEN	35 mg/L	461 mg/L	728 mg/L

Table 4 : Post Treatment of Textile Waste Water with ZVI Nanoparticle

CONCLUSION

Azadirachta indica leaves were subjected to extraction with two different solvents (aqueous and ethanol). The preliminary phytochemical analysis of the extract of *Azadirachta indica* revealed the presence of compounds such as alkaloids, phenol, tannins, flavonoids, steroids, saponins, terphenoids and glycosides. Zero Valent Iron Nanoparticle was synthesized from *Azadirachta indica* which was found to remove Dissolved Oxygen and Chemical Oxygen Demand respectively. The synthesized Zero Valent Iron Nanoparticle was characterized by SEM and FTIR. Characterization studies of the textile waste water before and after Zero Valent Iron Nanoparticle treatment showed a profound impact. Zero valent Iron Nanoparticle was found to be very effective in degrading the textile dye and also to remove the color from textile dye waste water by decolorization. Among the three samples used, two of them showed greater color removal efficiency. The Zero Valent Iron Nanoparticle was also used to estimate the Dissolved Oxygen and Chemical Oxygen Demand of the textile waste water. Percentage of color removed was highest in Sample 2 at pH 6 in 60 minutes of contact time and adsorbent dosage of 1ml.

REFERENCES

1. **V. Premkumar, M.R. Rajan and R.Ramesh (2016)**. Removal of Toxic Substance from textile Dyeing industry Effluent using Iron Oxide Nanoparticle. *Indian Journal of Research*, Volume 5 (2), Pages 01 - 04.

2. **Anitha S., Krishna B.M., Nagabhushana B .M, Sahana M. and Mahesh S. (2015).** Nano CuO as Adsorbent for Color Removal from Textile Wastewater. Strategic technologies of complex Environmental, Pages 7 - 12.

3. **Maha A. Tony, Shehab A. and Mansour (2019)** Removal of the commercial reactive dyeProcion Blue MX-7RX from real textile wastewater using the synthesized Fe_2 O_3 nanoparticles at different particle sizes as source of Fenton's reagent. *Journal @ the Royal Society of Chemistry*.

4. **P. Heera and S. Shanmugam (2015)** Nanoparticle Characterization and Application: An Overview. *International Journal of Current Microbiology and Applied Science*, Volume 4 (8), Pages 379 - 386.

5. **Asha Roshan and Navneet Kumar Verma (2000)** A brief study on neem (*Azarrdirachtaindia A.*). *Research Journal of Phytomedicine*, Pages 01 - 03.

6. **Sushree Priyanka Dash, Sangita Dixit and Soubhagyalaxmi Sahoo (2017)** Phytochemical and Biochemical characterization from leaf Extraction from *Azadirachta* in India: An Important Medicinal Plant. *Biochemistry and Analytical Biochemistry Journal*, Volume 6 (2), Pages 1 - 4.

7. **P. Christian, F. Von Der Kummer, M. Baalousha, T and Hofmann. (2008)** Nanoparticle structure, properties, perparationand behaviours in environmental media. *Exotoxicology*. Pages 14 – 20.

8. **Bhavika Turakhia, Paras Turakhia and Sejal Shah (2018)** Green Synthesis of Zero valent Iron Nanoparticle from *Spinaciaoleracea* (spinach) and Its Application in waste treatment. *International Journal of Advanced Research in Applied Sciences*. Volume 5(1), Pages 46 - 51.

9. **Pichsinee Somchaidee and Karaked Tedsree (2018)** Green synthesis of high dispersion and narrow size distribution of Zero –valent iron Nanoparticle using Guava Leaf. *Advance Research in Natural Science Nanoscience and Nanotechnology*, Pages 01 - 09.

10. **Shahram Eslamic, Mohamad Ali Ebrahi, Zaesh and Pourya Biparva (2018)** Green synthesis of safe zero valent iron nanoparticles by *Myrtuscommunis*leaf extract as an effective agent for reducing excessive iron in iron-pverloaded mice, a thalassemia model. *Journal @ the Royal Society of Chemistry*.