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CONTENTS

Research Papers

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ADVANCED TECHNIQUES IN WATER QUALITY ASSESSMENT AND MANAGEMENT

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ABSTRACT
Water quality assessment and management are concerned because declining of water quality affects economic growth in Asian countries. Water quality assessment includes three kinds of parameters; Chemical, Physical and Biological. Chemical parameters include Hardness, pH, alkalinity, BOD, Nitrate, Phosphate etc. Biological parameters refer to the number and types of organisms present. Physical parameters include odour, colour, etc. Water quality is affected by human activities as well as natural phenomena. The effects of polluted water on human health, aquatics, agriculture, etc. are devastating. It becomes very difficult to assign a single water quality standard which can be used for all the needs. For example, all the parameter i.e., chemical, biological, and physical of water that are suitable for irrigation are not same as that required for drinking purpose. There are several methods for characterization and management of water quality impairments. Single factor assessment, comprehensive pollution index, water quality grading, the numerous pollution index, principle component analysis, fuzzy comprehensive evaluation, comprehensive water quality identification index, harmony degree equation and remote sensing techniques are some of the water quality assessment methods. Traditionally, assessments were resulted by cost efficiency, emission reduction, etc.Water quality assessment, water quality management, quality index, assessment methods.

INTRODUCTION
The world's water resources are under increasing threats from a wide range of pollutants, resulting in deteriorating water quality in rivers, lakes, aquifers and seas.

Nowadays, it is driven by pollutants discharges via sewage system. Water quality management therefore involves the planning, development, implementation, monitoring and auditing of water quality. Water quality (WQ) modelling plays an important role in better understanding the magnitude and impact of WQ issues and in providing evidence for policy making and implementing measures to mitigate water pollution.

The operations involved in water quality assessment are many and complex. They can be compared to a chain of about a dozen links and the failure of any one of them can weaken the whole assessment. The main reason for the assessment of the quality of the aquatic environment has been, traditionally, the need to verify whether the observed water quality is suitable for intended uses. Monitoring and assessing the quality of surface waters are critical for managing and improving its quality.

In situ measurements and collection of water samples for subsequent laboratory analyses are currently used to evaluate water quality. Major factors affecting water quality in water bodies across the landscape are suspended sediments (turbidity), algae (i.e., chlorophylls, carotenoids), chemicals (i.e., nutrients, pesticides, metals), dissolved organic matter (DOM), thermal releases, aquatic vascular plants, pathogens, and oils. Suspended sediments, algae, DOM, oils, aquatic vascular plants, and thermal releases change the energy spectra of reflected solar and/or emitting thermal radiation from surface waters which can be measured using remote sensing techniques. Most chemicals and pathogens do not directly affect or change the spectral or thermal properties of surface waters, so they can only be inferred indirectly from measurements of other water quality parameters affected by these chemicals. Remote sensing tools provide spatial and temporal views of surface water quality parameters that are not readily available from in situ measurements, thus making it possible to monitor the landscape effectively and efficiently, identifying and quantifying water quality parameters and problems. The water quality varies according to the type of use.

OBJECTIVE
1. Assess the overall chemical and microbial factors that influence the water quality using a targeted sample approach.
2. To obtain advance techniques for water quality assessment.
3. To maintain the water quality according to its requirement that is water quality management.
4. To measure concentration of the constituents in quantity for characterisation of water for different uses.
5. To obtain COD reduction by freeze crystallization.

ISSN 2394 - 7780

Water quality assessment

Water quality is determined by assessing three classes of parameters: biological, chemical, and physical. Biological parameter : Biological attributes refer tothe number and types of organisms that inhabit a waterwayChemical parameters: include DO, COD, BOD, HARDNESS, Silanity, pH etc.. Assessment of water quality by its chemistry includes measures of many elements and molecules dissolved or suspended.Physical parameters : includes TSS, TDS, Temp, colour, odour, etc. There are considered of primary importance to the quality of drinking water. The EPA drinking water standards are categorized as primary drinking water standards and secondary drinking water standards. Primary drinking water standards regulate organic and inorganic chemicals, microbial pathogens, and radioactive elements that may affect the safety of drinking waterSecondary drinking water standards regulate chloride, colour, copper, corrosivity, foaming agents, iron, manganese, odour, pH, sulfates, total dissolved solids, and zinc, all of which may affect qualities of drinking water like taste, odour, colour, and appearance. Commonly measured chemical parameters include pH, alkalinity, hardness, nitrates, nitrites and ammonia, ortho and total phosphates, and dissolved oxygen and biochemical oxygen demand. Chemical measures can also be used to detect imbalances within the ecosystem. In addition, some "chemical" measurements actually indicate the physical presence of pollutants in water. These include measurements such as conductivity and density.

Treatment of Chemical Parameters

Reduction of COD by an advanced technique- Multistage Freeze Crystallization

This test is widely used to determine

a) Degree of pollution in water bodies.

b) Efficiency of treatment plants.

c) It also provides idea about the amount of bio chemical oxygen demand (BOD).

Principle

Many of the organisms get destroyed when boiled with a solution of potassium dichromate and sulphuric acid giving out carbon dioxide and water. A sample is refluxed with a known amount of potassium dichromate and sulphuric acid medium and excess of dichromate is titrated against ferrous ammonium sulphate.

Procedure

I. In one reflux, take 10 ml H_2SO_4, 10 ml $K_2Cr_2O_7$ (0.25), 10 ml effluent and 0.4g of $HgSO_4$ in 250 ml reflux sample and mix these well.

II. Now, if the colour turns to green, either take fresh sample with lesser aliquot or add more potassium dichromate with sulfuric acid.

III. In an another reflux, take 10 ml H_2SO_4, 10 ml $K_2Cr_2O_7$ (0.25), 10 ml distilled water and 0.4g of $HgSO_4$ in 250 ml reflux sample again mix well.

IV. Connect the flask to condenser and then mix the contents well before heating since improper mixing results into bumping.

V. Reflux for atleast 2 hours. Cool and then wash down condenser with fresh water.

VI. Disconnect reflux condenser.

VII. Cool to room temperature and titrate excess $K_2Cr_2O_7$ with 0.1M Ferrous Ammonium Sulphate using 2-3 drops of ferroin as indicator. The sharp colour changes from bluish green to reddish brown indicates completion of the titration. After sometime, the blue-green colour may reappear. Use the same quantity of ferroin indicator for all titrations.

VIII. Reflux blank in the same manner using distilled water instead of sample.

ISSN 2394 - 7780

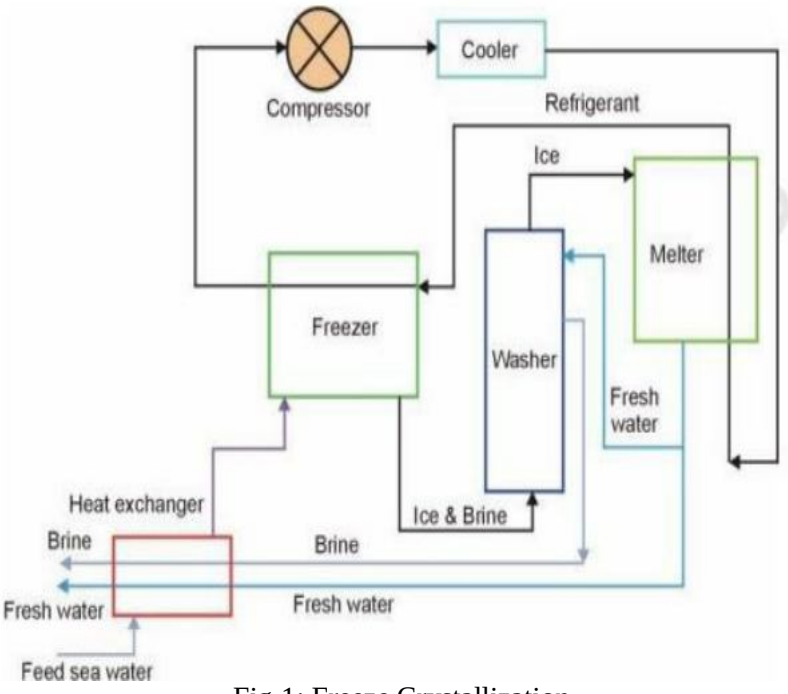

Fig-1: Freeze Crystallization

Calculation

Formula to calculate Chemical oxygen demand (COD)

$$COD = \frac{\text{Blank reading} - \text{Burette Reading} * 0.1 * 8000}{\text{SAMPLE VOLUME}}$$

0.1= Normality of ammonium ferrous sulphate hexahydrate

8000= Oxidation number of oxygen

*****Blank Reading= 25.0 ml & variant between 23.0 to 26.0

Table-1: Result summary for COD Reduction

Sample	Volume of sample (ml)	Temp. (℃)	Burette Reading	COD (ppm)
Feed sample	0.49	35	19.50	8979.6
Melted sample 1	0.39	-5	17.88	14605.1
Crystals obtained 1	1.23	-5	15.20	6374
Melted sample 2	1	-8	14.50	8400
Crystals obtained 2	1.5	-8	17.00	4000
Melted sample 3	1	-10	13.20	9440
Crystals obtained 3	2.5	-10	19.60	1728

The process involves nucleation, crystal growth washing and melting. There is still much to learn on the nucleation and crystallization aspects of the process. Recent Freeze Crystallization development enable to shed more light on the overall crystallization. Results shows that 2 hours of continuous freezing is eligible to reduce the liquid fraction to the half. The results show that there is approx. 80% reduction in COD in just three stages of freeze crystallization.

Treatment of all the parameter of assessment

Effluent Treatment Plant

To clean industry effluent and recycle it for further use. To reduce the usage of fresh/potable water in Industries. To safeguard environment against pollution and contribute in sustainable development. Effluent Treatment Plants or (ETPs) are used by leading companies in the pharmaceutical and chemical industry to purify water and remove any toxic and nontoxic materials or chemicals

from it. These plants are used by all companies for environment protection. An ETP is a plant where the treatment of industrial effluents and waste waters is done. The ETP plants are used widely in industrial sector, for example, pharmaceutical industry, to remove the effluents from the bulk drugs.

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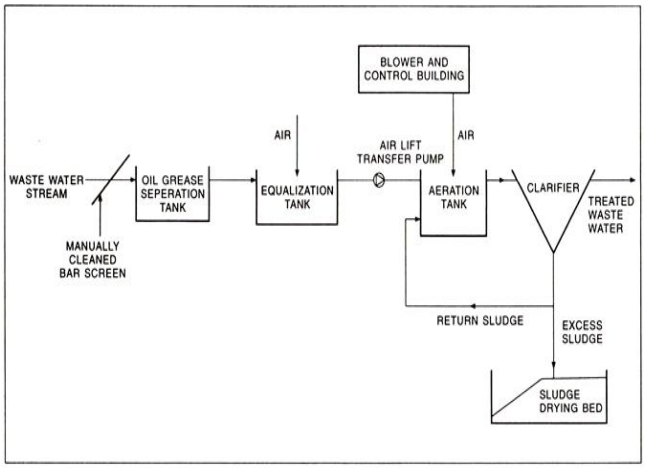

Fig-2: Effluent treatment plant

Water Quality Management

Water quality management involves planning, development, implementation and auditing of water quality. The steps perform in water quality management are

1) Setting water quality goal.
2) Water quality monitoring.
3) Identification of nature and magnitude of pollution.
4) Source inventory.
5) Water quantity information.
6) Selection of technology.
7) Financing waste management.
8) Maintenance of sewage treatment plant.
9) Pollution from industrial sources.
10) Pollution from non point sources.
11) Some other important options for water quality management.

There are several methods for management of water quality impairments.

A) Basis for Using Remote Sensing

Substances in surface water can significantly change the backscattering characteristics of surface water. Remote sensing techniques depend on the ability to measure these changes in the spectral signature backscattered from water and relate these measured changes by empirical or analytical models to a water quality parameter. The optimal wavelength used to measure a water quality parameter is dependent on the substance being measured, its concentration, and the sensor characteristics. Major factors affecting water quality in water bodies across the landscape are suspended sediments (turbidity), algae (i.e., chlorophylls, carotenoids), chemicals (i.e., nutrients, pesticides, metals), dissolved organic matter (DOM), thermal releases, aquatic vascular plants, pathogens, and oils. Suspended sediments, algae, DOM, oils, aquatic vascular plants, and thermal releases change the energy spectra of reflected solar and/or emitting thermal radiation from surface waters which can be measured using remote sensing techniques. Most chemicals and pathogens do not directly affect or change the spectral or thermal properties of surface waters, so they can only be inferred indirectly from measurements of other water quality parameters affected by these chemicals. Remote sensing tools provide spatial and temporal views of surface water quality parameters that are not readily available from in situ measurements, thus making it possible to monitor the landscape effectively and efficiently, identifying and quantifying water quality parameters and problems. Development of remote sensing techniques for monitoring water quality began in the early 1970s. These early techniques measured spectral and thermal differences in emitted energy from water surfaces. Developed an empirical approach to estimate suspended sediments. The general forms of these empirical equations are

$$\mathbf{Y = A + BX \text{ or } Y = AB^X}$$

ISSN 2394 - 7780

Where Y is the remote sensing measurement (i.e., radiance, reflectance, energy) and X is the water quality parameter of interest (i.e., suspended sediment, chlorophyll). A and B are empirically derived factors. In empirical approaches. Statistical relationships are determined between measured spectral/thermal properties and measured water quality parameters. Often information about the spectral/optical characteristic of the water quality parameter is used to aid in the selection of best wavelength(s) or best model in this empirical approach. A discussion of in situ sensors for remote monitoring is also included because these are essential for measuring water quality parameters that cannot be measured with remote sensing techniques and for data to calibrate remote sensing models for determining water quality.

Most researchers have concluded that surface suspended sediments can be mapped and monitored in large water bodies using sensors available on current satellites. The mapping was done in categories related to a management plan proposed for the lake.

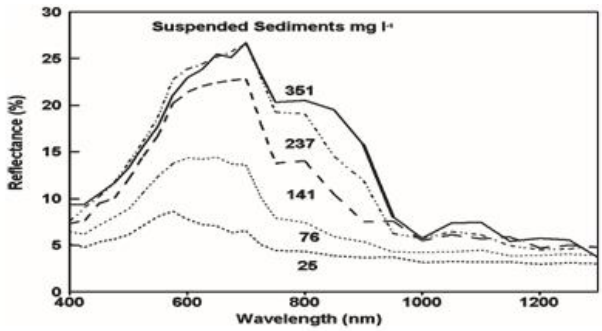

Fig-3: The relationship between reflectance and wave length as affected by the concentration of suspended sediments

B) Single factor assessment

For water quality evaluation, this determines that if only one parameter exceeds the standard, all functions of the water body will be lost. The formula for the SFA method is:

$F = F_a max$

F is the class of surface water

Table-2: Value of Surface Water Quality Standard

	Class 1	Class 2	Class 3	Class 4	Class 5
Permanganate Index (mg/L)	2.0	4.0	6.0	10.0	15.0
COD (mg/L)	15.0	15.0	20.0	30.0	40.0
BOD5(mg/L)	3.0	3.0	4.0	6.0	10.0
NH_3-N (mg/L)	0.15	0.5	1.0	1.5	2.0
TP(mg/L)	0.02	0.1	0.2	0.3	0.4
Petroleum (mg/L)	0.05	0.05	0.05	0.5	1.0

C) Comprehensive Water Pollution Index (CWPI)

The Single Factor Evaluation (SFE) method is used to create a Comprehensive Water Pollution Index (CWPI). The SFE (excluding DO) increases with the pollutant's concentration, and its equation is as follows:

$$I_a = \frac{Ca}{Soa}$$

Where I_a is the pollution index of water quality index, Ca (mg/L), was the measured concentration of water quality index of a, and Soa (mg/L) was the concentration limit of water quality index of a.

Fcpi referred to the arithmetic mean of n water quality indexes. The equation was as follows:

$$F_{cpi} = \frac{1}{n}\sum_{n=1}^{n} Ia$$

Where n is the number of selected pollutants.

D) Harmony degree equation.

Water quality assessment is an important basic work in the development, utilization, management, and protection of water resources, and also a prerequisite for water safety. In this paper, the harmony degree equation (HDE) was introduced into the research of water quality assessment, and a new method for water quality assessment was proposed according to the HDE: by harmony degree equation (WQA-HDE). The results

ISSN 2394 - 7780

showed that the calculation steps of WQA-HDE are similar to the comprehensive assessment method, and WQA-HDE is more operational comparing with the results of other water quality assessment methods. In addition, this new method shows good flexibility by setting the judgment criteria value HD0 of water quality; when HD0 = 0.8, the results are closer to reality, and more realistic and reliable. Particularly, when HD0 = 1, the results of WQA-HDE are consistent with the single factor assessment method, both methods are subject to the most stringent "one vote veto" judgment condition.

So, WQA-HDE is a composite method that combines the single factor assessment and comprehensive assessment. The research field of theoretical method system of harmony theory but also promotes the unity of water quality assessment method and can be used for reference in other comprehensive assessment.

E) Comprehensive Water Quality Identification Index (CWQII)

Based on the single factor water quality identification index, the comprehensive water quality identification index, which is a new tool for general water quality assessment of surface water, is presented. The comprehensive water quality identification index can fully depict the general water quality of surface water, and its characteristics are listed as follows. Firstly, it can evaluate general water quality both qualitatively and quantitatively. Secondly, it assesses general water quality by a group of typical assessing items instead of deciding by the worst assessing item, so the assessment of general water quality is reasonable. Thirdly, it can be used to compare general water quality of different stations of the same river and different rivers, and it can also be used to compare general water quality with the same classification of classes I-V and the class worse than class V. Nowadays the comprehensive water quality identification index has been applied in evaluating the general water quality of Shanghai rivers, and very convincing conclusions have been drawn. In addition, the criterion for river blackness and stink is ascertained **.**

As a relatively new method, the CWQII could be used to evaluate the water quality of surface water. The Single Factor Identification Index (SFII) is a basic part of the CWQII, and its equation was as follows (excludes DO).

$$\mathbf{P_{SF1} = P_1P_2}$$

Where P_1 is between 1 and 5, corresponding to its water quality, from Class 1 to 5. When the index was not the index for dissolved oxygen (DO), the equation was as follows:

$$\mathbf{P_2} = \frac{Ca - Sab}{Sabmax - Sabmin} \mathbf{*10}$$

C_a is the concentration of the ath water quality index, and Sabmax and Sabmin are the upper limit and lower limit of the concentration interval of Class b water in the ath index, respectively. The equation is as follows:

$$\mathbf{P_c = P_1P_2P_3P_4}$$

$$\mathbf{P_1P_2 = P_{COD} + P_{BOD} + P_{NH3-N} + P_{Tp} + P_{petroleum} + \sum_{n=1}^{n} Pa}$$

CONCLUSIONS

Multistage Freeze crystallization seems to be successful mainly due to its ability of producing high quality product with much lower energy requirement as compared to other available technologies. This technology it comes at different configuration and setups from direct crystallization to indirect and at promising cost reduction compared to conventional thermal and RO processes. Using this advanced Technology we can reduce COD to about 80% which is a very high amount. Water quality management is equally important as assessment and in that current remote sensing technologies have many actual and potential applications for assessing water resources and for monitoring water quality. Comprehensive water quality identification index can be applied to judge whether the water quality meets environmental water functions and suitable for assessment of the overall water quality when the water is seriously polluted. Comparing four methods of evaluating surface water quality, the Comprehensive Water Quality Identification Index (CWQII) is a feasible method for evaluating the water quality conditions. The Single Factor Evaluation (SFE) method only considers the most prominent factor and not all factors are considered in the resulting water quality evaluation. This means that the SFE method is limited in its ability to characterize the comprehensive water quality condition. Because of overemphasizing the influence of the maximum factor, the Comprehensive Water Pollution Index method cannot effectively evaluate the comprehensive water quality condition. Moreover, these methods could not determine the water quality classes. The CWQII method was the best method because this method used a group of evaluation factors instead of using only single evaluation factor, giving a more balanced result. This method can also evaluate the comprehensive water quality qualitatively and quantitatively. However, in order to achieve the environment targets of the 'Water Pollution Prevention Action Plan' by 2020, water quality management policies and water

ISSN 2394 - 7780

environmental controls need to be improved. The CWQII method is an efficient tool to classify the water quality of the river and give rapid and precise information about the situation of the river that can provide useful information for water quality management and decision making.

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CONSUMER BUYING BEHAVIOUR AT SHOPPING MALLS

Niraj Dilip Sharma

ABSTRACT

"A retail revolution is happening at newer markets, India presents exciting opportunities on account of its vast middle-class and a virtually untapped retail industry".

Shopping Malls are replacing 'kirana' stores all over India. India's retail infrastructure is slowly undergoing a change with many hi-fi Shopping Malls being constructed and operating in various cities. The mall concept has come to stay for good. The Indian consumer seems to be undergoing a shift in terms of personality, buying motives, interests, attitudes, beliefs and values when he or she is making a shift from 'kirana' stores towards shopping malls. In this context it assumes significance to study the buying behaviour of consumers, especially with changes taking place in India's retail scenario. The scope of this research is to assess the overall customer satisfaction, response of customers with regard to the availability and quality of products and services offered at shopping malls and the comfort level of the respondents towards shopping in the shopping malls. Factors influencing the customer to shop in the shopping malls, such as socioeconomic profiles, income, frequency of visit, period of relationship between the respondents and shopping malls, purpose of visit, occasion to visit shopping malls are some of the aspects studied in the present study.

Keywords: Shopping Malls, Retail, 'Kirana' Stores, Consumer Buying Behavior

I INTRODUCTION

Before business can develop marketing strategies, they must understand what factors influence buyer's behavior and how they make purchase decisions to satisfy their needs and wants. Buyers are moved by a complex set of deep and subtle emotions. Their behavior result from deeply held values and attitudes, their perception of the world and their place in it, from common sense, impulse or just plain whimsy.

There are also several stages through which the consumer exhibit before deciding to purchase goods or services .These includes 5 steps which are: problem or need recognition, information search, alternative evaluation, purchase and post-purchase evaluation.

II REVIEW OF LITERATURE

Consumer buying decision process is the processes undertaken by consumer in regard to a potential market transaction before, during and after the purchase of a product or service. (Source: Mr. Niraj Dilip Sharma) **"The Influence of Multi-Store Environmental Clues on Perceived Merchandise Value and Patronage Intentions"**

22 previously done projects has been reviewed for this research work, out of 22 8 were from the internal research of big bazaar, which derived the results of usage and they implemented changes like Wednesday big bazaar and paanch din ka maha bachath offer and more.6 are from wall-mart perceptional experiments, which stated the availability of merchandise which makes more purchases. Another 8 are from student's research reports from various stores in the world which showed the need for continuous research in the field of retailing. Hence we can carry on further research. The following conclusions have been made from the above review. Objectives have been designed from this review study.

III NEED FOR THE STUDY

The field of consumer behavior is interdisciplinary, i.e., it uses concepts from a large variety of fields like anthropology, sociology, marketing, psychology, etc. The belief that consumer behavior could be predicted and consumers influenced gave an added impetus to the study of consumer behavior. There are, thus, four underlying principles on which the field of consumer behavior is based.

- Sovereignty of the consumers.
- Consumer research facilitates an in-depth understanding of the consumers.
- It is possible to influence consumers.
- It is socially acceptable to influence consumers.

IV OBJECTIVES OF THE STUDY

- To know the perception of customers towards the purchasing.

ISSN 2394 - 7780

- To know the buying behavior of customers in retail store.
- To know the strategy of retail store for attracting customers
- To know the satisfaction level of customers.
- To know what are the main factors that influence buying decision process.

V SCOPE FOR THE STUDY

Consumer behavior has been studied by numerous scientists including psychologists, sociologists, economists, behavior analysts and anthropologists. These scientists are attempting to understand the buyer decision making process, both individually and in groups. It studies characteristics of individual consumers such as demographics, and behavioral variables in an attempt to understand people's wants. It also tries to assess influences on the consumer from groups such as family, friends, reference groups, and society in general.

Some of the areas that are considered are

1. Consumer recognition of a problem in their lives and the attempt to solve it by buying something.
2. How consumers search for things that they need.
3. How consumers evaluate the products that they buy.
4. What is the impact on dissatisfaction on consumer purchases?
5. How do consumers make purchase decisions?
6. What kinds of advertising is the most effective?

VI LIMITATIONS OF THE STUDY

Though the detailed investigation is made in the present study, still there are following limitations.

- This study is restricted only to the Big Bazaar Vasai (West) only. So, the results may not be applicable to other areas.
- This study is based on the prevailing customer's behavior. But the customer's behavior may change according to time, fashion, technology, development, etc.
- As per the population of the study is huge, a sample size of 100 sample respondents is only covered.
- Data collection of exact data for the research is not possible because there is a gap between what respondent say and what they actually do.
- Information provided by the customers may not be accurate. They may hide some of the information at the time of filling up the questionnaires
- Scientific methods of post testing could not be conducted.

VII METHODOLGY

The research has been done through descriptive questionnaire survey, the data required from this study is collected from primary and secondary sources the data collected are both Quantitative and Qualitative. The primary source used for gathering data required for this survey, in the survey method a Survey of the consumer's behavior towards a product in retail outlet is done. A planned effort is made using structured questionnaire to interview the respondents. The respondents had chosen using non probability sampling method. The survey can be done through personal interviews. In this study respondents are interviewed personally so that the errors involved in gathering primary data are minimize. The sample size covered for the purpose of this study is 100.This study covers Big Bazaar L. B. Nagar, Hyderabad only.

VIII RETAILING IN INDIA

Retailing is the interface between the producer and the individual consumer buying for personal consumption. This excludes direct interface between the manufacturer and institutional buyers such as the government and other bulk customers. A retailer is one who stocks the producer's goods and is involved in the act of selling it to the individual consumer, at a margin of profit. As such, retailing is the last link that connects the individual consumer with the manufacturing and distribution chain.

The retail industry is divided into organized and unorganized sectors. Organized retailing refers to trading activities undertaken by licensed retailers, that is, those who are registered for sales tax, income tax, etc. These include the corporate-backed hypermarkets and retail chains, and also the privately owned large retail businesses. Unorganized retailing, on the other hand, refers to the traditional formats of low-cost retailing, for

ISSN 2394 - 7780

example, the local kirana shops, owner manned general stores, paan/beedi shops, convenience stores, hand cart and pavement vendors, etc.

The Indian Scenario

Trade or retailing is the single largest component of the services sector in terms of contribution to GDP. Its massive share of 14% is double the figure of the next largest broad economic activity in the sector. India is the "second most attractive retail destination" globally from among thirty emergent markets. It has made India the cause of a good deal of excitement and the cynosure of many foreign eyes. With a contribution of 14% to the national GDP and employing 7% of the total workforce (only agriculture employs more) in the country, the retail industry is definitely one of the pillars of the Indian economy.

The sector is on a high growth trajectory and is expected to grow by more than 27 per cent over the next 5 to 6 years. Retail is one of India's largest industries, contributing to about 10 per cent of the GDP and providing employment to 8 per cent of the nation's workforce. Indian retail business promises to be one of the core sectors of the Indian economy, with organized retail sector estimated to grow by 400 per cent of its current size by 2007-08.

Income, technology and life styles of consumers are changing, even from whom they buy are changing. The location or the place where they buy is changing; the shops are opened closed according to the convenience of the buyers. The buying process has changed due to Internet buying, which brings new and better deals and also saves time.

Changing social attitudes towards work, home and leisure affect the retail strategies. Political decisions relating to the environment, shopping locations and fair trade affect, where and how retailers can trade. Changes in technology bring new attitudes to buying products and services and to better organization of the supply chain.

India has the highest shop density in the world and the present retail market in India. We are ranked second in the global retail development index out of 30 by AT Kearney. This figure shows the comparative penetration of organized retail in India.

Evolution of Retail Market in India

In the beginning there were only kirana stores called Mom and Pop Stores, the friendly neighborhood stores selling every day needs. In the 1980s manufacturer's retail chains like DCM, Gwalior Suitings, Bombay Dying, Calico, Titan etc started making its appearance in Metros and small towns. Multi brand retailers came into the picture in the 1990s. In the food and FMCG sectors retailers like Food world, Subhiksha, Nilgris are some of the examples. In music Segment Planet M, Music world and in books Crossword and Fountainhead are some others. Shopping Centres began to be established from 1995 onwards. A unique example was the Establishment of margin free markets in Kerala. The millennium year saw the emergence of super markets and hypermarkets. Now big players like Reliance, Bharti, Tatas, HLL, ITC are entering into the organized retail segment. The big international retail bigwigs are waiting in the wings, as the present FDI guidelines do not allow them to own retail outlets in the country. WalMart is testing the waters by agreeing to provide back end and logistic support to Bharti for establishment of retail chains with a view to study the market for future entry when the FDI guidelines change and to establish a backbone supply chain. Table 1 shows the different phases in the growth of organized retailing in India.

ISSN 2394 - 7780

Table:1. Journey of Organized Retail in India		
Year	**Growth**	**Function**
2000	First Phase	Entry, Growth, Expansion, Top line focus
2005	Second Phase	Range, Portfolio, Former options
2008	Third Phase	ment, Backend operation, Technology
2011	Fourth Phase	M&A, Shakeout, Consolidation, High investment

Global Scenario

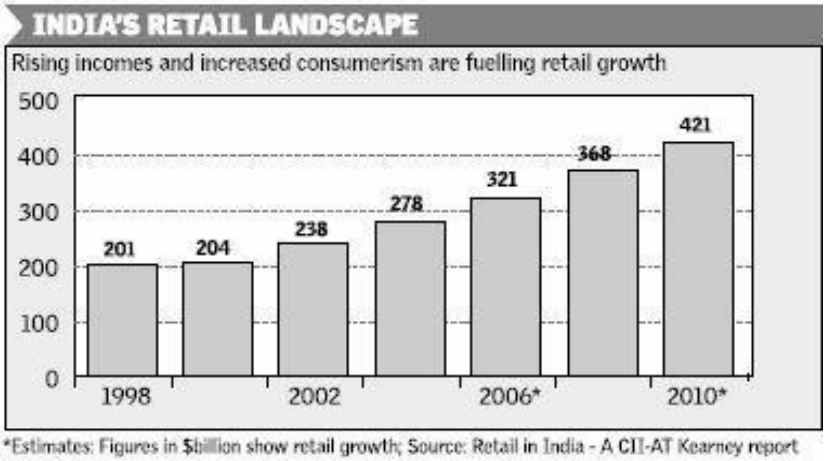
Retail stores constitute 20% of US GDP & are the 3 rd largest employer segment in USA. China on the other hand has attracted several global retailers in recent times. Retail sector employs 7% of the population in China. Major retailers like Wal-Mart & Carrefour have already entered the Chinese market. In the year 2003, Wal-Mart & Carrefour had sales of US $ 70.4 Crore & US $ 160 Crore respectively. The global retail industry has traveled a long way from a small beginning to an industry where the world wide retail sale is valued at $ 7 x 10" Crore. The top 200 retailers alone accounts for 30 % of the worldwide demand. Retail turnover in the EU is approximately Euros 2, 00,000 Crore and the sector average growth is showing an upward pattern. The Asian economies (excluding Japan) are expected to grow at 6% consistently till 2005-06.On the global Retail stage, little has remained same over the last decade. One of the few similarities with today is that Wal-Mart was ranked the top retailer in the world then & it still holds that distinction. Other than Wal-Mart's dominance, there's a little about today's environment that looks like the mid-1990s. The global economy has changed, consumer demand has shifted & retailers' operating systems today are infused with far more technology than was the case six years ago.

The Top Five	
Company	**Investment**
Wal-Mart -	Bharti Yet to announce
Reliance	$ 5.5 billion
Aditya Birla Group	$ 3.3 billion
Pantaloon	$ 1 billion
Tatas	$ 89 million
Source: The Economic Times	

Present Indian Scenario

India‟s retail market that is seen as the GOLDMINE by global players has grabbed attention of the most developed nations. This is no wonder to the one who knows that the total Indian retail market is US $350bn. (16, 00,000 crore INR approx.) of which organized retailing is only around 3 percent i.e. US $8bn (36,000 crore INR approx).

Modern retail has entered India as seen in sprawling shopping centers, multi-stored malls and huge complexes offer shopping, entertainment and food all under one roof. The future of Indian retailing may even witness the concept of 24 hour retailing. The urban retail market has been embracing various new formats and the malls turned out to be the trendsetters by promising the concept of shoppertainment. The trends in the rural market also have been changing from the old Haats and Melas to the rural malls like „Chaupal Sagar‟ launched by ITC, DCM Shriram Groups one- stop shopping destination called „Hariyali Bazaar‟, Godrej groups agri store „Adhar‟ etc.



ISSN 2394 - 7780

The trend in grocery retailing, however, has been slightly different with a growth concentration in the South. Though there were traditional family owned retail chains in South India such as Nilgris as early as 1904, the retail revolution happened with various major business houses foraying into the starting of chains of food retail outlets in South India with focus on Chennai, Hyderabad and Bangalore markets, preliminarily. In the Indian context, a countrywide chain in food retailing is yet to be established as lots of Supply Chain issues need to be answered due to the vast expanse of the country and also diverse cultures that are present.

- Unorganized market: Rs. 583,000 crores*
- Organized market: Rs.5, 000 crores* 5X growth in organized retailing between 2000-2005 * Over 4,000 new modern Outlets in the last 3 years* Over 5,000,000 sq. ft. of mall space under development

Major players

- Food and grocery-
- Food world-
- Shoppers' Stop-
- Subhiksha- Working at certain places
- Westside
- Planet M
- Nilgris
- Lifestyle
- Music World
- Nirma-Radhey
- Globus
- Reliance Fresh
- RPG‟s Spencers

Indian consumers are rapidly evolving and accepting modern formats overwhelmingly. Retail Space is no more a constraint for growth.

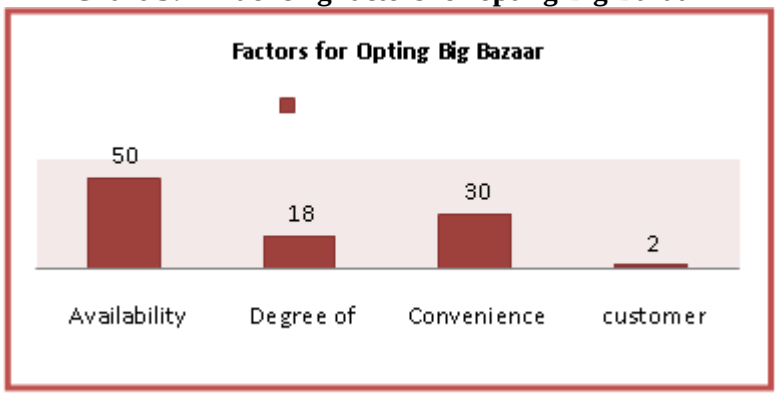
Few of India's top retailers are

1. **Big Bazaar-Pantaloons:** Big Bazaar, a division of Pantaloon Retail (India) Ltd is already India's biggest retailer. In the year 2003-04, it had revenue of Rs 658.31 crores & by 2010; it is targeting revenue of Rs 8,800 Crore.
2. **Food World:** Food World in India is an alliance between the RPG group in India with Dairy Farm International of the Jardine Matheson Group
3. **Trinethra:** It is a supermarket chain that has predominant presence in the southern state of Andhra Pradesh. Their turnover was Rs 78.8 Crore for the year 2002-03.
4. **Apna Bazaar:** It is a Rs 140-crore consumer co-operative society with a customer base of over 12 lakh, plans to cater to an upwardly mobile urban population.
5. **Margin Free:** It is a Kerala based discount store, which is uniformly spread across 240 Margin Free franchisees in Kerala, Tamil Nadu and Karnataka. Wholesale trading is another area, which has potential for rapid growth. German giant Metro AG and South African Shoprite Holdings have already made headway in this segment by setting up stores selling merchandise on a wholesale basis in Bangalore and Mumbai respectively. These new-format cash-and-carry stores attract large volumes from a sizeable number of retailers who do not have to maintain relationships with multiple suppliers for all their needs.

ISSN 2394 - 7780

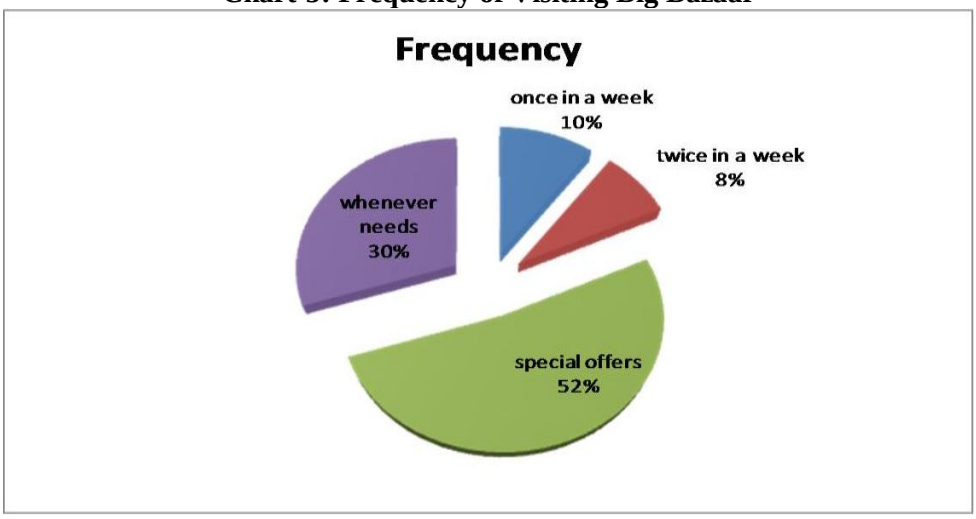
IX DATA ANALYSIS

Chart-3: Influencing factors for opting Big Bazaar



Big bazaar is basically very spacious. The graph indicates that 50% of the big bazaar customers visit it only on the basis of availability of goods. The other major factor is convinces. There are also other factors which are driving forces for the costumers to visit big bazaar.

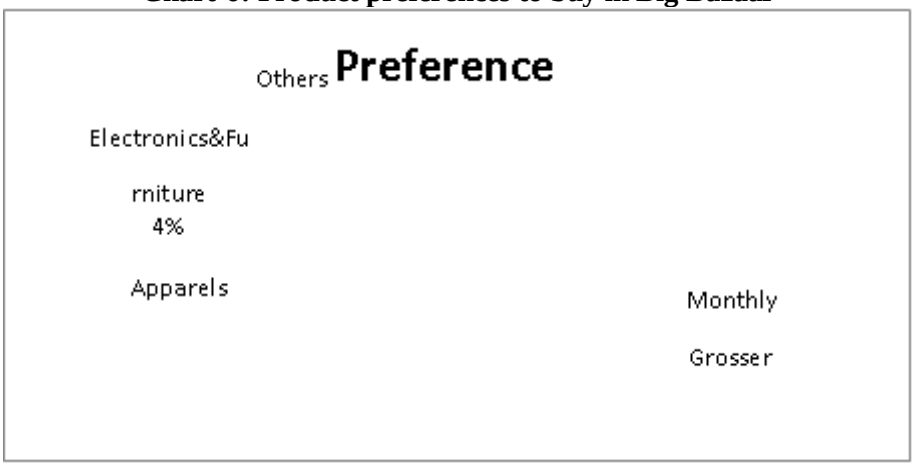
Chart-5: Frequency of Visiting Big Bazaar



Source: Primary Source - Questionnaire

People visit big bazaar whenever they need some product. Apart from their needs, its big bazaar's special offers that make people to visit. The graph clearly indicates that 52% of the people visit big bazaar it's only because of special offers.

Chart-6: Product preferences to buy in Big Bazaar

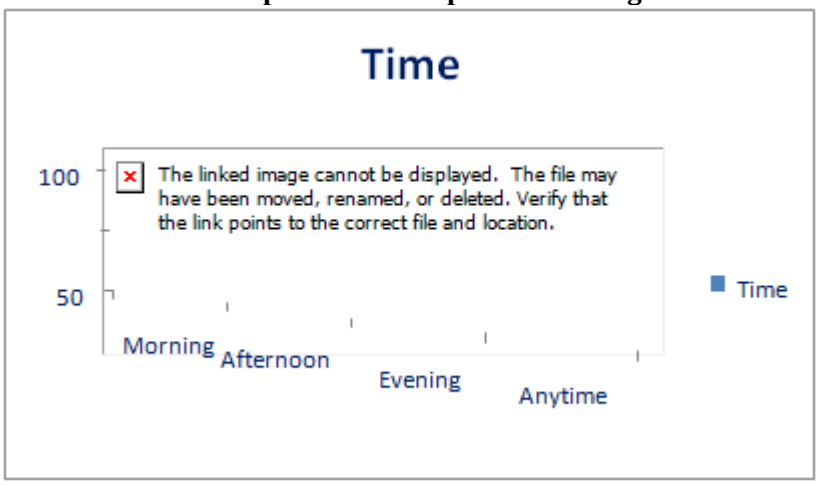


Source: Primary Source - Questionnaire

Though there are varies of products in big bazaar, its monthly grocery that attracts the customers to big bazaar. The above graph indicates that 62% of the big bazaar customers come to it only for the Monthly grocery. The next section is apparels. It shares about 22% of the total contribution.

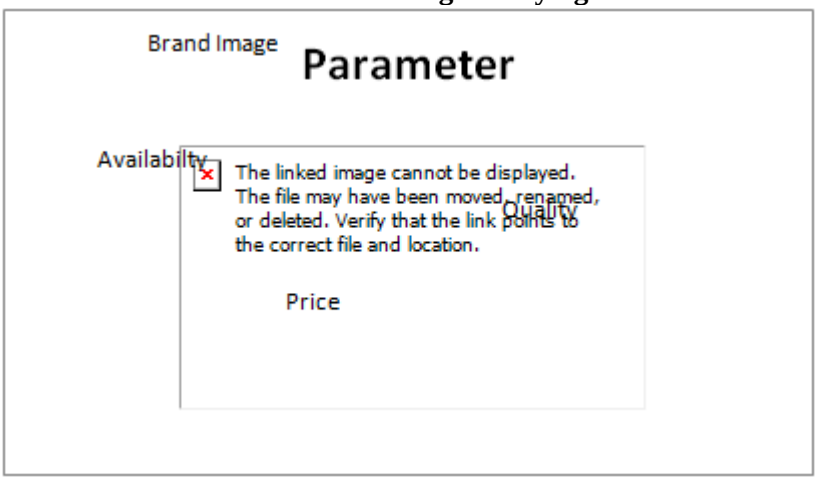
ISSN 2394 - 7780

Chart-7: Time preferences to purchase in Big Bazaar



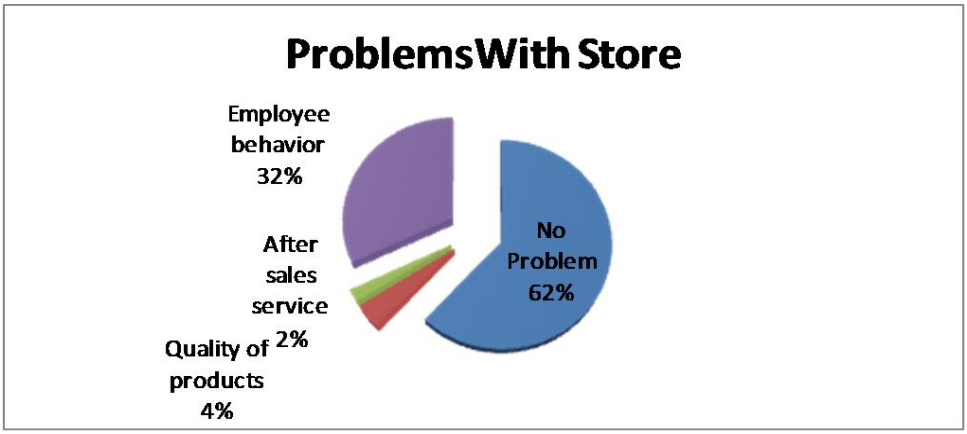
Customers are willing to buy the product mainly in the evening. Above graph indicates that 68% people are willing to buy in the evening. The next best percent of 24% indicates that people who are in need may buy the product at any time. Very few are willing to buy in the morning as well as in the afternoon.

Chart – 8: Factors Effecting on Buying Decisions



Quality is the well known parameter to buy any product. In the above its clearly indicates that 45% of the customers are will to buy products from the big bazaar because of its quality products. Its good to observe that the next priority is given to price. The graph indicates that 31% are mainly the products because of price as their main priority. The remaining people are willing to buy because of availability and brand image.

Chart – 9: Problem with Store



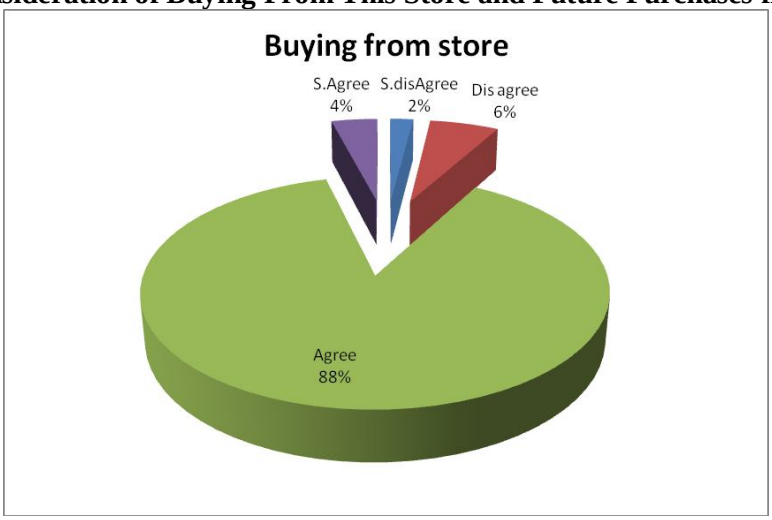
Majority of the customers of big bazaar do not face any problem. People are willing to come to big bazaar. The next major concern for the customers is employees who are working at big bazaar. The above graph indicates that 32% of the customers are facing problems regarding way of approach to the customers, not attentive to the customers.

ISSN 2394 - 7780

Chart- 10: Total Quality of Service

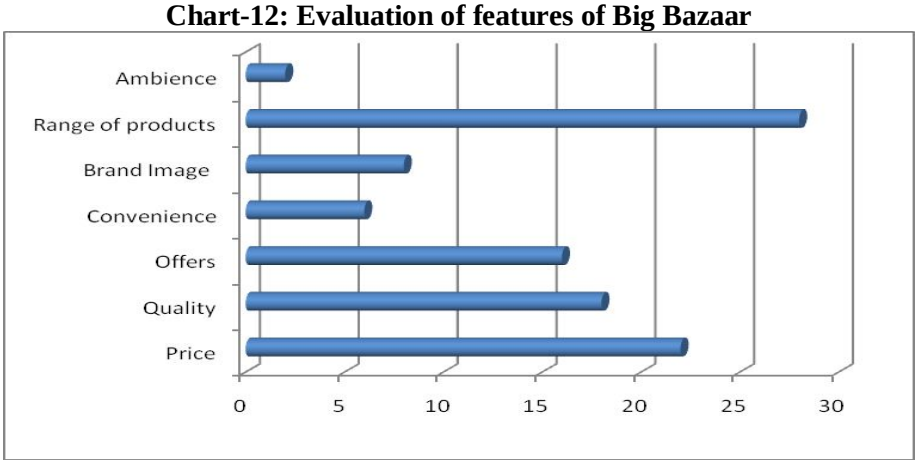
A good number of the customers have accepted that the total quality service provided by the big bazaar is good. Very few have accepted that it is excellent. There are also some customers (5%) who are not satisfied with the quality service.

Chart -11: Consideration of Buying From This Store and Future Purchases from This Store



Around 88% of the customers are willing to buy different products in future from this story. They agreed that they will increase sales from this store in future. And only few numbers of customers disagreed that they wont purchase and increase sales from this store they may be due to their dissatisfaction, chart 11 shows the details.

Chart-12: Evaluation of features of Big Bazaar



Big bazaar is well to its range of products. In the above its clearly indicates that majority of the customers are willing to come to big bazaar because of its variety of products. Price quality and offers are also having the major role to play in buying behavior of the customers.

ISSN 2394 - 7780

X FINDINGS

In the surveys, interviews and study conducted above, I came across many factors that influence the consumers‟ perception of a store and their subsequent shopping and buying decisions. Here, I present the findings gathered and the suggestions we offer to companies based on the data gathered and analyzed.

- As I analyze its clearly indicates that special offers, quality, variety and price are the major determinants which makes customers to visit Big Bazaar.
- Majority of the customers are willing to buy products at big bazaar in the evening times.
- In Big bazaar major proportion of customers are attracted by food bazaar‟s special offers and prices.
- Its variety of range of products which influences the buying behavior of customers at Big Bazaar.
- Next to food bazaar section, Apparels which attracts the customers.
- As my observation goes it‟s the quality of the products at big bazaar which makes the customers to buy.
- There are also good numbers of customers who wish to buy branded products.
- Advertisement is the main promotional tool for knowing about Big Bazaar, which attracts the customers to come to outlet.

XI SUGGESTIONS

Lower quality of goods: As Big bazaar aims more toward the middle income group, the quality of goods is not of the highest quality, and this is sometimes a disadvantage as some would prefer better quality to the price, making customers to search for different places.

Does not appeal to the elite: As mentioned above, the main customers are middle income and a few high income groups,

The elite do not like to shop at Big Bazaar as the quality of goods is lower and they would prefer a higher price and get a better brand, this decreases sales from the elite class

Not acclaimed for very good service: Big Bazaar is not known for high class service. The staff recruited is not very well trained and the billing queues take a long time to move, this irritates customers which makes them visit the store more seldom

Quality of goods: As the store is trying to concentrate on the middle income group the type of products used is not of the most superior quality and most of the times nor branded, this may dissatisfy certain customers

Consumer satisfaction: Long queues and lower quality leads to dissatisfaction of customers. Due to factors mentioned above Big Bazaar shoppers are not always satisfied, this is not a positive for the store.

XII CONCLUSIONS

Variety: Big Bazaar offers a wide variety of products of different prices and different qualities satisfying most of its customers.

Quality: Providing quality at low prices and having different types of products for different income customers is another advantage, Normally what the consumers want.

Price: As noted the prices and offers in Big Bazaar have been one of the main attractions and reasons for its popularity. The price ranges and the products offered are very satisfying to the customers.

Location: The location of Big Bazaar has been mainly in the heart of the city or in the out skirts giving a chance to both the City and the people living outside the city to shop.

Advertisements: Big bazaar has endorsed very popular figure like M S Dhoni and other famous personalities which has attracted a lot of customers. This has resulted in increase of sale and the outdoor advertising techniques have also helped Big Bazaar.

Middle class appeal: Considering the fact that there are a lot middle class families in India, Big bazaar has had a huge impact on the middle class section of India, the prices, quality and sales strategy has helped in getting the middle income groups getting attracted towards Big Bazaar.

Attractive sales: Big bazaar has been known for its great sale and great offers. Big bazaar has had long lines of people waiting to get into the store for the sale. Therefore, the sales that Big Bazaar has had has increased sales in a huge way due to the sales and offers, thus this has been one of the main advantages of Big Bazaar.

ISSN 2394 - 7780

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UNCERTAINTIES IN CLIMATE CHANGE PROJECTIONS

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ABSTRACT

The meteorological parameters Rainfall and temperature, simulated using Global Climate Models (GCMs), serve as a key inputs for hydrological models in studying catchment response to climate scenarios. GCM simulations of rainfall and temperature, however, are uncertain due to model structure, scenarios and initial conditions, which results in biased outcomes if used for impact assessment without due consideration of the uncertaintiesThis is mainly due to three factors: natural variability, model uncertainty, and GHG emission scenario uncertainty. In general, scenarioand model configuration uncertainty dominate for long term climate change, especiallyat the global scale. The contribution of internal variability increases for near term projections and for higher order climate statistics. Downscaling uncertainty is significant for variables primarily affected by local processes, such as summer convective precipitation. It is argued that because of these sources of uncertainty, the climate prediction problemshould be addressed in a probabilistic, rather than deterministic way. Resolving inter-model differences could reduce uncertainty significantly, but there is still a large irreducible uncertainty due to climate variability in the near-term and, particularly for temperature, future emissions scenarios in the long-term.

Keywords: Climate change, General Circulation Model, Global Climate Models, Green House Gases, Monsoon

INTRODUCTION

Projections of climate change for the 21st century at the global to regional scale in responseto increased emissions of greenhouse gases (GHG) are necessary in order to assess the impacts of GHG-inducedglobal warming and to develop suitable adaptation and mitigation response strategies. Climate changecan occur not only because of anthropogenic forcings, e.g. increased atmospheric GHG and aerosolconcentrations, but also because of natural forcings, e.g. changes in solar activity, and/ornatural unforced variability of the climate system. All these anthropogenic and natural factors,along with theuncertainties that characterize them, need to be accounted for in producing future climate projections.

In addition, climate projections are produced via a range of modeling tools, from coupled Atmosphere-Ocean Global Climate Models (AOGCMs) to statistical and dynamical downscaling techniques(e.g. Regional Climate Models or RCMs,). These tools are also affected by substantial uncertaintiesrelated to our imperfect knowledge and description of relevant processes in the climate system.

It is thus clear that multiple sources of uncertainty are present in the production of climate change projections for the 21st century. They compound in the cascade of steps involved in generating theprojections and their full characterization is a key element of the climate change problem, since it is an essential piece of information needed to assess the risks related to climate change and the costs of adaptation and mitigation options. Indeed, during the last decade or so increasing research interest has gone into the assessment, quantification and representation of the uncertainties in climate change projections for use in impact assessment and risk analysis studies.

It is important to note that the term “uncertainty” has a generally negative connotation, implyingthat uncertainty is related to our poor knowledge of the problem and thus needs to be reduced as muchas possible by advancing research. This is certainly true for some sources of uncertainty, which wecan broadly refer to as “Knowledge Uncertainty”. On the other hand, as will be clear by the following discussion, some elements of uncertainty are intrinsic to the climate change problem and thus it ismost important that they are fully characterized in order to provide the full range of possible outcomes, and in particular low probability-high impact outcomes. We can refer to this as “Intrinsic Uncertainty” and in this case, paradoxically, increased knowledge might lead to an increase in uncertainty. Understanding and relating the problems of Knowledge (or “bad”) uncertainty and Intrinsic (or “good”) uncertainty is a difficult task, especially when communicating this issue to non-experts.

Climate models have been evaluated (e.g. Flato et al. 2013) by assessing how well model results fit observation based data (empirical accuracy) and how well they agree with other models or model versions (robustness). Parker (2011) has argued that robustness does not objectively increase confidence in simulations of future climate change. Baumberger et al. (2017) address the challenge of building confidence in future climate model predictions through a combination of empirical accuracy, robustness and coherence with background

ISSN 2394 - 7780

knowledge. Assessing coherence with background knowledge is limited because of empirical parameterizations and the epistemic opacity of complex models (Lenhard and Winsberg 2010).

Sung et al, 2018 selected 26 climate projections that provide daily precipitation under the representative concentration pathway (RCP) 4.5. The results show that a 20-year return period of precipitation event during a reference period (1980~2005) corresponds to a 16.6 yr for 2011 to 2040, 14.1 yr for 2041 to 2070, and 12.8 yr for 2071 to 2100, indicating more frequent extreme maximum daily precipitation may occur in the future and further indicates that the design standard under the reference climate is not managed to cope with climate change, and accordingly the revision of the design standard is required to improve sustainability in infrastructures.

Inconsistencies in the calculation of radiative forcing by CO_2 introduce uncertainties in model projections of climate change, a problem that has persisted for more than two decades (Soden, et al. 2018). The explicit calculation of radiative forcing and a careful vetting of radiative transfer parameterizations provide a straightforward means to substantially reduce these uncertainties and improve the projections.

Uncertainties in projections of different climate variables are usually described only by the ranges of possible values. For assessing the possible impact of climate change, it would be more useful to have probability distributions for these variables. Obtaining such distributions is usually very computationally expensive and requires knowledge of probability distributions for characteristics of the climate system that affect climate projections. A few studies of this kind have been carried out with energy balance/upwelling diffusion models (Webster and Sokolov, 2000).

This article illustrates some of the potential sources of uncertainty. However, the answers to such uncertainities can provide guidance for how much care should be taken when using climate projections for planning efforts.

CLIMATE PREDICTIONS VS PROJECTIONS

Climate predictions are claims about the actual evolution of the climate system given knowledge of the current state of the climate system (and an external forcing scenario). They are usually obtained by starting from an initial conditions ensemble representing the uncertainty in the observations. Then models are used to evolve this ensemble forward to obtain forecasts of the climate variables, assuming a certain external climate forcing scenario. (Climate forcings are the factors that affect the climate: they drive or “force” the climate system to change. Examples are variations in the energy output of the sun, greenhouse gases or volcanic eruptions. External forcings are forcings external to the climate system (as it is modelled), e.g., the variation in energy output of the sun).

Climate projections are claims about the response of the climate system to external forcing scenarios (IPCC 2014). They are usually obtained by starting from initial conditions ensembles that (in contrast to predictions) represent possible (and not observation-based) initial conditions of the climate system at pre-industrial times (where the system has at least partially adjusted to the external forcings at pre-industrial times). Then models are used to evolve this ensemble forward to obtain a forecast of the climate variables (assuming a certain external forcing scenario). Predictions and projections are crucial: they provide the most important information about the future climate system and routinely inform policy decisions. Indeed, it seems no exaggeration to claim that the forecasts that have been most often shown to policy makers are projections.

SOURCES OF UNCERTAINTY IN CLIMATE CHANGE PROJECTIONS

Uncertainty in future climate change presents a key challenge for adaptation planning. Uncertainties in climate change projections arise from three primary sources:

- *Natural climate variability* resulting from natural processes within the climate system which cause changes in climate over relatively short time scales;
- *Future emissions of greenhouse gases* arising from uncertainty over the scale of future global emissions of greenhouse gases by human society, and thus the scale of future radiative forcing; this becomes a dominant source of uncertainty on time scales of 50 years or more.
- *Modelling uncertainty* arising from incomplete understanding of Earth system processes and incomplete representation of these processes in climate models.

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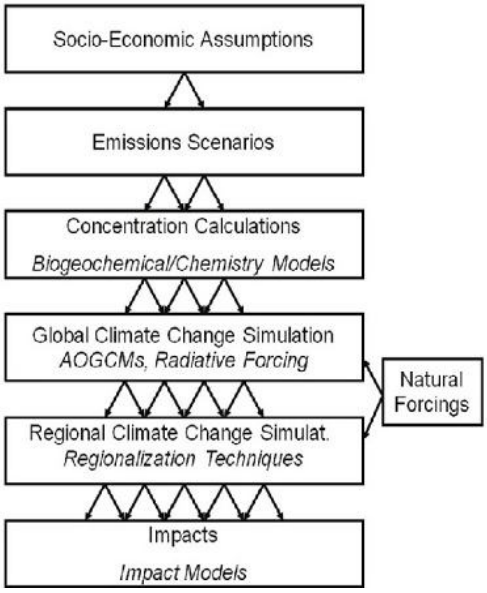

Figure-1: Cascade of Uncertainaties in Climate Projections.

Figure 1 shows the sequence of steps that are usually undertaken to produce a climate change projection at global and regional scales. Each step of the process described in Fig. 1 is affected by ascertain level of uncertainty, which is compounded to that of the next step in a cascade process that results in an overall level of uncertainty in the projection.

Key Uncertainties in Projections of Global and Regional Climate Change (IPCC)

• Based on model results there is limited confidence in the predictability of yearly to decadal averages of temperature both for the global average and for some geographical regions. Multi-model results for precipitation indicate a generally low predictability. Short-term climate projection is also limited by the uncertainty in projections of natural forcing.

• There is medium confidence in near-term projections of a northward shift of NH storm track and westerlies.

• There is generally low confidence in basin-scale projections of significant trends in tropical cyclone frequency and intensity in the 21st century.

• Projected changes in soil moisture and surface run off are not robust in many regions.

• Several components or phenomena in the climate system could potentially exhibit abrupt or nonlinear changes, but for many phenomena there is low confidence and little consensus on the likelihood of such events over the 21st century.

• There is low confidence on magnitude of carbon losses through CO 2 or CH 4 emissions to the atmosphere from thawing permafrost. There is low confidence in projected future CH 4 emissions from natural sources due to changes in wetlands and gas hydrate release from the sea floor.

• There is medium confidence in the projected contributions to sea level rise by models of ice sheet dynamics for the 21st century, and low confidence in their projections beyond 2100.

• There is low confidence in semi-empirical model projections of global mean sea level rise, and no consensus in the scientific com - munity about their reliability.

• There is low confidence in projections of many aspects of climate phenomena that influence regional climate change, including changes in amplitude and spatial pattern of modes of climate variability.

DOWNSCALING UNCERTAINITY

Downscaling comes in two main types: statistical and dynamical. In the case of dynamical downscaling, regional climate models (RCMs) are used to translate GCM information to local scales. Given their similar construction, it is a reasonable assumption that RCMs have similar internal sources of uncertainty as GCMs (structural and parametric; Knutti et al. 2008). However, what are the sources of uncertainty internal to statistical downscaling? Statistical downscaling is defined by creating a statistical relationship between GCMs and observations, which is effectively an exercise in statistical modeling. Therefore, one could argue that statistical downscaling has model uncertainty as described by the statistics community (Chatfield 1995),

ISSN 2394 - 7780

including structural and parametric. However, a close examination of the literature suggests that statistical downscaling includes more sources of uncertainty than simply the model uncertainty associated with the downscaling technique (e.g. Pourmokhtarian et al. 2016; Olyer and Nicholas, 2018). Statistical downscaling also includes numerous sets of data handling and special processing approaches. These are processes that include those implemented prior to downscaling (such as data transformations, regridding, or interpolation) and processes implemented alongside a downscaling technique (such as treatments for extreme values).

IMPACT MODELS

The primary sources of uncertainty of impact models stem from measurement errors, variability and model structure (Morgan &Henrion, 1990). For the analysis of changes in discharge and flood risk, hydrological models are used. Hydrological modelling represents the physical process of runoff production through mathematical formulations. Two main uncertainties of hydrological modelling are derived from measurements and structural uncertainty of the model (Prudhomme, Jakob, &Svensson, 2003). The measurement uncertainty is related to the measurements that are used to calibrate and validate the model.

Representing uncertainty in climate change projections

The presence of "Intrinsic" uncertainty sources, such as the scenario and internal variability ones, essentially precludes a deterministic approach to the problem. The unpredictable nature of future socio-economic and technological development and the non-linearitiesin the climate system (which determine its internal unforced variability), are such that it is essentiallyimpossible to exactly predict what will be the climate of the 21st century. This is the case even if we had perfect climate models and observing systems. The imperfect knowledge in present day modelsand observation systems further adds to preventing a deterministic climate prediction.

This implies that the problem of climate change prediction has to be approached in a probabilisticway, by which we can evaluate the range of possible outcomes and assign to each outcome a certainprobability to occur. From the technical point of view this can be achieved by producing ProbabilityDensity Functions (PDFs) of future climate (or climate change) variables. The width of the PDF (forexample its standard deviation) is a measure of the overall uncertainty in the projection and the PDF can be used in risk-based impact assessment studies in conjunction to the calculation of the costs (inthe broad sense) of the impacts. The real change that the Earth's climate system will experience willthen be one realization hopefully falling within the PDF of the predicted outcomes.

INDIA SUMMER MONSOON

At present, the general circulation models (GCMs) are the best tools to understand and project climate change due to global warming. Compared to the earlier versions, the latest Intergovernmental Panel on Climate Change (IPCC) Coupled Model Intercomparison Project, Phase 5 (CMIP5) coupled general circulation models (CGCMs) projects climate change with slightly better skill in representing the important characteristics of the present□day Indian summer monsoon (ISM, Sperber et al., 2012; Jayasankar et al., 2015). In spite of their ability to characterize large□scale weather systems, they fail to capture some important phenomena of regional and fine□scale structures, viz., coastal area's information and orographic impacts that affect regional climate, due to their coarse resolution of the order of ~ 2°. This seriously limits CMIP5 models particularly to resolve the narrow orographic and vegetation heterogeneity of the west coast. Jayasankar et al. (2015) showed that a group of CMIP5 CGCMs with the highest reliability still projected future intensification of Indian summer monsoon rainfall (ISMR) including rainfall over the west coast, which was however opposite to the observed trend in rainfall. This suggests that it is deficient to use climate change information projected by global GCMs directly for regional□scale climate change assessments and impact studies.

The only way to understand the impact of global warming on the Indian monsoon and to assess future monsoon climate is to use climate models based on the scenarios of emission of greenhouse gases (Rajeevan and Nanjundiah, 2009). Various climate models have been developed to study the Earth's climate system in the past and future at a global as well as regional scales, driven by assumptions based on different emission scenarios, which attempt to address the uncertainty in future emissions and might be an important aspect of assessing the future climate conditions. Using a range of different climate model simulations provides a better understanding of uncertainty in the projections (Jones et al., 2012) and by using ensemble approach (Jacob, 2007; Reichler and Kim, 2008), the uncertainty in the projections can be estimated quantitatively. The simulation of several GCMs over the Indian monsoon region concludes that GCMs have difficulties in simulating the mean monsoon climate of Indian region (Sperber and Palmer, 1996; Giorgi and Mearns, 2002; Kang et al., 2002; Douville, 2005; Turner and Annamalai, 2012). The analysis of many GCMs (both atmospheric and atmosphere-ocean coupled models) showed that there are several problems in the representation of the mean Indian monsoon climate

ISSN 2394 - 7780

(Gadgil and Sajini, 1998; Kang et al., 2002; Wang et al., 2004b, 2005; Rajeevan and Nanjundiah, 2009). Furthermore, GCMs are often run at a very coarse resolution to depict the influence of complex topography on regional climate dynamics. As a result, "GCMs cannot access the spatial scales that are required for climate impact and adaptation studies" (WMO, 2002), whereas the high resolution RCMs are capable of producing more realistic precipitation climatologies (Kumar et al., 2013) and they can also produce appropriate projections to generate climate scenario at a regional scale. In the recent years, there has been an increase in the interest among different research groups in developing high resolution climate scenarios for India at a regional scale by using various high resolution RCMs. In this aspect, the simulation of the Indian summer monsoon circulation features and the associated rainfall by a numerical model had been the most challenging problems so far. Although some attempts have been made to simulate monsoon features and extreme weather events over India by RCMs. Kumar et al. (2013), in a series of simulations by using two RCMs (HadRM3 and REMO) forced by two GCMs (ECHAM5-MPIOM and HadCM3), observed that RCMs forced with GCMs are more efficient than GCM in simulating the inter-annual variability of the mean monsoon precipitation. The predictions of the temperature and precipitation by RCMs are quite close to the observations. Various attempts have been made to analyse the uncertainty of RCMs in simulating Indian summer monsoon (Bhaskaran et al., 1996, 2012; Dash et al., 2006). Earlier studies (Bhaskaran et al., 1996; May, 2004; Dash et al., 2006; Mukhopadhyay et al., 2010; Bhaskaran et al., 2012) analysed the possible impacts of the global warming on Indian summer monsoon using the output of different RCMs and most of them reported that the model outputs concord well with the observations; and the high resolution RCMs are able to show improvement in the distribution of monsoon rainfall at spatial and temporal scales.

Furthermore, several studies emphasised on regional climate modelling systems to predict the future uncertainty of the climate variability and climate change at a regional scale over different regions of the globe with a coarse resolution using the Providing REgional Climates for Impacts Studies (PRECIS), that is the third generation Hadley Centre RCM (Zhang et al., 2006; Islam et al., 2007; Kotroni et al., 2008; Marengo et al., 2009; Nazrul Islam, 2009; Jones et al., 2012; Mohammad et al., 2012; Met Office Report, 2012), and the PRECIS simulations showed good performance when the temperature and rainfall for the analysed regions were calibrated. Hence, extensive debates still exist in understanding the possible characteristics of monsoon variability and its provenience in climate change. Many studies (Rupa Kumar et al., 2006; Krishna Kumar et al., 2010, 2011; Geethalakshmi et al., 2011; Revadekar et al., 2012; Kulkarni et al., 2013; Rajbhandari et al., 2014; Caesar et al., 2015) have used PRECIS to simulate high resolution climate change scenarios for the whole India at 50 km × 50 km horizontal resolution with limited ensemble members, and produced quite reasonable results for the prediction of meteorological parameters like rainfall and temperature over the region. These studies also provided a robust evaluation of the 17 HadCM3Q downscaled experiments over South Asia but most of these regional studies considered only single model projections and few had been in India that used RCM with multi ensemble and high resolution downscaling approaches to assess the future climate change uncertainties.

SUMMARY AND CONCLUSIONS

Clearly, the issue of uncertainty is at the heart of the climate change prediction problem and due to its complexity, both conceptual and when applied to specific impact issues, it will remain a central issue within the climate change debate. This paper discusses in detail the contribution of different sources of uncertainty, scenario, model configuration, model bias, internal model variability and downscaling, on the overall uncertainty range in climate projections from the global to the regional scale. None of these recognized uncertainties can make the problem go away. It is virtually certain that human-caused greenhouse warming is going to continue to unfold, slowly but inexorably, for a long time into the future. The severity of the impacts can be modest or large, depending on how some of the remaining key uncertainties are resolved through the eventual changes in the real climate system, and on our success in reducing emissions of long-lived greenhouse gases.

For early 21st century projections, the scenario uncertainty becomes secondary and the contribution of internal model variability becomes of primary importance. The contribution of internal variability increases when going from the global to the regional scale and it increases for higher order climate statistics.

A full characterization of uncertainty will require large ensembles of model projections, which in turn will necessarily require large international cooperative programs such as CMIP5, ENSEMBLES, and CORDEX in which climate change projections are carried out by a large number of models and laboratories worldwide in a coordinated fashion. Both climate scientists and policy makers need to accept the limits of probabilistic methods in conditions of ambiguity and deep uncertainty that characterize climate change.

ISSN 2394 - 7780

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NALGAD DAM AND RESERVOIR OPERATION SIMULATION USING HEC-RESSIM MODEL FOR HYDROPOWER GENERATION

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ABSTRACT
This study aims to develop the Nalgad dam and reservoir operation simulation model using HEC-ResSim for hydropower generation. Simulations are carried out to develop reservoir operation rule for maximum dry season energy generation under four different operation scenarios using historical daily discharge data for the period 1966 to 2016. From first operation scenario per time step (day) maximum average energy generation obtained is 3407.04 MWh/day *when four turbine units are in operation for 24 hour without using any hydropower rule. In second operation scenario hydropower schedule rule with different energy generation pattern as 24, 16, 12 and 8 hours operation throughout the year without seasonal variation (daily simulation). Maximum and minimum reservoir operation levels are 1580 msl and 1498 msl. Results of this scenario show that the maximum annual dry season energy generation is* 515.088 *GWh/year for 18 hour. From third operation scenario(daily simulation) the optimum dry season energy generation is* 742.727 *GWh/year with annual reliability 92.67% and total annual energy generation is 1250.75 GWh/year when hydropower schedule rule with energy generation pattern as eleven-hour operation during dry season and one-hour operation during wet season and reservoir level in between 1580 masl to 1489 masl. From forth operation scenario (hourly simulation) the optimum dry season energy generation is 735.04/year with half annual reliability 90.19 % and total annual energy generation is 1247.12 GWh/year when hydropower schedule rule with energy generation pattern as ten-hour operation during dry season and one-hour operation during wet season and reservoir level in between 1580 masl to 1498 masl. Further, these scenarios are analyzed by comparing the inflow, water level in reservoir, total annual energy production and firm energy production etc. From the analysis of results of these four scenarios, the operation rule/policy for optimum dry season energy generation from Nalgad reservoir is operation of reservoir using Hydropower–Schedule–Rule through generation pattern as ten hours peaking operation in dry season and one hour evening peaking operation in wet season with four turbine units in operation and maintain minimum and maximum reservoir level as defined in forth operation scenario.*

Keywords: Nalgad Dam Reservoir, HEC-ResSim, Simulation, Hydropower-Schedule-Rule, Optimum energy.

1. INTRODUCTION
Water resources are one of the most important natural resources available in abundance in Nepal. It has been rightly believed as a major source for economic development of the country. Hydropower development is one of the most beneficial uses of water resources which can play a major role in the overall development of the country. Nepal has been endowed with tremendous hydropower potential due to numerous rivers and favorable terrain. Nepal has a theoretical power generation potential was estimated to be 83,500 MW in 1966, out of which 42,000 MW is technically and economically feasible to be produced (Jha 2010). At present, the Integrated Nepal Power System (INPS) has only one seasonal storage project - Kulekhani -I. After the completion of this project in 1982, the peak power demand of the country was met for almost a decade. However, the country has been facing an acute shortage of both base and peak load since the last few years. Despite having an estimated potential of 83,500 MW and an economically feasible potential of about 42000 MW. The actual grid connected generating capacity as reported for 2016-17 was approximately 968 MW (NEA Annual Report 2016-17, page 161). The approximate total of 968 MW is comprised mainly of hydropower generation, except for 53.4 MW of thermal and a negligible amount of solar. Much of the capacity is run-of-river and is therefore not always available for meeting peak power demands, although Kaligandaki, Marsyangdi and Middle Marsyangdi power plants (combined capacity of 283 MW) were run for peaking operation during the 2016-17 dry season (Annual Report 2016-17, page 12).There are some 60 hydropower plants in operation: 38 in the public sector, 22 in the private sector and some 23 small hydropower plants in isolated operation. Only about 40 % of the total population has access to electricity. The quality of supply is relatively poor. The dry season generation as well as wet season capacity is inadequate. System losses are fairly high at 25 % and outages are quite frequent. Out of 25%, approximately 16% is the technical loss and the rest is system loss. To cope with system demand, there is urgent need of combined RoR and Storage Project for the system. The Nalgad Storage Hydroelectric Project (417MW) was conceived as one of the attractive project among the screened and ranked storage projects during (IFSSP-2001).

ISSN 2394 - 7780

HEC-ResSim is reservoir simulation model that has been developed by the Hydrologic Engineering Center of the US Army Corps of Engineers to aid engineers and planners in predicting the behavior of reservoir systems in water management studies and to help reservoir operators plan releases in real time during day-to-day and emergency operations. This study aims to model dams and reservoirs operation in the Nalgad river basin to simulate reservoir operation for hydropower generation using HEC-ResSim (Hydrologic Engineering Center – Reservoir System Simulation) model. In this study various operational scenarios with different generation patterns are studies through the developed simulation model and the generation pattern (defined in hydropower schedule rule in HEC-Ressim) which results the optimum dry season energy generation above 90% reliability is selected as reservoir operation rule /policy. Average reservoir water level of different month (Jan–Dec) corresponding to selected generation pattern are the reservoir minimum target level to maintain at any time is reservoir operation guide rule curve.

2. STUDY AREA DESCRIPTION

The Nalgad Storage Hydroelectric Project is located in Jajarkot District in the Karnali Province of Nepal. Nalgad is a tributary of the Bheri River in the Karnali Basin. The dam site of the project is located approximately 9.25 km upstream from the confluence of the Nalgad and the Bheri-River and the powerhouse is located on the left bank of Nalgad River approximately 500 m upstream from the suspension bridge at Dalli . The index map of the study area is shown in Figure 2.1. Extending from 800 m to 5,500 m, the area experiences wide variation in climatic conditions from sub-tropical to alpine climates. Areas above 4,500 m lie in the freezing zone during most of the year. Precipitation in the form of rain is expected in areas below 2,500 m, whereas snowfall is expected above 5,000 m throughout the year. Seasonal snow is observed in areas between 5,000 m and 2,500 m. The lower valleys are hot in summer but most of the mountainous areas with settlements have a relatively comfortable climate. Under the strong influence of monsoons, the watershed is wet with greenery in most of the areas during the summer monsoon season. Winter is generally dry with chilly weather conditions. Average elevations of the Nalgad basin at the Bheri River confluence and at the intake site are 2,890 and 3,110 m which indicate an annual average temperature of 8^{o}C and 9^{o}C respectively (based on the annual average temperature of 12.7^{o}C at Jumla). Average precipitation ranges from 1244 mm to 1793 mm.

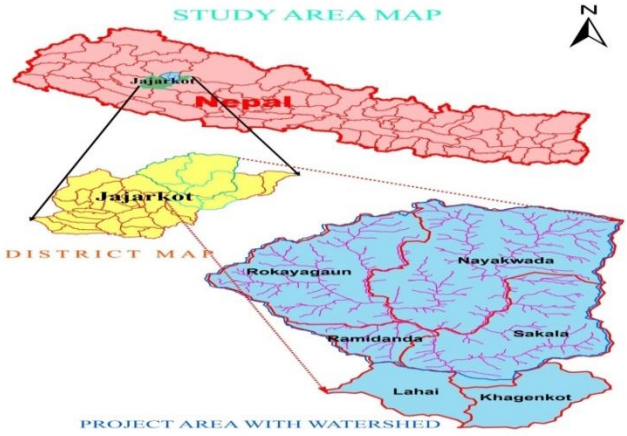

Figure-2.1: Location of Nalgad Hydropower Project

3. DATA AND METHODOLOGY

Prior to any river basin simulation, it is mandatory to search and collect basic inputs about the principal simulation components to be used for the proper simulation of the basin. The Daily inflow to reservoir and physical characteristics of reservoirs, spillways and outlet works, hydroelectric power plants, and other water control facilities etc. were collected from review of previous studies as well as data from institutions various organization viz. Ministry of Energy, Water Resources & Irrigation Nepal, Water and Energy Commission Secretariat (WECS), Nepal, Nalgad Hydropower Company Limited (NHCL), Nepal, Nepal Electricity Authority (NEA), Nepal. HEC-ResSim model computes reservoir storage contents, evaporation, hydroelectric energy generation, and river flows for specified system operating rules and input sequences of stream inflows and evaporation rates. In this study four different operation scenarios are considered and number of alternatives in each scenarios are made for different generation patterns then simulation for each created alternatives was carried out. Results of each simulation were analyzed and best alternative is selected based on; maximum energy generation per time step for scenario1. Maximum energy generation per time step and maximum total annual energy generation for scenario2.Maximum total annual energy generation, maximum dry season energy and reliability of dry season energy for scenario 3 & scenario 4.Then finally best operation set (Alternative) is

ISSN 2394 - 7780

selected as reservoir operation rule/policy for hydropower generation based on maximum annual energy generation, maximum dry season energy generation above 90% reliability, water level maintained in reservoir etc.

3.1 Development of reservoir model in HEC-ResSim

The initiation of the basin model development includes importing the ArcGIS stream alignment data, shape file of the watershed in HEC-Ressim. The common approach of the reservoir simulation model setup may include more than one reservoir creating the reservoir network. Here, in this study, only one reservoir network has been created. The river reach created in ArcGis was imported for the Nalgad Reservoir Project.

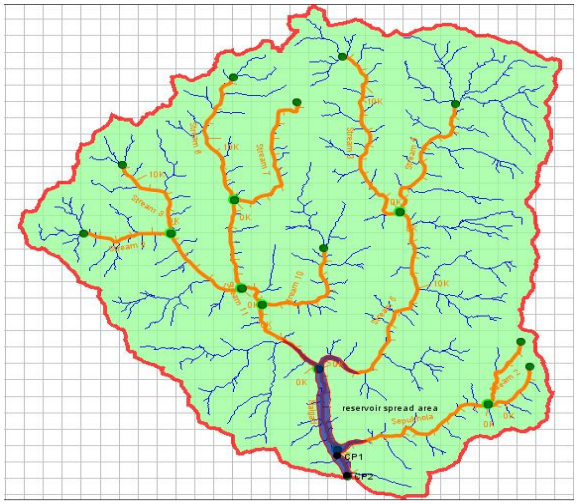

Figure-3.1: Watershed setup

Figure-3.2: Reservoir network

3.2 Data input for HEC-ResSim model setup

The data input for the model setup can be basically divided into Physical part, operation rule and the creation of the HEC-DSS time series data for running the simulation for specified time control. HEC-DSS system is designed to efficiently store and retrieve scientific data that is typically sequential. The daily inflow data for 51 years (1965 to 2016) is created in the HEC-DSS system.

Definition of physical parts is most important part in HEC-ResSim model. Even small changes affect significantly the system behavior and the impacts deteriorate or meliorate the result in the simulation part. Input that should be considered for the physical part consists of reservoir details and dam stretchers that here for this project consist of spillways and power plants, for reservoirs, storage and area is needed, for dam crest and length in terms of structures and spillways and power plants for regulating part must be considered. The general data requirement for this model included the physical and operational characteristics of Nalgad Reservoir. The physical reservoir data is described through the use of Reservoir Elevation-Area-Capacity curve, evaporation & seepage loss from the reservoir and the type and capacity of each outlet. Seepage is considered as 100 lps. There is a bell mouth type power intake having two gates of size (Height * Width) 4.5m*3m of capacity 78.4 m^3/sec. Ogee shaped, non - gated overflow weir spillway of crest width 60m, crest elevation 1580 masl and designed PMF 4759 m3/sec. Nalgad power plant installed capacity 417 MW having four units of capacity 104.25 MW each. Tail water elevation is 867.6 masl. Overload factor is considered as 1.0 and station use as 0 for this study. Hydraulic losses is 2.5% of gross head.

The operational data includes, the zone or pool level definitions along with the rules governing the operations in each zone. Nalgad reservoir has three major water management zones or pools; these are flood control, conservation and inactive zone. The inactive zone is often referred to as dead storage since this is water that is below the elevation of the lowest outlet in the dam and is considered for the sediment accumulation space.The top of conservation zone is assigned to the maximum operating level of reservoir 1580 masl, level above which the water is automatically spilled through the uncontrolled spillway. The top of inactive zone is assigned to the minimum operating level of reservoir 1498 masl, level below which no release. Low level uncontrolled outlet for continues environmental release 0.6 m3/sec is provided at level 1416 masl.

4. RESULTS AND DISCUSSION

The reservoir simulation study was carried out for Nalgad Reservoir Project using the estimated long term daily inflow data of Nalgad reservoir at intake site for the period 1966 to 2016.The total storage zone was divided in to flood control zone, conservation/storage zone and the inactive storage zone. The maximum operating levels

ISSN 2394 - 7780

considered in this study is full Supply Level at the elevation of 1580 masl which is set as top of conservation zone .The excess flow above that maximum operating level is spill through uncontrolled spillway. Minimum operating level 1498 masl is set as the top of inactive zone which is the minimum drawdown level. The operation rule for the conservation zone is to set the target to fill the reservoir to that level. The hydropower system schedule rule was applied to this level varying the hourly and seasonal generation pattern. The optimum energy is selected based on the comparison of energy generated per time step, total annual energy generated, annual dry season energy generated, total return from generated energy and system reliability for different operation scenarios with different generation patterns. There are four different alternate operation scenarios with number of generation patterns are considered and studies through simulation process in this study. Each of these operation scenarios results are presented and described as below. Operational zone used in this study are presented in table 4.1.

Table-4. 1: Water Management Zone of Nalgad Reservoir

Operational Zone	Elevation at top of Operational Zone
Flood Control	1589 masl
Conservation	1580 masl
Inactive	1498 masl

Operation Scenario 1

In this scenario operation rule was assigned for the twenty-four hours generation pattern for all seasons. The power guide rule curve is not used here and the power generation is totally based on the variation of inflow throughout the year. It is further analyzed by varying the number of turbine units in operation as two, three and four throughout the year. Best alternative is selected based on maximum energy generation per time step. The energy generated per time Step for 2, 3 and 4 turbine units are 3185.52, 3363.36 and 3407.04 MWh/day respectively. Energy generated per time step is maximum when the four turbine units are in operation. However, the increase is small from three to four turbine units. Hence run four turbine units together to get maximum energy generation for upcoming scenarios.

Operation Scenario 2

This operation scenario includes twenty-four hours generation pattern throughout the year varying the minimum total daily energy requirement. The power guide rule curve used here is hydropower schedule rule. Five different alternatives were considered for the different minimum daily energy requirement such as one-fourth, one-third, one-half, three-fourth and full energy of the maximum daily total energy generated. In this scenario HEC-ResSim try to meet the total daily energy requirement as daily time step was assigned for simulation. Summary of simulation result of each alternative shown in table 4.2.

Table-4.2: Comparison of results of various competitive alternatives of scenario 2

Parameters		**Alternatives**				
Alternatives		**1**	**2**	**3**	**4**	**5**
Total daily Energy Requirement		100%	75%	50%	**33.33%**	25%
Equivalent Operation Hour		24	18	12	**8**	6
Average Energy Generated Per Time Step (MWh)		152.21	151.35	148.75	**145.03**	138.6
Dry Season Energy Generated (MWh/year)		193.33	277.527	429.129	**515.088**	451.057
Wet Season Energy Generated (MWh/year)		1141.00	1049.27	874.9	**733.911**	763.884
Total Annual Energy Generated (MWh/year)		1334.3	1326.8	1304.03	**1249.00**	1214.942
Spill (m^3/s)	Average	0.189	0.48	1.04	**1.85**	3.23
	Maximum	187	187	211	**239**	297
Annual Energy Generation Reliability (%)		15.26	34.46	57.1	**87.34**	98.84
Remarks					**Selected**	

In this operation scenario the maximum total annual energy generation is 1334.3 GWh/year when hydropower schedule rule with minimum daily energy requirement is equal to maximum total energy generation capacity i.e. total annual energy generation is maximum when the power plant operated /run for 24 equivalent hours. But as per the study objective maximum dry season energy generation is 515.088 GWh/year when the minimum daily energy requirement assigned is one-third that means dry season energy generation is maximum when power plant operated/run for 8 equivalent hours throughout the year. Hence from this scenario hydropower schedule rule with 8 hours energy generation pattern throughout the year is selected as best operation policy/rule to generate maximum dry season energy.

ISSN 2394 - 7780

Operation Scenario 3

This operation scenario includes seven different generation pattern with seasonal and hourly variation in energy requirement. The power guide rule curve used here is hydropower schedule rule and the daily energy requirement varies with season as dry season (Dec to May) and wet season (Jun to Nov). As daily time step was assigned for simulation in this scenario HEC-ResSim try to meet the total daily energy requirement. This scenario result gives the operation policy for maximum total annual energy generation, optimum dry season energy generation with reliability above 90 % and reservoir level in between 1580 and 1498 masl. Summary of simulation result of each alternative presented in table 4.3.

Table-4.3: Comparison of various competitive alternatives of scenario 3

Parameters		**Alternatives**						
Alternate		**1**	**2**	**3**	**4**	**5**	**6**	**7**
Daily total Energy Requirement (MWh/day)	Dry	4170	4170	**4587**	4587	5004	3753	3336
	Wet	417	1668	**417**	1251	417	2502	2919
Equivalent Operation Hour	Dry	10	10	**11**	11	12	9	8
	Wet	1	4	**1**	3	1	6	7
Energy Generated per Time Step (MWh)		3417.84	3459.36	**3424.32**	3452.4	3422.88	3466.32	3453.6
Dry Season Energy Generated (GWh/year)		731.917	699.167	**742.727**	726.036	743.021	617.286	552.522
Wet Season Energy Generated (GWh/year)		516.414	564.394	**508.023**	534.973	507.231	648.642	708.845
Total Annual Energy Generated (GWh/year)		1248.33	1263.56	**1250.75**	1261.009	1250.25	1265.93	1261.37
Annual Energy Generation Reliability (%)		97.8	92.42	**92.67**	90.47	88.07	90.81	91.1
Remarks				**Selected**				

From the results of this operation scenario, the maximum total annual energy generation is 1265.93 GWh/year when hydropower schedule rule with generation pattern nine-hour operation during dry season and six-hour operation in wet season is assigned. But as per the study objective maximum dry season energy generation is 742.727 GWh/year with 92.67 % reliability (reliability is calculated for both season i.e. 612 month) of total annual energy generation when the power plant operated/run for eleven hours during dry season and one hour during wet season. Hence from this scenario hydropower schedule rule with energy generation pattern as eleven-hour operation during dry season and one-hour operation during wet season is selected as best operation policy/rule to generate maximum dry season energy. Application of this operation rule resulting almost uniform reservoir level throughout the simulation period however the energy violation is much during dry as well as even in wet year also that's why it is necessary to consider reliability for dry season energy only because wet season energy requirement is meet out in all historical years and which is not much important for this project.

Operation Scenario 4

In this operation scenario seasonal variation is considered, for that whole year is divided in to two seasons as dry season (Dec to May) and wet season (Jun to Nov) according to inflow availability. This operation scenario includes seven different generation pattern with seasonal and hourly variation in energy requirement. The power guide rule curve used here is hydropower schedule with seasonal and hourly variation in generation pattern. Hourly time step was assigned for simulation so that the HEC-ResSim distribute defined monthly total energy requirement in to each operation hours defined in hourly generation pattern. Hourly generation pattern is defined by putting 1 for operation hour and 0 for non-operation hour that means value 1 represent open gate to release water required to generate target energy and 0 represent close the gate no release of water. Summary of results different alternative are presented in table 4.4

ISSN 2394 - 7780

Table-4.4: Comparison of results of different competitive alternatives of scenario 4

Parameter	Alternatives				
	1	2	3	4	5
Operation Hours (Dry_Wet)	**9_4**	**9_5**	**10_1**	**10_2**	**11_1**
Energy Generated per Time Step (MWh)	142.72	143.38	**142.34**	142.88	142.62
Plant Capacity Factor Total Energy (%)	34.24	34.38	**34.1**	34.2	34.2
Plant Capacity Factor Target Energy (%)	27.05	29.14	**22.86**	24.95	24.95
Dry Season Target Energy (GWh/year)	683.046	683.046	**758.94**	758.94	834.834
Wet Season Target Energy (GWh/year)	305.244	381.555	**76.31**	152.622	76.311
Total Dry Season Energy Generated (GWh/year)	660.454	640.184	**735.04**	728.8	746.202
Total Wet Season Energy Generated (GWh/year)	590.661	615.862	**512.68**	523.641	503.935
Total Spill Energy (GWh/year)	287.081	239.604	**436.37**	371.019	427.624
Total Annual Energy Generated (GWh/year)	1251.12	1256.05	**1247.72**	1252.44	1250.14
Annual Energy Value (Million NRS)	11045.85	11222.35	**10703.59**	11011.16	10820.98
Average Spill (m^3/s)	2.45	2.23	**2.62**	2.47	2.54
Dry Season Energy Generation Reliability (%)	92.48	87.58	**90.19**	88.56	78.1
Remarks			**Selected**		

Simulation result of this scenario shows that the optimum dry season energy generation is 735.04GWh/year with 90.19% reliability (reliability is calculated for dry season only i.e. 306 month) and total annual energy generation is 1247.72 GWh/year when plant is operated for 10 hours peaking in dry season and 1 hour evening peaking in wet season, hydropower schedule rule is used with seasonal variation.

Developed Operation rule/policy

Hydropower schedule rule with generation pattern 10 hours operation during dry season (Dec to May) and 1 hour evening peak operation during wet season (Jun to November) is selected as the optimal reservoir operation rule/policy for hydropower generation from Nalgad hydropower project. Further the reservoir release rules for each time step are as: (i) Seepage and evaporation losses are always accounted for and the Environmental releases with highest priority, (ii) Release to generate energy in accordance with Hydropower Schedule Rule is made with least priority. If the resulting end of day reservoir content would result in spill, the power plant is used to release water and generate secondary/Spill energy. Lastly, spill is made to maintain the end of day reservoir content no greater than the reservoir volume corresponding to the FSL. Application of the above operational rules results in a reservoir operational guide rule curve as indicated in figure 4.1.

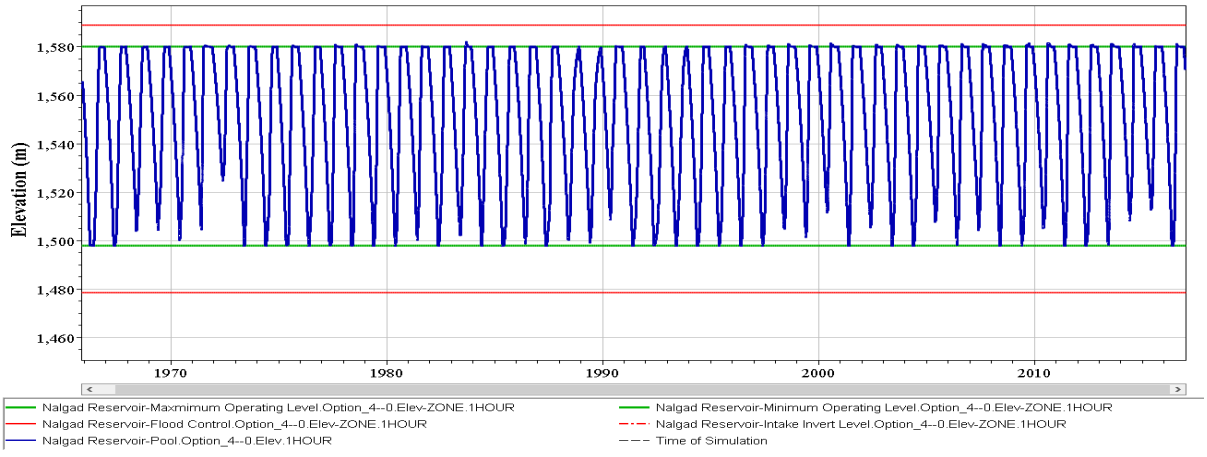

Figure-4.1: Developed Reservoir Operation Guide Rule Curve

5. CONCLUSIONS

In this study HEC-ResSim is used to develop reservoir operation rule for hydropower generation of the Nalgad hydropower project in Nepal. Optimum reservoir operation rule to utilize the available inflow to reservoir for hydropower generation is developed through simulation study of long term estimated daily inflow of time

ISSN 2394 - 7780

period 1966 to 2016.From this study it is observed that the optimum dry season energy generation is 735.04GWh/year with 90.19% reliability and total annual energy generation is 1247.72 GWh/year when hydropower schedule rule with energy generation pattern as ten hours operation during dry season and one hour operation during wet season is employed. Hence the operation rule/policy for optimum power generation from Nalgad reservoir is operation of reservoir using Hydropower–Schedule–Rule through generation pattern as ten hours peaking operation in dry season and one hour evening peaking operation in wet season with four turbine units in operation and maintain minimum and maximum reservoir level as defined in forth operation scenario. On evaluating the reliability of the reservoir system to meet the specified hydropower targets it is found that system is in unsatisfactory condition over the 9.81% of dry season time period (306 month). That unsatisfactory condition occurs mostly during dry season month of May and in case of some critical water year's unsatisfactory condition also occurs in dry season month of March, April and even in December also but that unsatisfactory condition exist for very few time. . Hence during the month of May deficit energy managed either from other power plant or from other source of energy and this power plant can operate as per developed guide rule curve during May month for better system performance and better utilization of available reservoir inflow.

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FLOOD HAZARD ASSESSMENT FOR A DAM FAILURE

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ABSTRACT

Flood hazard assessment in downstream valley from a possible dam failure requires a comprehensive modelling of breach formation in the dam, outflow through breach and routing of flood wave in the downstream valley. Over the years, several analytical and numerical methods have been developed to simulate the entire process. This paper presents an application of the hydraulic model (Mike Flood) and GIS for studying various failure scenarios of an earthen dam in Odisha. The design flood of 100 year return period at the dam site and other river reaches are estimated using synthetic unit hydrograph and design rainfall. The Hydrologic Modelling System (HEC-HMS) is used for hydrological routing of flow from the six sub-catchments. The estimated peak flow to dam is about 11590.2 m^3/s and the time to peak is 32 h. The Mike 11 model is calibrated and validated by comparing the simulated and observed water levels at the Gomali gauging site. The Nash–Sutcliffe model efficiency for various manning's coefficients of 0.035, 0.03, 0.04, 0.038 and 0.033 are found to be 0.937, 0.922, 0.879, 0.909, and 0.941 respectively for the calibration period. The Nash–Sutcliffe model efficiency of 0.937 for manning's coefficient of 0.035 is identified for simulations as it reproduces the peaks with reasonable accuracy. The estimated Nash–Sutcliffe model efficiency is 0.86 for the validation period for the year 2013. The dam break model setup developed in Mike Flood is simulated with inflow of 100 year return period. It is observed that a time of about 15.5 h is required for peak flow to reach the downstream location at 100 km. The simulated discharge also shows that there is very high discharge just below the dam location and it gradually reduces towards downstream. This occurs due to storage of flood water in the river channel as well as in the flood plain. The sensitivity analysis of the various parameters of the dam breach model viz. breach width, duration of breach is carried out by comparing the combined outflow from dam. It is observed that in this case breach width is a more sensitive parameter. The output from the hydrodynamic modelling in the form of floods characteristic maps viz. flood depth, velocity, time to peak etc. are used for hazard assessment. The flooded area is classified into five hazard categories viz. Low, Medium, High, Very High and Extreme depending on maximum flood depth, maximum velocity and time to peak. It is observed that about 84 km^2 of possible inundated area is under water depth of more than 4 m. Further the reclassified land use land cover map may be overplayed to prepare a risk map of the study area.

Keywords: Dam break, Design flood, Flood risk, Hazard Category, Mike Flood.

1. INTRODUCTION

Dam is a very important hydraulic structure, which has very economic importance. Benefits like supplying of water for drinking, irrigation, industrial purposes, hydropower, recreation activities etc. Besides being multifunctional, it also provides safety to human lives and properties downstream by storing water in the reservoir and releasing water when there is huge demand and emergency. Besides being an asset to a country, its failure or collapse leads to the huge loss of human beings and properties. Dam break analysis is primarily carried out to find the potential of the downstream disastrous for a dam break. It gives the appropriate guidance for the standards to adopt for dam design, construction, operation, and monitoring. Though the probability of dam break is low but its failure resulted in high casualties. Many cases studies have resulted in two perspectives dealing with dam failure. First perspective gives answer to the question whether a dam will fail or not referring to the strength of material of which dam is built. It also deals with the breaching process of dam. Second perspectives assume a dam failure and study its disastrous effect in the downstream areas. This leads to the preparation of the emergency action plans for dam failure. The Dam Rehabilitation and Improvement Project (DRIP) basically envisaged the rehabilitation and improvement of about 223 dams in many places of India, it aims to promote a new technology and improving institutional capacity for dam safety evaluation and implementation at the Central and State levels and in some particular premier academic and research institutes of India. During this project the Guidelines for Developing Emergency Action Plans for Dams is developed describing all elements of an EAP and comprehensively covers requirements for notification flow charts, emergency conditions, inundation maps, emergency detection, evaluation and classification, emergency preparedness and implementation methodologies are developed (CWC, 2016). This guideline recommends preparation of inundation map for possible dam failure scenario along with time to flood (the time from the breach to the time that critical structures are flooded) and the time to peak flow.

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Mitigation is the proactive effort to decrease the loss of life and property by reducing the effect of disasters. This is achieved through identification of potential hazards and the risks they pose in any given area, identification of mitigation alternatives to reduce the risk, and risk analysis of mitigation alternatives. The most appropriate method for flood hazard assessment is a combination of hydrologic and geomorphologic approach (Bates and Roo, 2000; Hunter et al., 2007; Chen et al., 2009, Mani et al. 2014). The flood hazard maps are produced by simulation of detailed hydrological and hydraulic models with various flooding scenarios. These models are forced and parameterized by locally available, high resolution and preferably high quality spatio-temporal data. The hydrological-hydraulic mechanisms integrated with GIS approach for modelling of flood provides, systematic and consistent analyses of flooding together with their likelihood of occurrence in a given time period. The hydraulic packages solve 1D (river/drain) and 2D (overland) shallow water equations considering the topography of area. The combination of GIS and 1D hydrodynamic modelling may provide a cost efficient system for planning and management of flood. This paper presents an application of the hydraulic model (Mike Flood) and GIS for studying various failure scenarios of an earthen dam in Odisha. Further attempts have been made to classify the flooded area is various hazard categories depending on maximum flood depth, maximum velocity and time to peak.

2. STUDY AREA AND DATA

The Mandira dam is located near Kansbahal in Sundergarh district of Odisha located about 16 km upstream from Mandira. The water from the dam is mainly used to meet the water requirement for Rourkela Steel Plant. In addition, the dam supplies water to more than 250 surrounding villages. Water is stored in dam during rainy seasons and provided from the reservoir to the plant region through the weir constructed in Brahmani River. This is an earth dam with height of about 35.38 m from the foundation level. The Brahmani river is formed by the confluence of the rivers Koel and Sankh river at Ved Vyasa near the major industrial town of Rourkela. Both of these sources are in the Chota Nagpur Plateau. The index map of study area is shown in Figure 1. The SRTM DEM is used for delineation of various sub basins and estimation of catchment characteristics. The various data requirements for dam break analysis includes; dam and spill way characteristics, reservoir storage characteristics, downstream river cross section, reservoir inflow information are collected from various state and central government organizations.

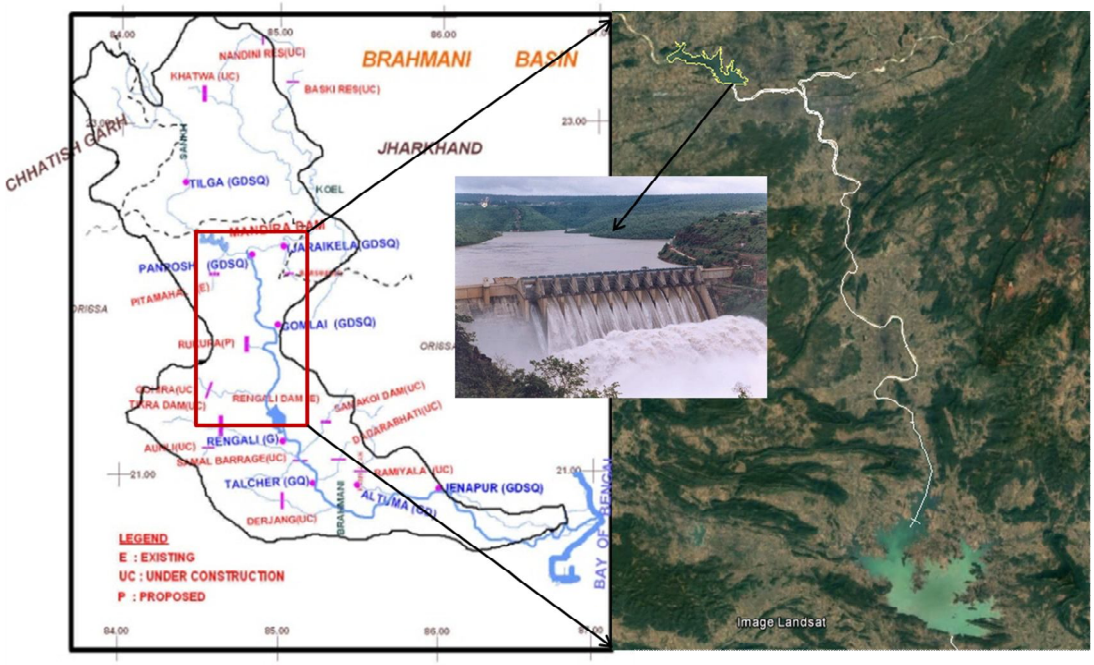

Figure-1: Index map of the study area.

3 METHODOLOGIES

3.1Estimation of Design Floods

The design flood for 100 year return period to Mandira dam and other river reaches are estimated using synthetic unit hydrograph approach (CWC, 1997). The SUHs are derived from catchment characteristics viz. drainage area, slope, longest flow length, flow length from basin centroid, etc. of the study area and relationships provided in the Flood Estimation Report (CWC, 1997). The Hydrologic Modelling System (HEC-HMS) is used for estimating discharge from each sub basin from the developed unit hydrograph, hourly

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effective rainfall and base flow. Further, hydrologic routing for the reaches is carried out by 'Muskingum-Cunge routing' method. The model setup in HEC-HMS with six sub basins, five junctions and three reaches is shown in Figure 2.

Figure-2: HEC-HMS model setup.

3.2 Dam Break Model Set-up

The MIKE FLOOD couples MIKE 11 (1-D) and MIKE 21 (2-D) into a solitary framework utilizing a coupled approach. MIKE FLOOD empowers to remove the best elements of both MIKE 11 and MIKE 21 to reproduce surges, while in the meantime staying away from large portions of the confinements of determination and exactness experienced when utilizing MIKE 11 or MIKE 21 independently. The hydrodynamic (HD) model is knows as nucleus for MIKE 11 model. The governing equations in MIKE 11 is a one-dimensional (1-D) & shallow water type. This is the modification of the basic Saint-Venant equation, which is converted into a set of implicit and finite difference equation help to solve by applying the double sweep algorithm (Abbot and Ionescu, 1967). Computational grids are used to comprise of alternating Q & H_1 points spontaneously and generated with the help of model. The Q points are to put at the middle of between the nearest H_1 pt. The H_1 points are pointed at the cross sections or at an equal interval. The dx is specified by users (dx=500 m in the present setup) if the distance between the cross-sections is more than maximum space intervals. In MIKE 11 Model, dam break portion, helps to simulate the hydrograph for outflow, resulting from dam break. The speeding of flood causes of failure of dam is to be a highly unsteady nature. The river course required to describe correctly by using a no. of cross-sections where the cross-sections are changing frequently. Generally the cross-sections are extended as it is possible further, for covering a higher modelled water level, this is counted as the highest recorded of the level of flood generally. However in this case the cross-sections are limited up to river banks as the flood plain is modelled in Mike 21. The dam break modelling is similar as for hydrodynamic model besides the failure of dam structure which is located at a reservoir branch separately modelled. Here three analysis points are counting .i.e. (2-h points and one Q point). The river set-up with a dam is shown in Figure 3. The reservoir is regularly demonstrated as a solitary h-indicate in the model get an exact depiction of the supply stockpiling qualities. The surface stockpiling scope of the dam is portrayed as a component of the water level and it is entered as additional storage area. At the Q point where the structure of dam break locate, the equation that describes flow through structure is placed the momentum equation. Since at Q point that momentum equation is not used, there is no relevance of Δx set up.

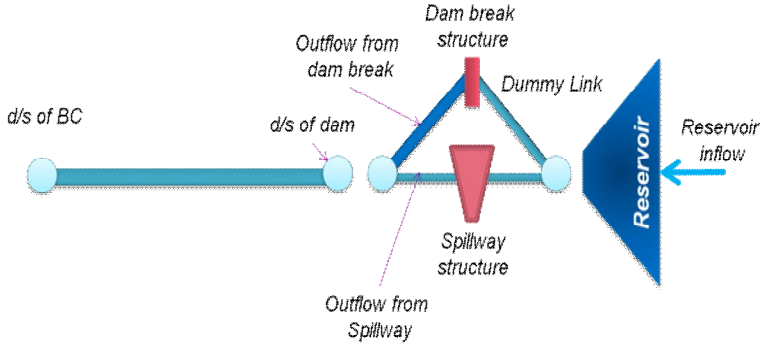

Figure-3: River set up with dam

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The setup of Mike-21 is necessary for simulating of MIKEFLOOD. The basic unit parameters which used in this study are bathymetry, simulated period, mass budget, flood and dry thresholds, boundry, point source, precipitation, initial surface elevation. For different simulation the Δt (computational time set up) is set to 15 seconds as lower and the prepared bathymetry for resolution is taken as is 180 m × 180 m.

3.3 Calibration and Validation of MIKE 11

Calibration of a model is the way toward modifying model parameters to get a nearby assertion between the observed and simulated values. The Mike 11 model is calibrated for manning's coefficient by simulating water level at Gomali gauging site for the period November 2011. The Nash–Sutcliffe model efficiency is estimated for comparing observed and simulated water levels. Further, the model is validated by comparing observed and simulated water level for the period 15 June 2013 to 15 December 2013.

3.4 Flood Hazard Assessment

The validated model is used for dam break flood simulation for 100 year return period flood using Mike Flood. The model provides outputs in terms of inundation area, time series of flood depth, velocity, the time from the breach to the time that critical structures are flooded, the time to peak flow etc. These parameters are used for assessing the flood hazard in a GIS environment (ArcGIS). Further flood risk map are derived by incorporating Land use and Land cover map in to the flood hazard map.

4 RESULTS AND DISCUSSIONS

4.1 Flood Hydrographs

The 100 year 24 h rainfalls for each sub catchments are extracted from figure given in CWC (1997) report. These rainfall values are transferred for design storm duration. Finally, rainfall reduction factor is multiplied to obtain the sub catchment average rainfall. The rainfalls are then distributed to incremental hourly value as methods mentioned in the flood estimation report (CWC, 1997). The effective rainfall hyetographs and unit hydrographs are convoluted using HEC-HMS. The estimated design flood hydrographs at Mandira dam and Koel River at junction are shown in Figure 4.

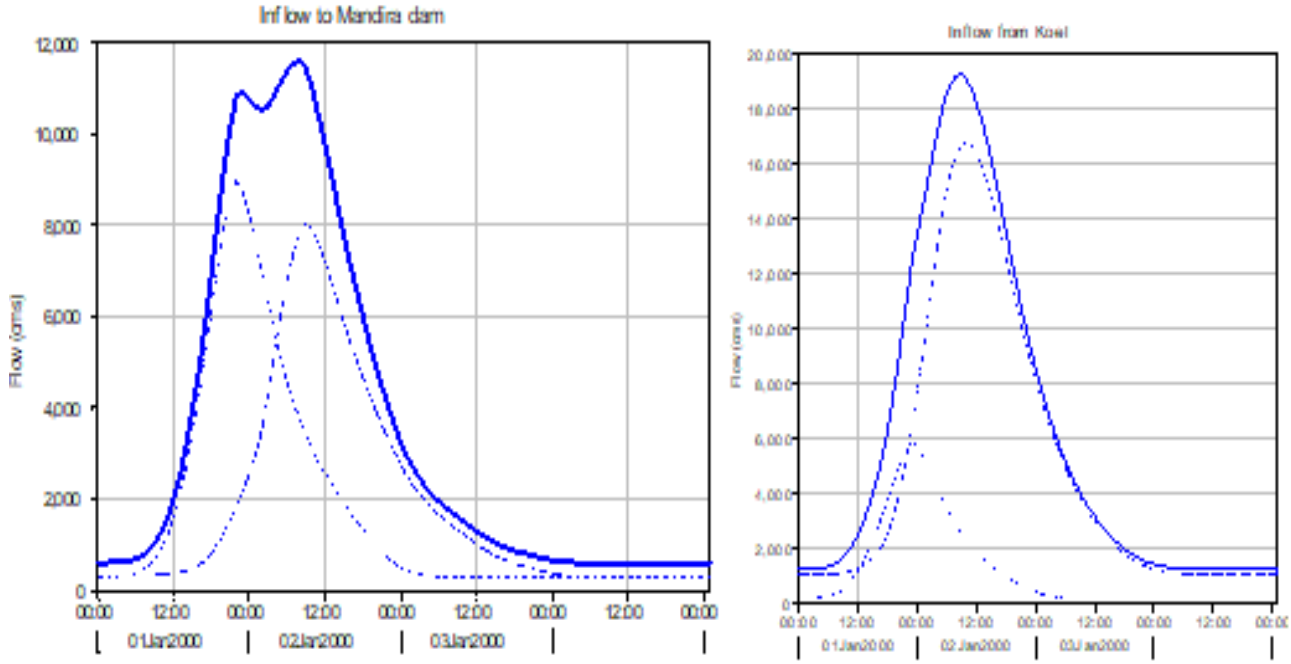

Figure-4: Design flood hydrographs for 100 year return period flood

4.2 Calibration and Validation of Mike 11

The Mike 11 model is calibrated and validated for manning's coefficient by comparing the simulated and observed water levels at the Gomali gauging site. The Nash–Sutcliffe model efficiency for various manning's coefficient of 0.035, 0.03, 0.04, 0.038 and 0.033 are found to be 0.937, 0.922, 0.879, 0.909, and 0.941 respectively for the calibration period. The Nash–Sutcliffe model efficiency is 0.937 for manning's coefficient of 0.035 is selected as it reproduces the peaks. Further, the model is validated by comparing observed and simulated water level for the period 15 June 2013 to 15 December 2013. The estimated Nash–Sutcliffe model efficiency is 0.86 for the validation period. The comparatively lower value of Nash–Sutcliffe model efficiency is due to a relatively larger period with low flow values. However, from the Figure 5 it may be noted that the peak floods are well matched.

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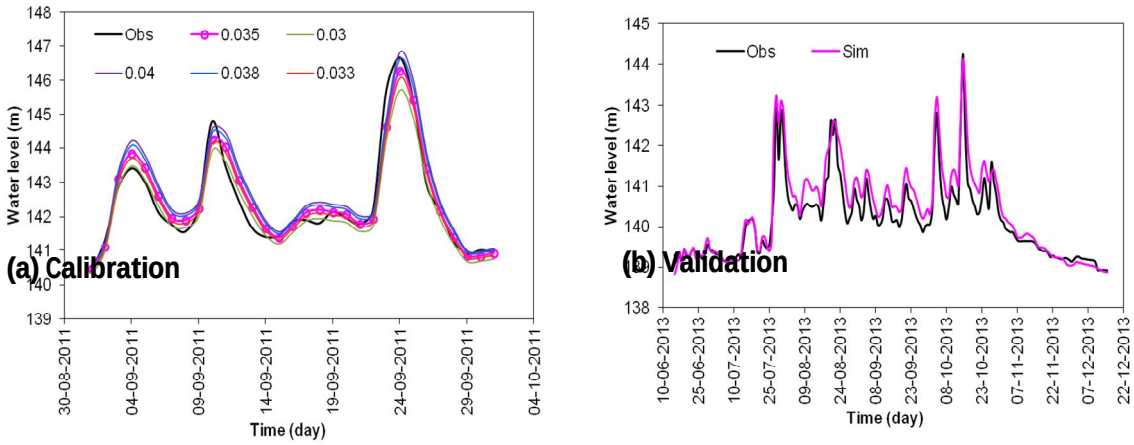

Figure-5: Comparison of the observed and the simulated water level at Gomali.

4.3 Dam Break Simulations

The dam break model setup developed in Mike Flood is simulated with inflow of 100 year return period both at Mandira dam and Koel river. In Mike-11 the results of simulated discharge and stages are available at alternate grid points. The simulated discharge and water level due of dam break simulation are shown in Figure 6. It may be noted that about 15.5 h is required for peak flow to reach downstream located at 100 km. The simulated discharge also shows that there is very high discharge just below the dam location and it gradually reduces towards downstream. This occurs due to storage of flood water in the river channel as well as in the flood plain.

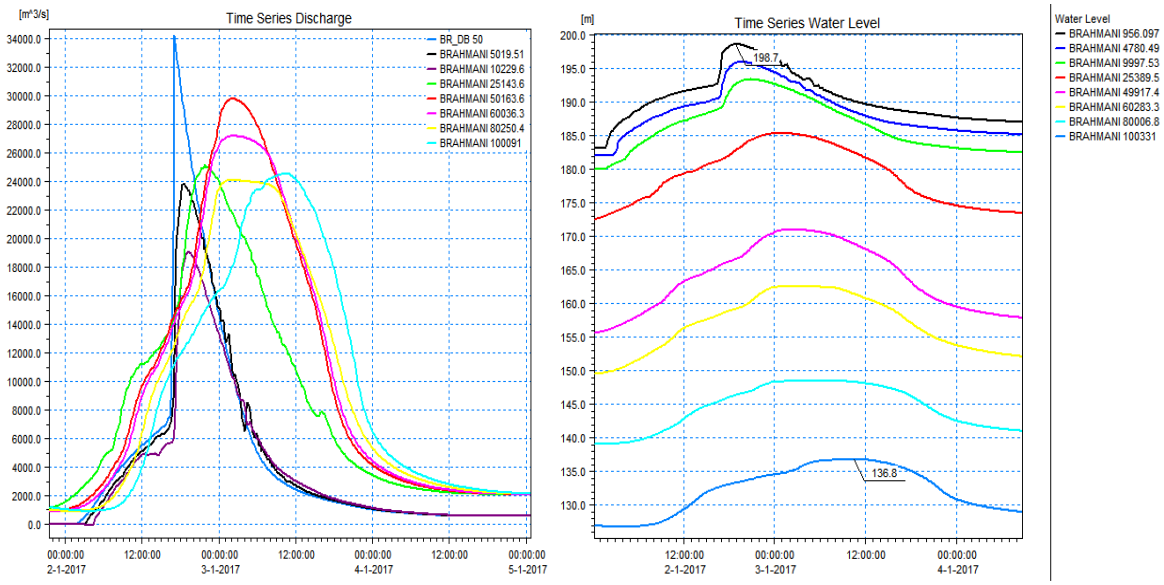

Figure-6: Simulate discharge water level due to dam failure at various downstream locations.

4.4 Flood Hazard Assessment

The output from the hydrodynamic modelling in the form of floods characteristic maps viz. flood depth, velocity, time to peak etc. are used for hazard assessment. The five hazard classes and range of the flood characteristics are shown in Table 1. Figure 7 show the classified hazard map. The combined hazard map is prepared by integrating these factors. Further the reclassified LULC map is overplayed to obtain risk map.

Table-1: Various hazard classes

Classes	Max. Depth(m)	Max. Velocity (m/s)	Time to peak (h)
Low	< 0.25	< 0.2	> 12
Medium	0.25 - 1	0.2 -0.8	6 -12
High	1 - 2	0.8 – 1.2	3 - 6
Very High	2 - 5	1.2 - 2	1 - 3
Extreme	> 5	> 2	> 1

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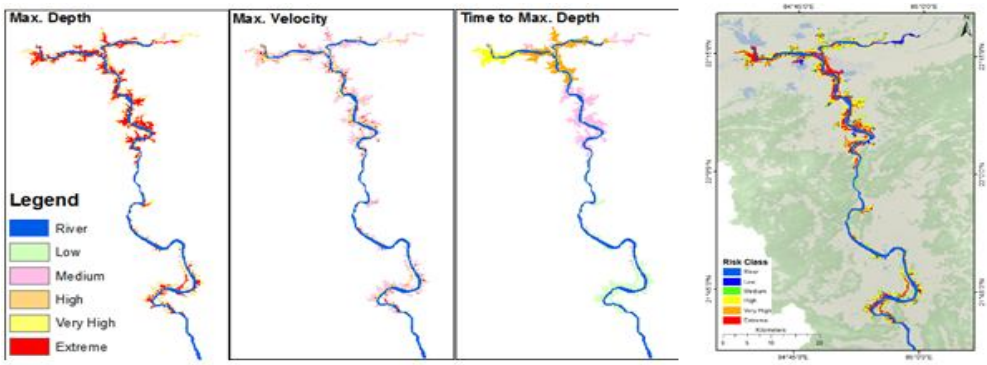

Figure-7: Classified flood hazard and risk maps.

5. CONCLUSIONS

The design flood for 100 year return period to Mandira dam and other river reaches are estimated using synthetic unit hydrograph approach. The SUHs are derived from catchment characteristics viz. drainage area, slope, longest flow length, flow length from basin centroid, etc. of the study area and relationships provided in the Flood Estimation Report. The Hydrologic Modelling System (HEC-HMS) is used for estimating discharge from each six sub basins from the developed unit hydrograph, hourly effective rainfall and base flow. Further, hydrologic routing for the reaches is carried out by 'Muskingum-Cunge routing' method. The estimated peak flow to dam is about 11590.2 m^3/s and the time to peak is 32 h from start of the simulation. The 1-D Mike 11 model is calibrated and validated by comparing the simulated and observed water levels at the Gomali gauging site. The Nash–Sutcliffe model efficiency for various manning's coefficients of 0.035, 0.03, 0.04, 0.038 and 0.033 are found to be 0.937, 0.922, 0.879, 0.909, and 0.941 respectively for the calibration period. The Nash–Sutcliffe model efficiency of 0.937 for manning's coefficient of 0.035 is identified for simulations as it reproduces the peaks with reasonable accuracy. The estimated Nash–Sutcliffe model efficiency is 0.86 for the validation period for the year 2013. The dam break model setup developed in Mike 11 and coupled with Mike 21 in Mike Flood. The dam break simulation is carried out with inflow of 100 year return period flood. It is observed that a time of about 15.5 h is required for peak flow to reach the downstream location at 100 km. The simulated discharge also shows that there is very high discharge just below the dam location and it gradually reduces towards downstream. This occurs due to storage of flood water in the river channel as well as in the flood plain. Further, sensitivity analysis, it is observed that in the breach width is a most sensitive parameter. The output from the hydrodynamic modelling in the form of floods characteristic maps viz. flood depth, velocity, time to peak etc. are used for hazard assessment. The flooded area is classified into five hazard categories viz. Low, Medium, High, Very High and Extreme depending on maximum flood depth, maximum velocity and time to peak. Further the reclassified land use land cover map may be overplayed to prepare a risk map of the study area. However, for policy implementation the flood hazard maps need to be developed with high resolution DEM and needs regularly updated as variations in hydrologic and LULC changes are expected in the area.

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REVIEW STUDY OF RHIZOFILTRATION BY WATER HYACINTH (*Eichhornia crassipes)*: A METHOD TO REMOVE HEAVY METAL CONTAMINANTS FROM TEXTILE INDUSTRY EFFLUENTS

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ABSTRACT

Developing Cost Effective and Environment-friendly technologies for the remediation of soils and waste water polluted with toxic substances is an issue of global interest. Increasing pollution of surface and ground water bodies is posing new challenges while dealing with the problem of Water Crisis. Rhizofiltration is a technique of bioremediation which uses plant roots for removal of different categories of pollutants from water. Water Hyacinth (Eichhornia crassipes, Family Pontederiaceae) is a fast growing vascular aquatic macrophyte and commonly found in tropical and subtropical regions. Being a worse invasive aquatic weed, if cultivated in controlled form it can be used in rhizofiltration of toxic trace substances from water bodies. It has been utilised for various research activities over the last few decades and its absorption capacity responsible for minimising various organic & inorganic contaminants, heavy metals, TDS, TSS, BOD, COD etc. in the industrial wastewater, has been explored in detail.

Jaipur City has large number of textile mills & industries. Safe disposal of water discharged from these industries is a big challenge because effluent is of very complex nature containing different chemicals and dyes in varied concentrations. Research needs to be done on the direct application of water hyacinth and its derived products in removal of dyes and heavy metals from textile effluent as well as from wastewater. Present study is aimed to review and find out the possibilities of In-situ application of Water Hyacinth roots in Effluent Treatment Plants of textile industries for removal of heavy metal contaminants. It could prove to be a cost effective and eco-friendly method to reduce heavy metal concentrations in industrial discharge. Due to its high rate of biomass production, high tolerance to pollution and capacity to absorb heavy metal and reducing organic load, Water Hyacinth has enormous potential to become a promising material for control of water pollution in Jaipur.

Keywords: Effluent Treatment, Jaipur, Rhizofiltration, Textile Industry, Water Hyacinth.

INTRODUCTION

According to recent study conducted by Central Ground Water Board (CGWB), Rajasthan is facing severe water crisis due to a sharp decline in ground water by 62.7% at majority of places and only 37.2% rise at some places. These results can be explained by the fact that due to scanty rainfall in the state, the extraction of ground water occurs at a faster rate than its recharge.

Jaipur, the capital city of Rajasthan is the 10^{th} largest Indian city with a population of 3.1 millions and annual growth rate of nearly 5%. It is located in the semi-arid zone of India, which is characterized by high temperatures, low rainfall (Average annual rainfall nearly 600mm), and a mild winter. For its water supply, Jaipur relies extensively on ground water and a single surface water source, the Bisalpur Dam, which is located 120km southwest of Jaipur and shared with Ajmer and Tonk district village.

Major economic activities of the city include tourism, trading, administration along with the local handcraft, textile, dyeing and printing industries. These industries in and around the city have deteriorated the surface as well as ground water quality. Therefore it has become essential to follow waste water treatment and reuse to combat with the situation of water crisis.

The present research paper mainly focuses on the treatment of waste water effluents from textile industries as they are present here in majority. The discharge of toxic effluents from various industries adversely affects water resources, soil fertility, aquatic organisms and ecosystem integrity. Appearance of colour in discharges from various industries is one of the major problems encountered in the textile industry.

The textile waste water is rated as the most polluting among all in the industrial sectors (Vilaseca et al., 2010; Awomeso et al., 2010). It is a complex and variable mixture of polluting substances like inorganic, organic, elemental and polymeric products (Brown and Laboureur, 1983). Among complex industrial wastewater with various types of colouring agents, dye wastes are predominant. The textile wastewater containing dye substances is not only toxic to the biological world, its dark colour blocks sunlight that leads to severe problems to the ecosystem. (Choi et al., 2004).

ISSN 2394 - 7780

RHIZOFILTRATION POTENTIAL OF WATER HYACINTH

Water hyacinth belongs to family *Pontederiaceae* and genus *Eichhornia*. It grows through out the tropics and sub- tropics as a free-floating perennial. The growth is adversely affected by low temperature and completely ceases in freezing cold. Therefore, water hyacinth shows seasonal growth during summers and no growth during winter season (Gopal 1987). In India, the plant was first introduced in early 1890s in Bengal and due to its invasive nature soon it became a serious problem by the year 1914.

Water hyacinth is fast growing perennial with great reproduction potential. Growth of water hyacinth is primary dependent on ability of plant to use solar energy, nutrient composition of water, cultural methods and environmental factors. Optimal water pH for its growth is neutral but it can tolerate pH values from 4 to 10. This is very important fact because it points that water hyacinth can be used for treatment of different types of wastewater. Optimal water temperature for growth is 28-30^{o}C. It is well-known for its reproduction potential and as a plant that can double its population in only twelve days. Water hyacinth is also known for its ability to grow in severe polluted waters. (Rajendra et.al 2017)

(I) POTENTIAL TO REMOVE HEAVY METALS FROM TEXTILE EFFLUENT

Aquatic macrophytes have great potential to accumulate heavy metals inside their plant bodies. These plants can accumulate heavy metals up to 100,000 times greater than the amount in the associated water. Therefore, these macrophytes have been used for heavy metal removal from a variety of sources (Mishra and Tripathi, 2008). Survival of water hyacinth is based on the nutrients provided by various habitats. These can range from clean waters which can be lacking in key nutrients to extremely contaminated waters with high amounts of nutrients. Although the growth of water hyacinth is more vibrant in neutral water bodies, the weed can grow well in waters severely polluted by organic matter and heavy metals, like in sewage lagoons waters, due to phyto-extractive properties (So et al., 2003, Jafari, 2010).

Phytoextraction is the uptake of pollutants by roots with successive accumulation in the aerial parts of a plant (Pivetz, 2001). A study by Zhu et al. (1999) on phyto-accumulation of various elements by water hyacinth revealed that the weed builds up trace elements like silver, lead, cadmium and so many other metals. In addition, the plant proved to be effective in phyto-remediation of wastewater contaminated with cadmium, chromium, copper and selenium. Similar research conducted by Shao and Chang (2004), indicated that water hyacinth is capable of absorbing, as well as translocating heavy metals like Pb, Cd, Ni, Zn, and Cu. Mahamadi (2011) in a related study attributed these properties to numerous poly-functional metal-binding sites in the plant, for both anionic and cationic metal complexes, thus the ability to 20 absorb heavy metals along with other contaminants.

In Pakistan, an investigation by Hussain et al. (2010) on phytoremediation of nickel ions by water hyacinth, reported an accumulation of heavy metals in the roots. Water hyacinth has a high content of fermentable matter, as well as nitrogen and essential nutrients. Mokhtar et al., 2011 reported E. crassipes as a hyperaccumulator for copper with an efficiency of 97.3% removal from an aqueous solution containing various concentrations of copper. (1.5, 2.5 and 5.5 mg/L of copper for a period of 21 days). Ajayi and Ogunbayo, 2012 studied the efficiency of water hyacinth in removing Cd, Cu and Fe from various wastewaters like textile, pharmaceutical and metallurgical in which it seems to be a good choice for removing cadmium but not so much for the removal of iron and copper. During the 5 weeks duration of the experiment, the removal of cadmium by the water hyacinth was 94.87% in textile wastewater, 95.59% in metallurgical wastewater and 93.55% in pharmaceutical wastewater.

(II) POTENTIAL TO REMOVE CHEMICAL DYES FROM TEXTILE EFFLUENT

The textile industry consumes large quantities of water and produces large volumes of wastewater through various steps in dyeing and finishing processes. The textile waste water is a complex and variable mixture of polluting substances like inorganic, organic, elemental and polymeric products (Brown and Laboureur, 1983). Among complex industrial wastewater with various types of colouring agents, dye wastes are predominant. The textile wastewater containing dye substances is not only toxic to the biological world, its dark colour blocks sunlight that leads to severe problems to the ecosystem. (Choi et.al., 2004).

Textile industries utilize substantial volumes of water and chemicals ranging from inorganic compounds, polymers and organic products for wet-processing of textiles (Dos Santos et al., 2007). The cationic dye methylene blue was widely studied for its removal from aqueous solution by the water hyacinth (Low et.al., 1995). The author concluded the water hyacinth root as a cheap source of biosorbent for basic dyes.

Kanawade and Gaikwad (2011) studied the adsorption property of the water hyacinth and activated carbon in removing methylene blue from aqueous solution. Soni et al., 2012 found the water hyacinth root to be an

ISSN 2394 - 7780

efficient adsorbent for removing methylene blue from aqueous solution as it had shown 95% dye removal efficiency in an optimum experimental condition. (Nath et al., 2013) where maximum percentages of removal of the dyes were found to be 90%, 88%, 92%, and 90% for methylene blue, congo red, crystal violet, and malachite green, respectively. Vasanthy et al., 2011 removed the textile dyes red RB and Black B from their aqueous solutions by water hyacinth plant material. The efficiency of E. crassipes to remove the colour and degrade the dye was about 95% with Red RB and 99.5% with black B. r, adsorption of an anionic dye Congo red by activated water hyacinth roots was studied by Rajamohan (2009). An effective pH of 6 was optimised for the adsorption of Congo red through batch studies.

(III) REUSE OF WATER HYACINTH PLANT AFTER WASTE WATER TREATMENT

After the use of Water Hyacinth for effluent treatment, the huge biomass can be used for various purposes. Its biomass is rich in nitrogen and other essential nutrients and this aquatic macrophyte can be used in biogas production. Apart from biogas (Singhal and Rai 2003), its sludge contains almost all nutrients and can be used as a good fertilizer with no detrimental effects on the environment (Patil et al. 2011). After harvesting, it can be used for composting, anaerobic digestion for production of methane, and fermentation of sugars into alcohol (Patil et al. 2011), green fertilizer, compost, and ash in regenerating degraded soils. These operations can help in recovering expenses of wastewater treatment.

(IV) COMPARISON OF ADVANCED METHODS WITH RHIZOFILTRATION BY WATER HYACINTH

Although various physical, chemical and biological processes like reverse osmosis, flocculation, activated carbon adsorption, and microbial treatment are involved as dye treatment techniques, adsorption process plays a major role and was preferred as a promising and efficient method for the treatment of dyes and dye effluents. Various studies are reported in the literatures using different adsorbents like alumina, zeolite, and polyurethane foam etc. The disadvantages of advance technology are high operating cost which makes them ineffective to treat the wide range of effluents. Thus still the search for simple, economic, eco-friendly, and highly effective adsorbents is continuing.

E. crassipes being one of the worst weeds in the world as a vigorous grower which is known to double its population within two weeks was worked out as a cheap and easily available adsorbent for dye and effluent treatment by various researchers. It is highly suitable for tropical wet and dry climate. Also, it requires minimal space for the setup and if the waste water flow is high, then a series or parallel set up of water hyacinth can be done, thus using land and space to the maximum extent. The weed and its dried root/ shoot powder have been found be suitable for improving water quality and effluent polishing. The plant does not require any energy for its function and hence it is suitable where there isn't proper supply of powder or where the cost of energy is too high (Rajendra et.al., 2017).

CONCLUSION

Currently, the Pink city (Jaipur) is facing a rapid growth of water scarcity and water demand. Although city has a glorious past of having different traditional water management systems, but lack of maintenance, awareness, rapid urbanisation and industrialization, old water management strategies have proved to be insufficient. Under such circumstances, waste water treatment has become the only viable solution to overcome the Water crisis.

Water hyacinth has huge potential in waste water treatment process. If it can be combined with existing waste water treatment technologies, cost effective and eco-friendly effluent treatment process can be developed. The process can be adjusted according to the effluent characteristic of different type of textile industries and can be executed with less skilled man power.

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GEOSTATISTICAL ANALYSIS OF SPATIAL AND TEMPORAL VARIATIONS OF GROUNDWATER LEVEL: A CASE STUDY OF BHILWARA DISTRICT RAJASTHAN.

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ABSTRACT

Water is one of the natural resources that cannot be generated but only be preserved. In future water scarcity will be one of the biggest challenges in the world. In the current scenario the ground water is a major source of drinking water for the Bhilwara district as well as irrigation & industries. Thus the study is used to analyzed the spatial and temporal variation in the pre and post monsoon ground water level. Ground water level plays a key role in conserving the sustainable conditions in arid and semi-arid regions. Rajasthan state of India is located in arid & semi-climatic region with poor water level. Same is the situation in Bhilwara district located in the central part of Rajasthan where availability of ground water level is very poor because ground water draft is very high and the deeper level of water gives the poor quality of water. The present study is focused on spatial variability of groundwater level using geo-spatial techniques. The study has analyzed the spatial-temporal variations in groundwater level to understand the hydrological behavior and status of both pre & post monsoon water level in the study area. Various thematic maps were prepared for both pre-monsoon and post-monsoon groundwater level for the period 2007 to 2016. The main objective of the study is to identify the temporal trends in annual groundwater level through Remote Sensing & Geographical Information Systems (GIS) and ground water level relate with rainfall. In this study the analysis of pre and post monsoon ground water level with rainfall gives good idea about status of water level in the study area.

Keywords: Ground water level, Remote Sensing, GIS, Interpolation.

INTRODUCTION

Water is one of the precious natural resources present on the earth and it is very necessary for survival of flora and fauna. Water can be considered as one of the most vital for human existence out of all the natural resources such as drinking purposes and irrigation needs for higher level of crop production. The demand for the water has been increasing day by day due to increase in population and industrial growth. Looking towards shortage of ground water level, which restrict the development of industries, irrigation etc.

From last decade the mica mining has played a vital role for the economic development and social condition of Bhilwara and it is famous for mica mining centre all over the country. There is a huge scarcity of water for drinking and irrigation purpose, because this area has less rainfall and deeper ground water level. This area is selected for study because it is situated in the central part of Rajasthan state and falling in semi-arid zone which is suffering from a viral scarcity of water for irrigation as well as domestic purposes. The district is also facing the problem of industrial growth due to the water crisis.

Distribution of water level plays an important role in understanding the ground water level. Analysis of pre and post monsoon ground water level with rainfall gives good idea about status of water level in the study area. In the study the analysis of ground water level and rainfall is used to understand the variability of ground water level with rainfall for last 10 year. Rainfall pattern is very important to understand spatial and temporal variations in ground water level. The ground water availability depends on rainfall of the particular year as the district has hard rocks having very low permeability and poor water holding capacity.

Remote sensing and GIS technology is being used to monitor agriculture and crop growth status in term of both space and time (Jeyaseelan 2003; Seelan et al. 2003). In this study Ordinary Kriging interpolation method is used for the surface generation of both pre & post monsoon water level. Kriging is often regarded as one of the most popular and robust interpolation techniques (Irabor et al., 2008). The Kriging method performs a weighted averaging on point values where the output estimates equal the sum of product of point value and weights divided by sum of weights (Babiker et al., 2007).

Spatial distribution of ground water level data for both pre and post monsoon is generated using Ordinary Kriging interpolation method and prepare the layout map in ArcGIS 10.4. Spatial interpolation techniques were implemented in ESRI's ArcGIS 10.4 software using Spatial Analyst Tool. ArcGIS 10.4 software is used for surface generation of water level data for the year 2007 to 2016 of Bhilwara District.

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Previous Work

The number of researchers worked on rainfall analysis using the remote sensing and GIS techniques. In previous study most of the work used to extract the information from the satellite image to get the feature of the earth surface and the analysis of water level and rainfall using interpolation and image processing techniques. we got that Bhilwara district suffer from the deteriorating of ground water in both quality and quantity. In recent years ground water level has become major concern in the study area.

Study Area

Bhilwara district is located in south eastern part of Rajasthan state. The coordinates of this district are 25□ 00' 38.87 to 25□ 57' 53.70 North latitude and 74□ 00' 31.67 to 75□ 27' 46.25 east longitude. The total geographical area of the district is 10,455 sq km. It is bounded in the north by Ajmer district in the north-west, west and south-west by Rajsamand district; in the south and south-east by Chittaurgarh district and in the east and north-east by Bundi and Tonk District. The area of the district generally slopes gently except in western & northwestern part where slope is high (Ministry of Water Resources, Govt of India). Figure shows the geographical extent of study area.

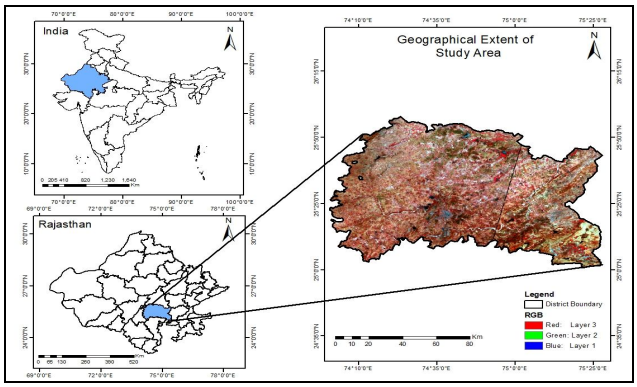

Fig-1: Geographical Extent of Study Area.

Data Requirement

In the research, Landsat 8 satellite data was downloaded from https://www.usgs.gov./. Landsat 8 data which is used for study area.

Administrative map were collected from Survey of India and prepared the district boundary through the digitization in ArcGIS 10.4. Ground water level data for both pre and post monsoon is collected from Central Ground Water Board (CGWB), Rajasthan.

Rainfall datasets of study area were acquired from the website of India Meteorological Department (IMD) & website of India Water Portal http://www.indiawaterportal.org/ for the period 2007-2016.

Methodology

Methodology adopted for this study is given below in the form of a flow chart which is presented in **Fig.2.**

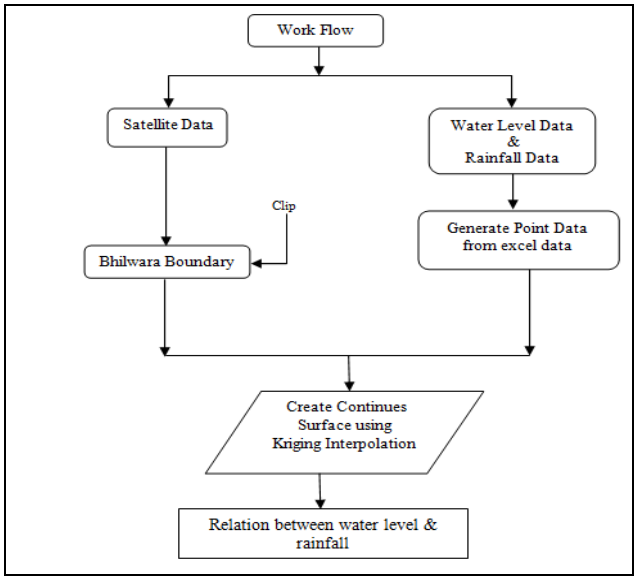

Fig-2: Methodology

ISSN 2394 - 7780

Remote Sensing & GIS Analysis

Spatial distributions of ground water level for pre-post monsoon is generated using "Ordinary Kriging Interpolation" method and prepare the layout map in ArcGIS 10.4.

By using the Geo-statistical analysis points with known values to estimate values at other points. These points with known values are called known points, control points, sampled points, or observations. Spatial interpolation is therefore a means of converting point data to surface data so that the surface data can be used with other surfaces for analysis (pandey et al., 2016).

Pre-Post monsoon water level and rainfall data has been analyzed to illustrate spatial distribution of ground water level and its categorization under different ranges in ArcGIS 10.4. Water table may be change due to the topography, structural geology and seasonal changes. The water table is the level at which the groundwater pressure is equal to atmospheric pressure (Sukumar.S et al. 2011). Fluctuation of ground water level is the variation of pre and post monsoon water level and it is depends on the overall behavior of groundwater. The study of rainfall pattern is very important for understanding spatial and temporal variations in water level.

Surface Generation (Ordinary Kriging) for ground water level

Ground water level for Bhilwara district is collected from Central Ground Water Board (CGWB), Rajasthan for the year 2007 to 2016. The thematic maps generated by Kriging interpolation method which is shown in figure 3(a) & 3(t) which depicts a continuous surface for water level. Blue colour shows high water level whereas low water level is illustrated by shades of green colour.

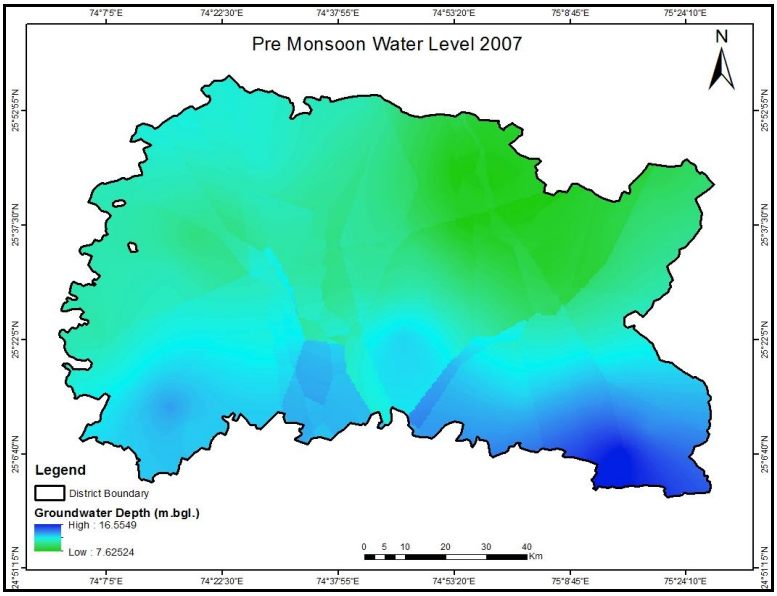

Fig.3 (a). Pre-monsoon water level 2007

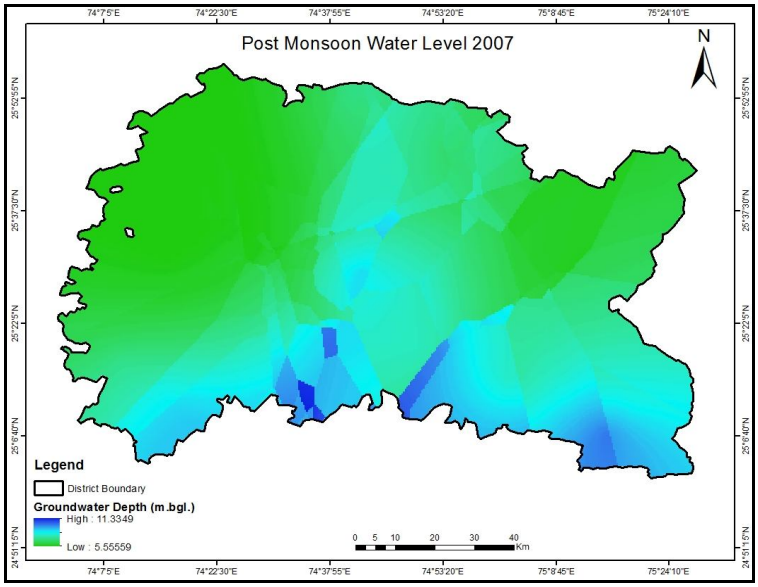

Fig.3 (b). Post-monsoon water level 2007

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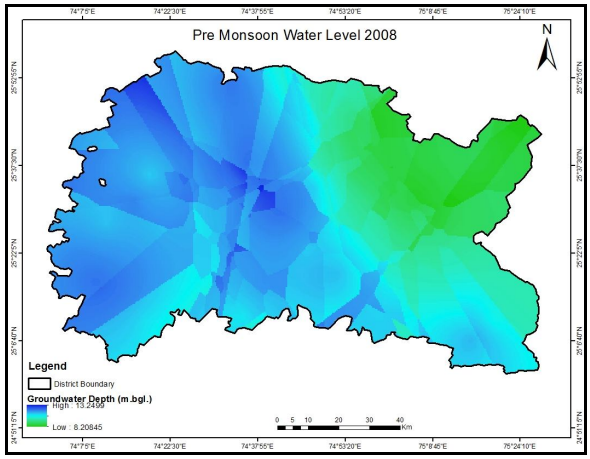

Fig.3 (c). Pre-monsoon water level 2008

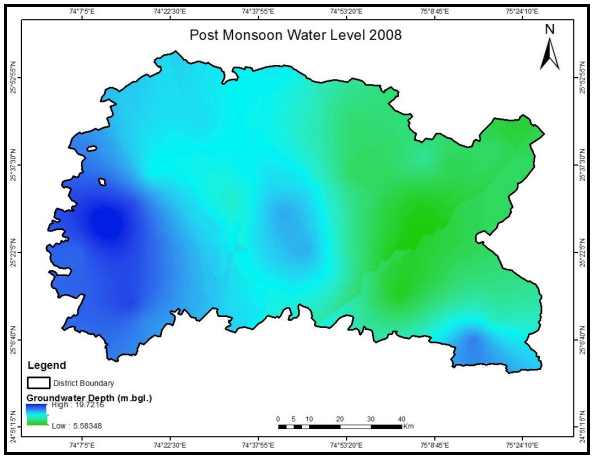

Fig.3 (d). Post-monsoon water level 2008

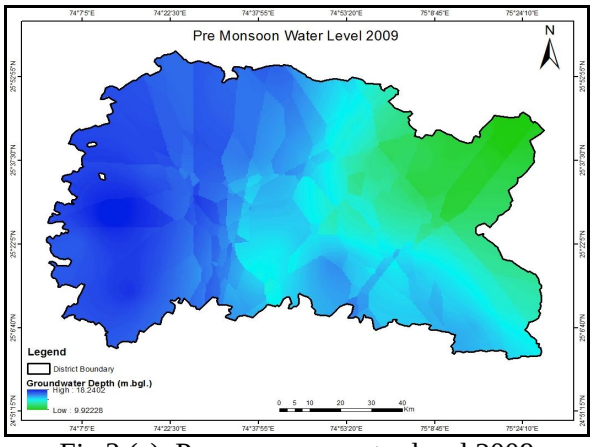

Fig.3 (e). Pre-monsoon water level 2009

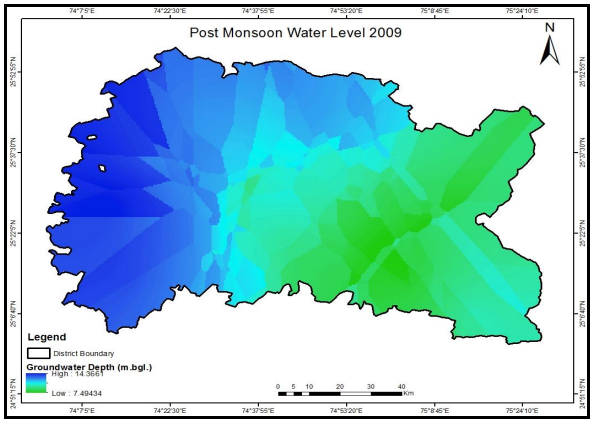

Fig.3 (f). Post-monsoon water level 2009

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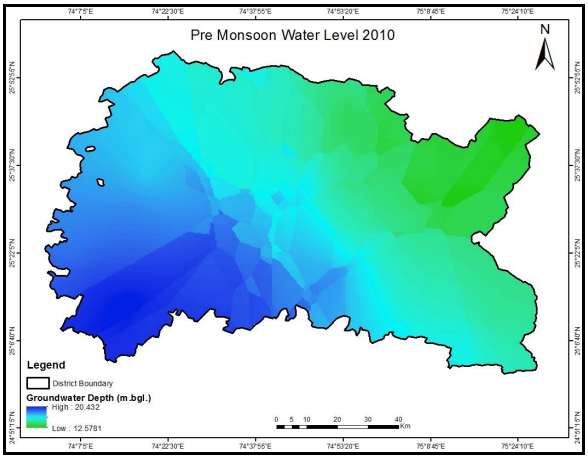

Fig.3 (g). Pre-monsoon water level 2010

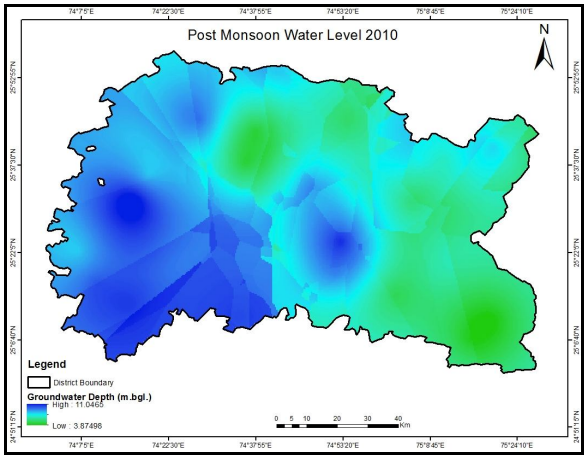

Fig.3 (h). Post-monsoon water level 2010

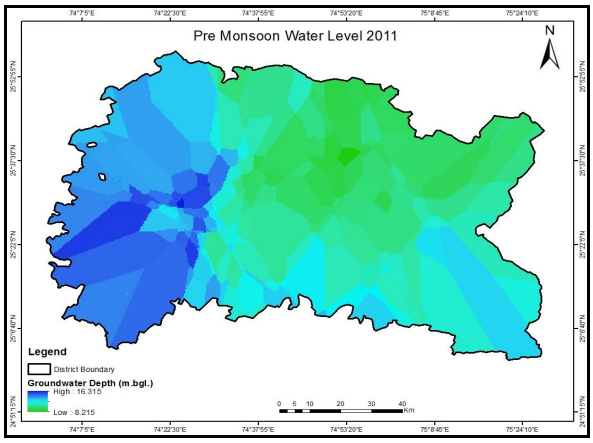

Fig.3 (i). Pre-monsoon water level 2011

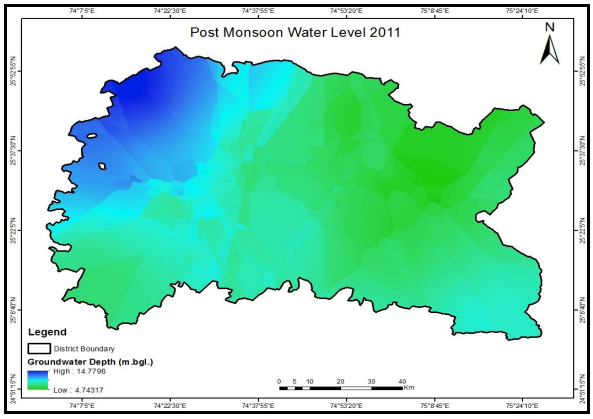

Fig.3 (j). Post-monsoon water level 2011

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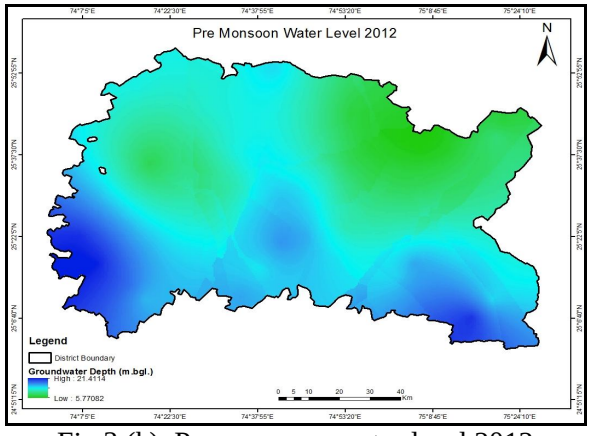

Fig.3 (k). Pre-monsoon water level 2012

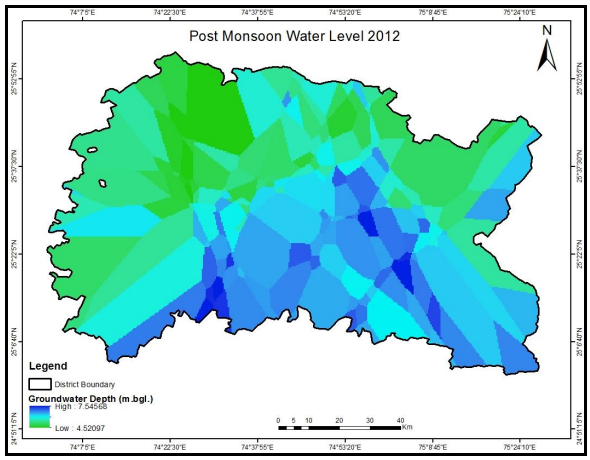

Fig.3 (l). Post-monsoon water level 2012

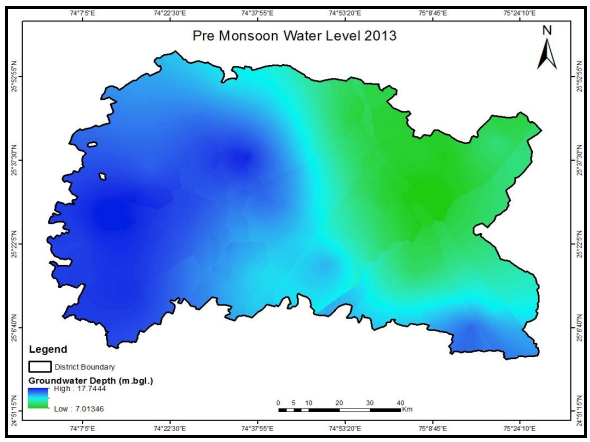

Fig.3 (m). Pre-monsoon water level 2013

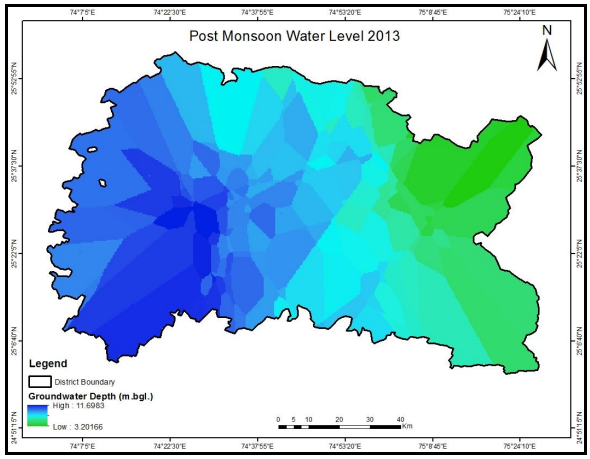

Fig.3 (n). Post-monsoon water level 2013

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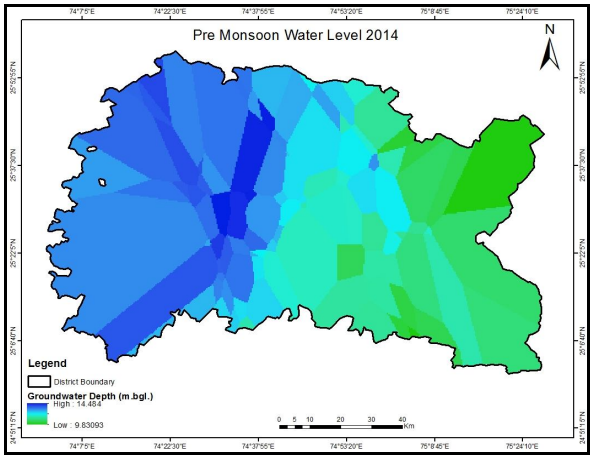

Fig.3 (o). Pre-monsoon water level 2014

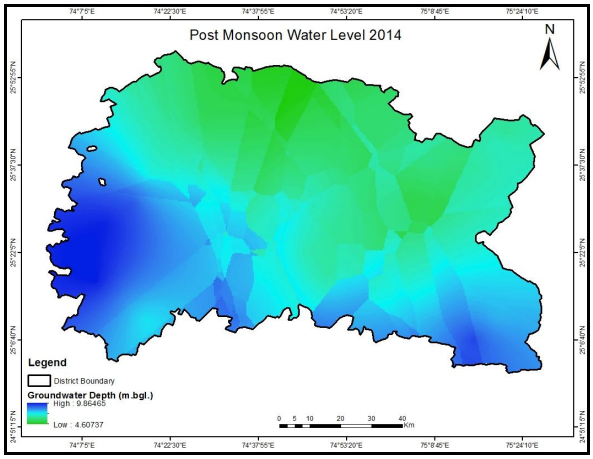

Fig.3 (p). Post-monsoon water level 2014

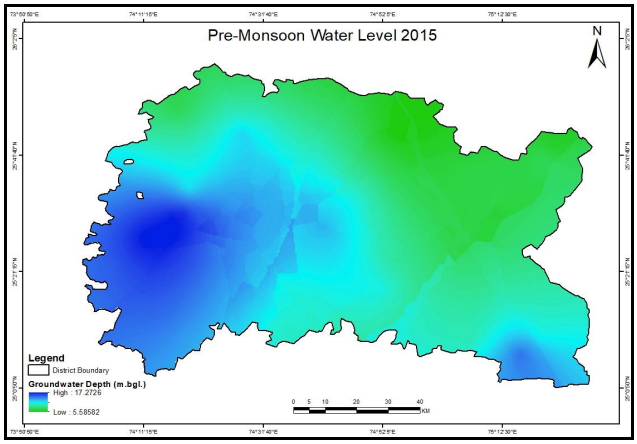

Fig.3 (q). Pre-monsoon water level 2015

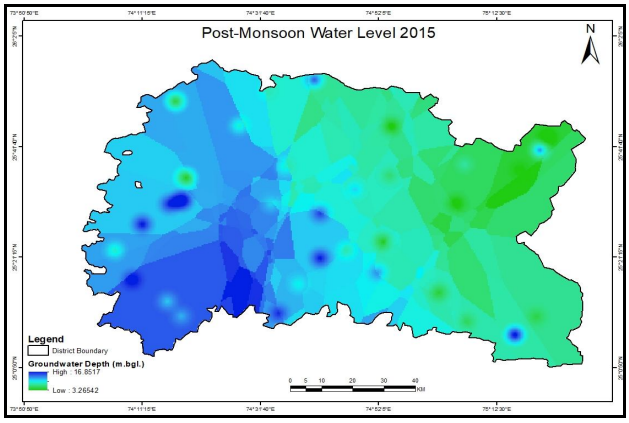

Fig.3 (r). Post-monsoon water level 2015

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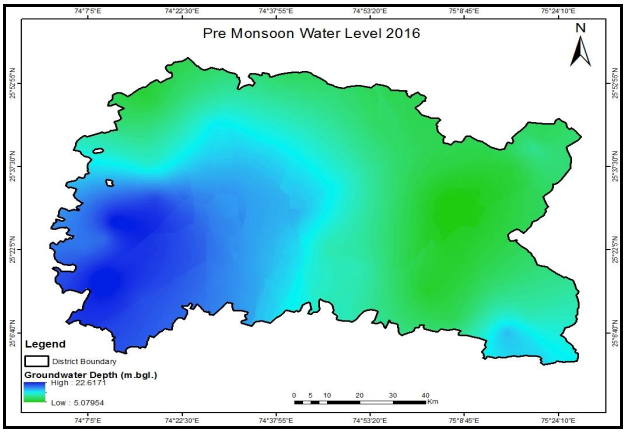

Fig.3 (s). Pre-monsoon water level 2016

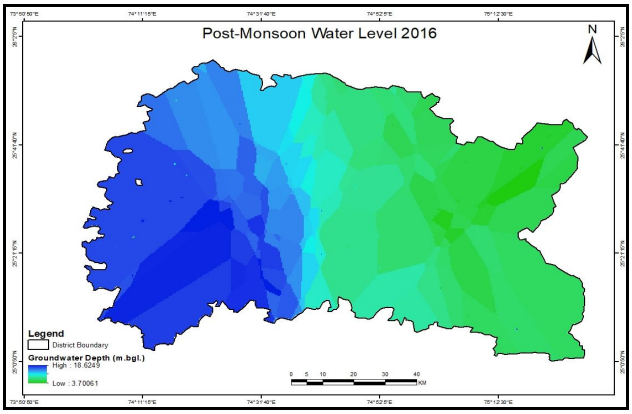

Fig.3 (t). Post-monsoon water level 2016

Figure 3(a) to 3(t): Ground water level for the year 2007 to 2016

Surface Generation (Ordinary Kriging) for Rainfall Data

Rainfall map has been generated using Kriging interpolation method of ArcGIS 10.4 for the year 2007 to 2016. Which is shown in figure 4(a) & 4(j) which depicts a continuous rainfall surface. Blue colour shows high rainfall whereas low rainfall is illustrated by shades of orange colour.

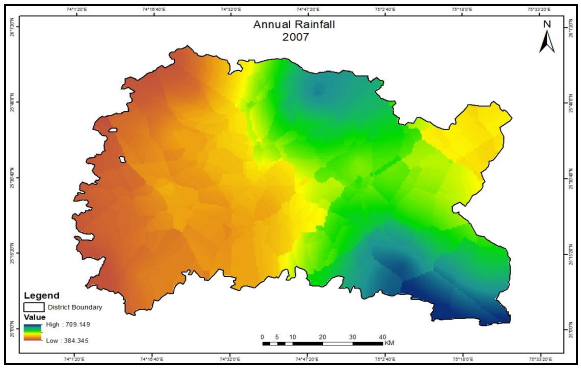

Fig.4 (a) Rainfall 2007

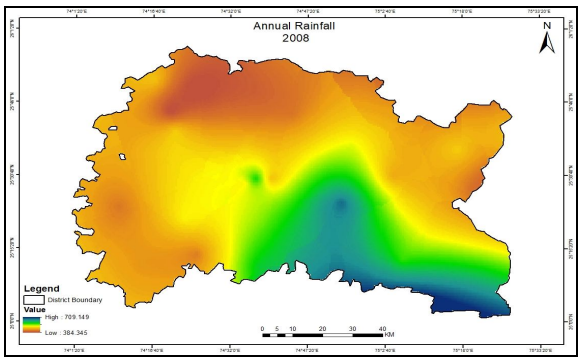

Fig.4 (b) Rainfall 2008

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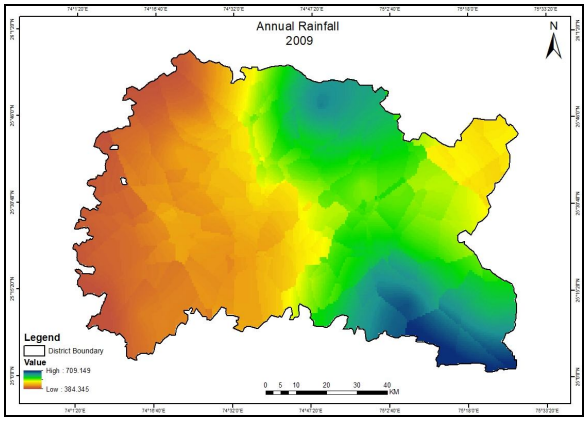


Fig.4 (c) Rainfall 2009

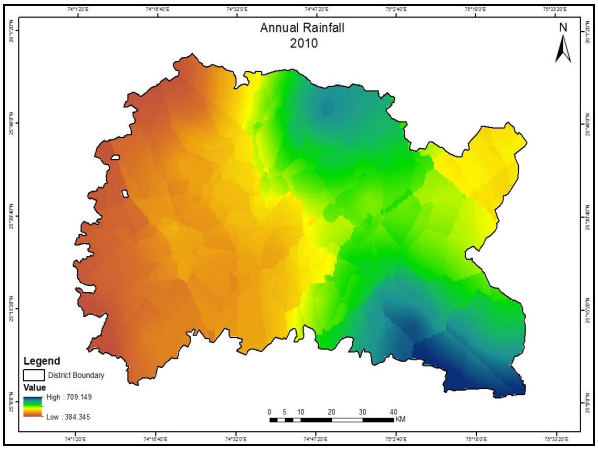


Fig.4 (d) Rainfall 2010

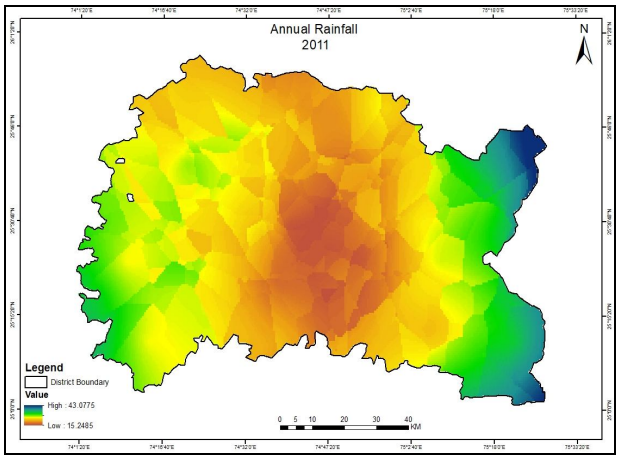


Fig.4 (e) Rainfall 2011

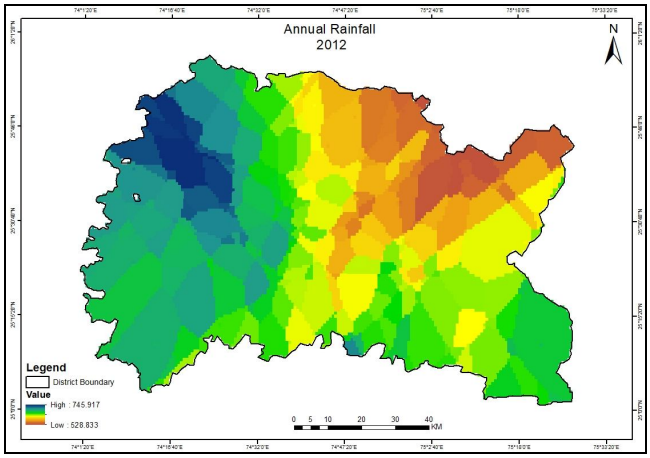


Fig.4 (f) Rainfall 2012

ISSN 2394 - 7780

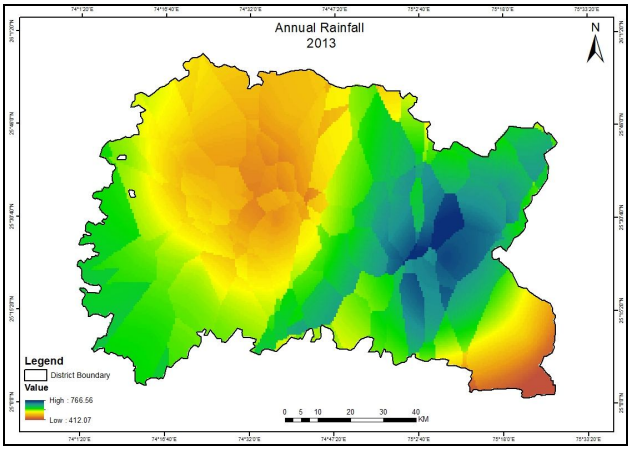


Fig.4 (g) Rainfall 2013

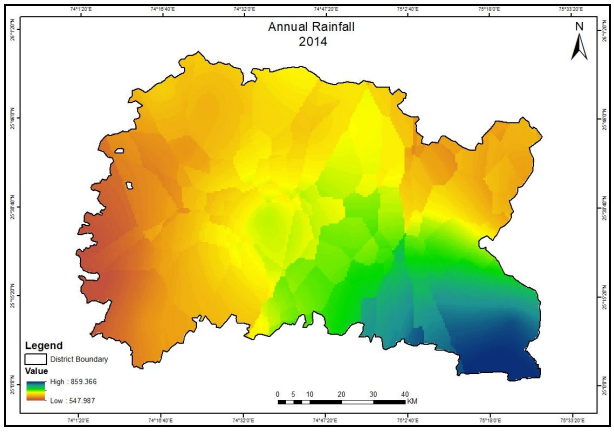


Fig.4 (h) Rainfall 2014

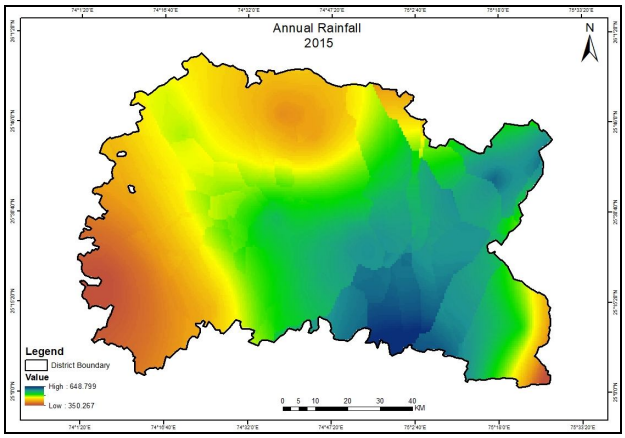


Fig.4 (i) Rainfall 2015

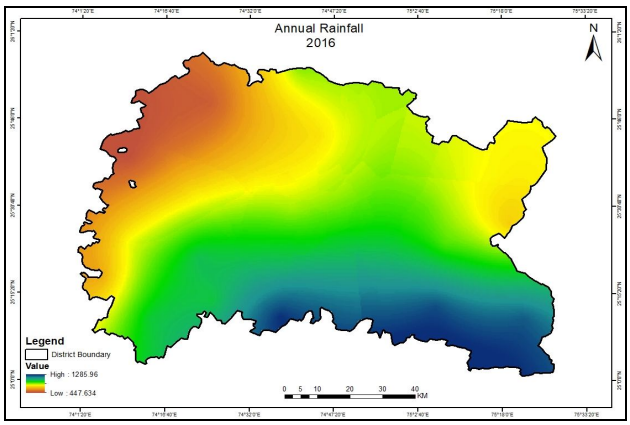


Fig.4 (j) Rainfall 2016

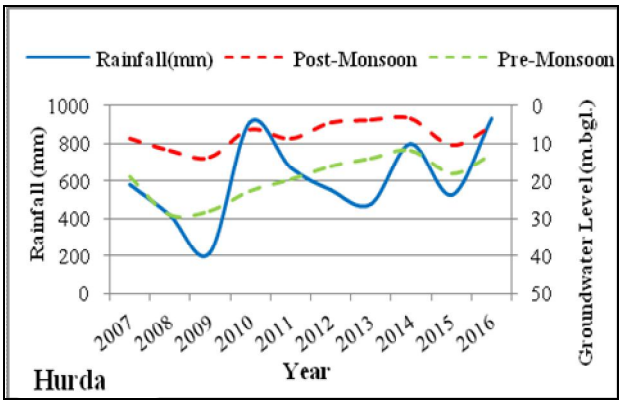
Fig 4(a) to 4(j): Geo-Statistical Models of Kriging interpolation technique for rainfall data.

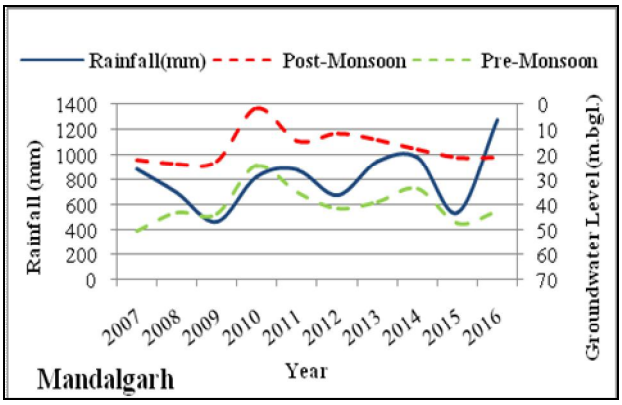
ISSN 2394 - 7780

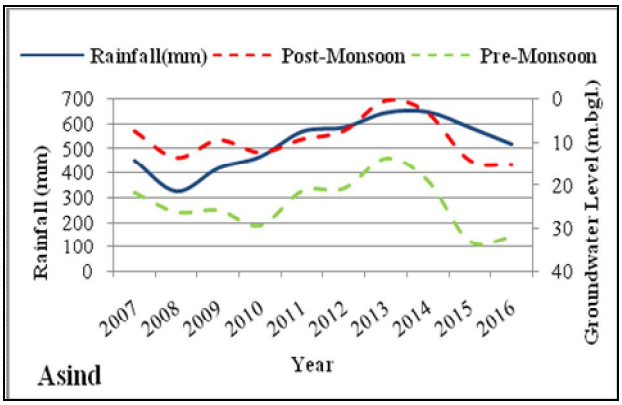
RESULTS & DISCUSSION

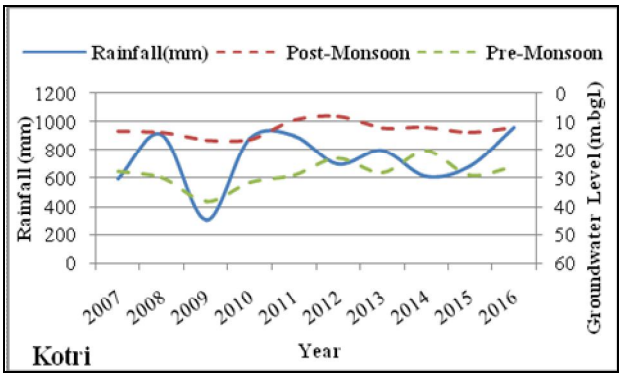
Pre and post monsoon water level for the years 2007 to 2016 have been analyzed with the rainfall data of the study area to understand the variability of ground water level for last 10 year, water table fluctuation in pre and post monsoon, possible causes of low and high recharge zones and show the overall behavior of groundwater. Figure.5 shows the relation between rainfall, pre & Post monsoon ground water level according to geographical location of station.

Two groundwater level series were plotted on the same chart together with annual average rainfall. The relation of rainfall with groundwater level (Pre-monsoon and Post-monsoon) is interpreted here. It was observed that this rise is sustained at sufficient level till 2016.









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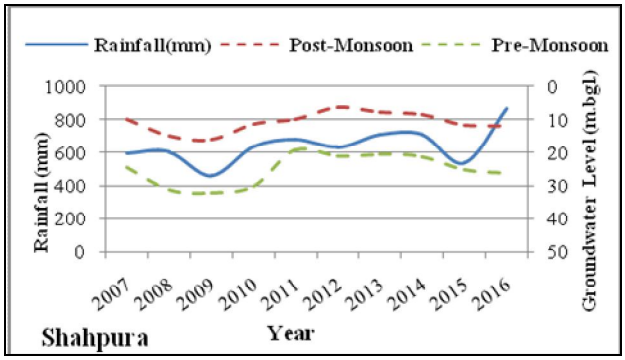

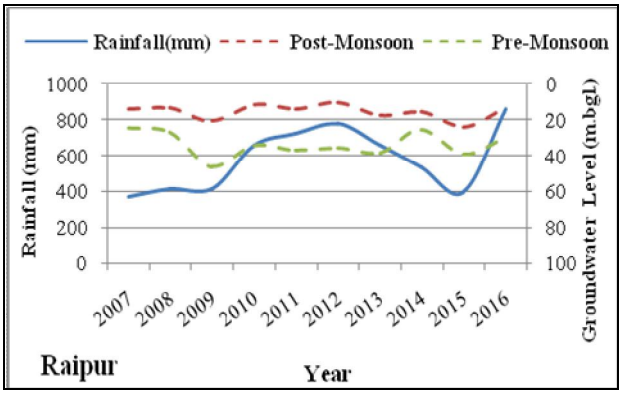

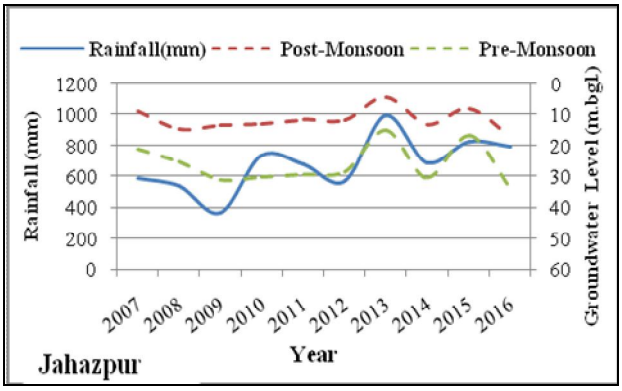

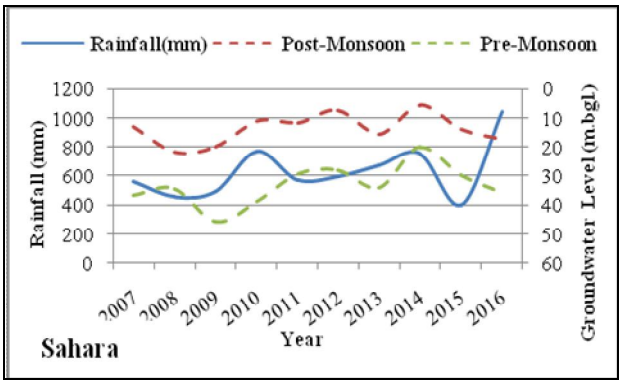

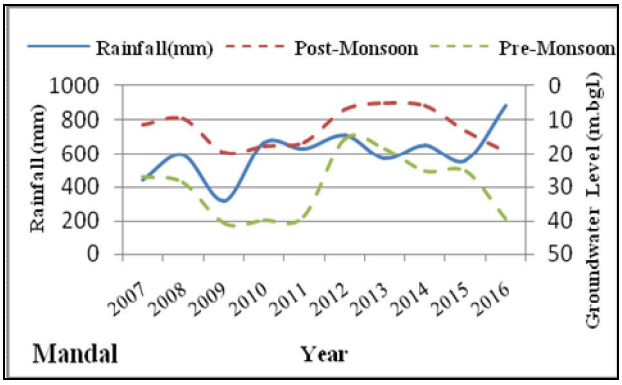

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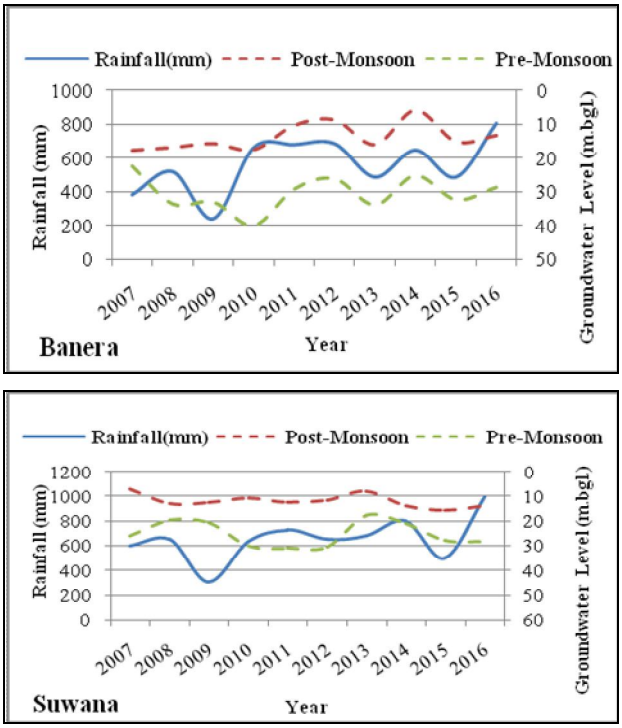

Fig.5. Relation between rainfall, pre & Post monsoon ground water level according to geographical location of station.

This study will give a fairly good idea about status, availability and distribution of surface and ground water throughout the year.

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REDUCTION OF PHYSICOCHEMICAL PROPERTIES OF DYE INDUSTRIAL WASTEWATER

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ABSTRACT
Environmental Pollution is becoming a threat around the world due to the release of hazardous substances and influence of contaminated water is a global issue. To protect the environment from the harmful effect of the waste generated, the ministry of Environment, Government of India has set standards for the wastewater and other wastes which are discharged into the environment. Almost all chemical industries release contaminated water, of which 17 - 20% is dye industries. In current scenario recycle is the best option than disposing. Water which is to be recycled or disposed must not contain colour as well as it must have its other physicochemical properties like pH, BOD, COD, TDS etc. in permissible limits. Untreated water of dye industries is highly coloured water due to the use of chemicals and different pigments in processes it has key parameters above specified standards. For recycle of this water, colour should be first removed and then its chemical and physical treatment is carried out to achieve parameters according to CPCB norms. In this paper we studied on the reduction of some of the key properties of dye industry waste water to the specified standards so it can be recycled to the industries. There are many methods available for colour removal from that one of method is decolourization which is achievable by one or combination of the methods like Adsorption, Filtration and Precipitation, Chemical degradation, Photo degradation and biodegradation. We used adsorption for the decolourization which is carried out by using Bentonite clay because it is easily available and its amount required for the treatment is less compared to other adsorbents. Bentonite adsorption and coagulation is employed for removing colour from synthetic dye waste water containing reactive red K□2G, K□RN blue, K□GN orange, KB□3G yellow. COD can be achieved in permissible limits using one or combination of the chemicals such as Activated charcoal, Bentonite clay, Ferric alum, Bleaching powder and Lime. We have used combination of above chemicals for different proportions to get better results which are shown in this paper. Advantage of using such composition is that we can also control the TDS and also good efficiency of about 55% reduction in TDS and 57% reduction in COD has been observed using the treatment we have used.

Keywords: Dye industries, Adsorption, Bentonite Clay, Ferric Alum, TDS and COD

1. INTRODUCTION
The major sources of water contamination are domestic, industrial, agricultural, thermal and radioactive waste (Gaur 1997). The industries which contribute to water pollution are pulp and paper industries, distilleries, oil refineries, pharmaceutical, textile, dyeing industry, dairy, acid pickling, power plant roller and flour mills etc. (Kudesia 1994). Effluents discharged from dyeing industries are highly coloured and toxic to aquatic life.[1] There are many parameters which are considered in determining the physicochemical properties of waste water which includes colour, odour, pH, temperature, Total Solids (TS), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), chloride and chromium (APHA 1989). There are many techniques for reduction of these properties which mainly involves Biological treatment, Catalytic oxidation, Membrane filtration, Sorption process, Coagulation, Flocculation, Ion exchange, Ozonisation, Physicochemical treatment etc.[2] There are many methods available for colour removal from that one of method is decolourization which is achievable by one or combination of the methods like Adsorption, Filtration and Precipitation, Chemical degradation, Photo degradation and biodegradation. pH can be controlled by addition of Calcium Carbonate and COD is controlled using one or combination of the chemicals such as Activated charcoal, Bentonite clay, Ferric alum, Bleaching powder and Lime. Advantage of using such composition is that TDS can also be controlled and also good efficiency is achievable.

2. EXPERIMENTATION
2.1 Materials
For the present work, we used analytical grade chemicals such as Activated Charcoal, Ferrous Alum ($NH_4Fe(SO_4)_2 \cdot 12H_2O$), Bentonite Clay, Bleaching powder ($Ca(OCl)_2$) and Lime (CaO) purchased from Desai Chemicals, Ahmedabad. All chemicals were used as received without any further purification. Dye wastewater was employed throughout the study which was obtained from Synthopharma Chemicals Ltd., GIDC Naroda.

2.2 Treatment Methods
Five different chemical treatment methods were carried out with vigorous mixing initially/after each operation.

ISSN 2394 - 7780

Treatment 1: Effluent (100 mL) + Activated Charcoal (1 g)

Treatment 2: Effluent (100 mL) + Bleaching powder (1 g)

Treatment 3: Effluent (100 mL) + Lime (1 g)

Treatment 4: Effluent (100 mL) + Ferric alum (1 g)

Treatment 5: Effluent (100 mL) + Lime + Bentonite Clay (0.5 g) + Bleaching Powder + Activated Charcoal (0.5 g) (2 g total)

We took a sample of effluent and measured it's physicochemical properties like pH, COD and TDS using pH meter, cod equipment and TDS Meter respectively. In first experiments, we have used activated charcoal for the treatment. We took 1g of activated charcoal in 100ml effluent and rigorous stirring was done. The mixture was then left for 24 hours. After this much time the properties of treated effluent was measured. Similarly, other treatments were done by taking bleaching powder, lime, ferric alum and mixture of lime, Bentonite clay, activated charcoal and bleaching powder respectively. For the final treatment, we increased the amount of Bentonite clay and Activated Charcoal which are good adsorbents of colour. All the experiments were carried out at room temperature.

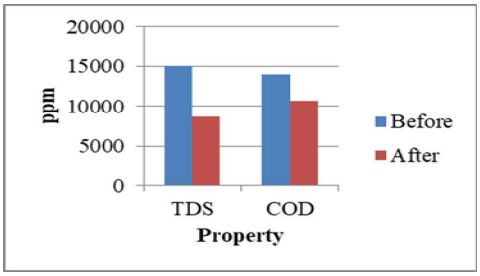
3. RESULT AND DISCUSSION

3.1. Effect of Activated Charcoal

By addition of activated charcoal it is seen that, there is very less percentage of reduction in pH whereas reduction in TDS and COD was observed about 42% and 23% respectively.

Table 1: Reduction of pH, TDS and COD by Activated Charcoal

Property	Before	After	% Reduction
pH	8.5	8	5.88
TDS	15000 ppm	8700 ppm	42.00
COD	14000 ppm	10740 ppm	23.29



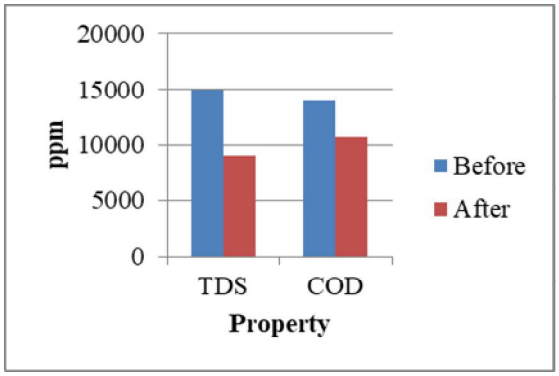
Graph-1: Comparison of initial and final TDS and COD by Activated Charcoal

3.2. Effect of Bleaching Powder

By addition of bleaching powder it is observed that there is negligible change in pH but reduction in TDS and COD was observed about 40% and 24% respectively.

Table-2: Reduction of pH, TDS and COD by Bleaching Powder

Property	Before	After	% Reduction
pH	8.5	8.4	1.18
TDS	15000 ppm	9000 ppm	40.00
COD	14000 ppm	10700 ppm	23.57



Graph-2: Comparison of initial and final TDS and COD by Bleaching Powder

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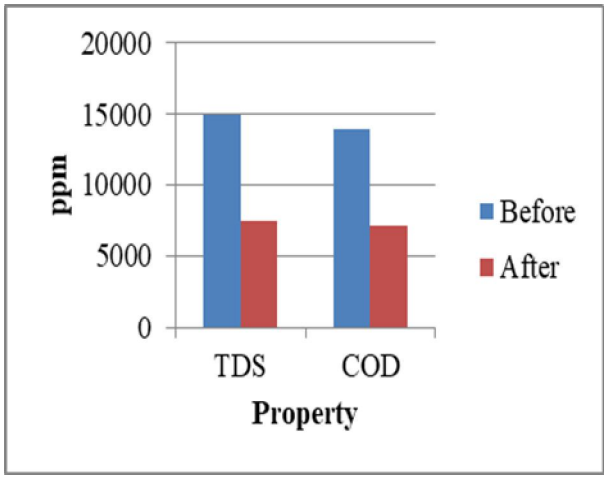
3.3. Effect of Lime

By addition of lime it is observed that there is highest change in pH which is about 15% and reduction in TDS and COD was observed about 50% and 49% respectively.

Table-3: Reduction of pH, TDS and COD by Lime

Property	Before	After	% Reduction
pH	8.5	7.2	15.29
TDS	15000 ppm	7500 ppm	50.00
COD	14000 ppm	7200 ppm	48.57



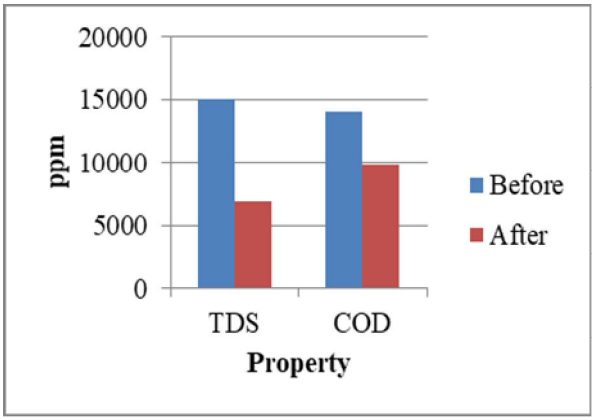
Graph-3: Comparison of initial and final TDS and COD by Lime

3.4. Effect of Ferric Alum

By addition of ferric alum it is observed that change in pH is nearly to 7.5 and about 54% reduction in TDS and 29% reduction in COD were observed respectively.

Table-4: Reduction of pH, TDS and COD by Ferric Alum

Property	Before	After	% Reduction
pH	8.5	7.4	12.94
TDS	15000 ppm	6900 ppm	54.00
COD	14000 ppm	9890 ppm	29.36



Graph-4: Comparison of initial and final TDS and COD by Ferric Alum

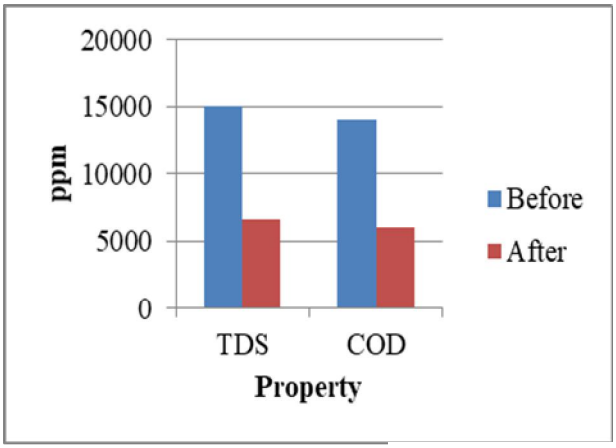
3.5. Effect of Lime + Bentonite Clay + Bleaching Powder + Activated Charcoal

When we added the mixture of all the chemicals we observed the maximum reduction in all the three parameters. In this method we have increased the amount of activated charcoal and Bentonite clay and because of that we obtained nearly colourless water.

Table-5: Reduction of pH, TDS and COD by Lime + Bentonite Clay + Bleaching Powder + Activated Charcoal

Property	Before	After	% Reduction
pH	8.5	7.31	14.00
TDS	15000 ppm	6700 ppm	55.33
COD	14000 ppm	6000 ppm	57.14

ISSN 2394 - 7780



Graph-5: Comparison of initial and final TDS and COD by Lime + Bentonite Clay + Bleaching Powder + Activated Charcoal

4. CONCLUSION

The experimental studies approach succeeded in reduction of pH, TDS and COD using all treatments up to certain level but with the treatment no. 5, in which we have used the mixture of Lime, Bentonite Clay, Bleaching Powder and Activated Charcoal. The results indicated that reduction in COD was from 14000 ppm to 6000 ppm which was about 57% whereas reduction in TDS was from 15000 ppm to 6700 ppm which was about 55%. The pH was also observed nearly about 7.3 which is near to the neutral. Therefore, it can be concluded that treatment no. 5 is sufficient to reduce pH, TDS and COD.

5. ACKNOLEDGEMENT

The Authors are grateful to the Department of Chemical Engineering, Sal Engineering and Technical Institute, Ahmedabad for supporting us. We also extend our gratitude to Synthopharma Pvt. Ltd.

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ZERO LIQUID DISCHARGE – THE NEW AGE EFFLUENT TREATMENT TECHNOLOGY

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ABSTRACT
Industrialization over the past few decades has brought rapid development to many regions in the world today. This fact even though undeniable, has also had an adverse impact on several natural resources on Earth, particularly water. Rapid development of the industrial sector has constantly degraded the quality of water resources available in nature, especially freshwater resources. Freshwater sources account for just about 3% of the total water resources on Earth and there has been large scale scarcity of fresh water around the globe, posing a major threat to economic growth, water security, and ecosystem health. Industrial processes of the most polluting industries like Tanneries, Paper-pulp, Pharma, Dyeing, Chemicals, etc. generate wastewater with high TDS, salinity, and pH, thus have threatening the availability and value of freshwater resources. Industrial processes today reduce the availability of water for the environment or other processes since they require water as a raw material or an intermediate processing material. In addition to this these, industrial processes often contaminate nearby water resources by releasing effluents (Wastewater) that damages the local environment further, often severely polluting ground and surface waters. Since recovering and recycling of wastewater becoming a growing trend over the past two decades, several countries have begun investing in setting up Effluent Treatment Plants (ETPs) to treat the industrial wastewaters. Increased and unplanned disposal of effluents have led to heavy contamination of numerous important rivers. However, countries like India and Nigeria have experienced failed ETP projects, particularly due to improper management of funds and resources. To tackle this challenge, many governments are now aiming to push high-polluting industries towards Zero Liquid Discharge by creating regulations that require ZLD compliance.

Keywords: *Water resources, Wastewater, Effluent treatment, Zero Liquid Discharge, ZLD*

1. INTRODUCTION
Supplies of water are vital for agriculture, industry, recreation and human consumption. One problem that the water industry faces is disposal of concentrate from advanced water treatment processes. The public and industrial sectors consume substantial amounts of freshwater while producing vast quantities of wastewater. If inadequately treated, wastewater discharge into the aquatic environment causes severe pollution that adversely impacts aquatic ecosystems and public health. The most viable solution to this issue is recycling the wastewater generated as much as possible. Recovery and recycling of wastewater has become a growing trend due to rising water demand. It not only minimizes the volume and environmental risk of discharged wastewater, but also alleviates the pressure on ecosystems resulting from freshwater withdrawal.

Zero Liquid Discharge (ZLD)is the only option currently available in many inland regions where surface water, sewer, and deep well injection disposal are either prohibited or have caused damage to water and land resources, and effected biotic health. The strategy eliminates any liquid waste leaving the plant or facility boundary, with the majority of water being recovered for reuse. In this paper we will learn how a ZLD-system can produce a clean stream from industrial wastewater and make it suitable for reuse in the plant or can be further reduced to a solid. We will also understand the major advantages ZLD systems have over conventional ETP technologies.

2. WASTEWATER TREATMENT
Water having the highest dielectric constant is also called universal solvent because it can virtually dissolve everything in its intra-molecular space. During its passage through industrial processes (in manufacturing or utilities) it comes out as wastewater having large amounts of contamination mostly inorganic but also organic referred to as pollutants. This highly contaminated water when discharged into free flowing water bodies like lakes, rivers make the surface water polluted and unfit for human as well as plants and aquatic life.

From a typical water cycle, it is well known that the source of water is limited but consumption is increasing manifold due to increasing human lifespan and the corresponding industrialization. Over the years due to the selfish nature of human beings the industries continued to withdraw fresh water while simultaneously discharging and polluting the rivers, lakes, ponds etc.

2.1 Scenario in India
India has witnessed rapid industrialization over the past 30 years and several large scale industrial projects have generated effluents that contain either oils or greaseor toxic materials (e.g., cyanide). Effluents from food and

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beverage factories contain degradable organic pollutants. Since industrial wastewater contains a diversity of impurities and therefore specific treatment technology called **Effluent Treatment Plant (ETP)** is required.

The most polluting industrial sectors in India like chemicals, drugs, pharmaceutical, tannery, refineries, dairy, ready mix plants & textile, etc. have been relying on ETP to purify industrial wastewater for reuse and to release safe water to environment from the harmful effect caused by the effluent. The plant works at various levels and involves various physical, chemical, biological and membrane processes to treat wastewater from these industries. However, improper management of funds and resources has led to the failure of ETP facilities in India. ETPs in India are failing to meet the water discharge standards, thus leading to pollution of fresh water sources. This scenario is being further aggravated due to rising water scarcity in the country.

2.2 Rationale for Wastewater Reclamation and Reuse

Water reclamation is the treatment or processing of wastewater to make it reusable with definable treatment reliability and meeting water quality criteria. Water reuse is the use of treated wastewater for beneficial uses, such as agricultural irrigation and industrial boiling and cooling. In the recent light of public environmental awareness and pollution control regulations, water reclamation and reuse has assumed a more important and diversified role. The attractiveness of reuse results from several circumstances, one or more of which may be appropriate in any situation. Some of the rationale behind water reclamation and reuse are hereby highlighted below:

- Water reuse accomplishes zero liquid discharge (ZLD) mandates. Reclamation and reuse of wastewater for beneficial purposes eliminates potential pollution load to receiving water.
- Water reclamation optimizes conservation ethics. Legislative directives have asked for more wise use of resources. Extensive wastewater treatment requirements imposed for the maintenance of receiving water quality often results in the production of a product that is literally too good to throw away. This water may serve many purposes in a community.
- Water is a limited resource and where there is insufficient potable water of high quality, growth of a community may also be limited. Reclaimed water may be utilized for many of the purposes ordinarily served by the high-quality potable source, thereby permitting the high quality water to serve increasing populations.
- Reuse may result in significant economies. These economies can accrue from the postponement of the development of additional potable water supplies and/or from the lesser requirements for wastewater treatment for non-potable purposes than for discharge into fragile receiving waters. For example, the reclaimed water may be used as industrial boiler water which does not require a drinking water quality. Also, some of the nutrients in wastewater may not need to be removed at all where reuse is practiced for irrigation purpose as those nutrients have intrinsic values for agricultural plants.
- In coastal areas, recharging highly treated effluents into ground-water aquifers can provide a seawater intrusion barrier, restore depleted supplies, provide a consistent reliable source, and eliminate the need for a secondary distribution system.

3. ZERO LIQUID DISCHARGE (ZLD)

Zero Liquid Discharge (ZLD) as the name clearly indicates, is a modern engineering approach to conventional water treatment practices where the contaminants are reduced to solid waste and all water is recovered. ZLD technology is being popularly accepted due to its potential for recovering resources that are present in wastewater. Numerous global organizations have installed ZLD technologies for their waste in addition to ETPs because they can sell the solids that are produced or left over as residues after the ZLD treatment or reuse them further as a part of their industrial process. It ensures that the majority of the water is recovered for reuse.

3.1 Importance and scope in India

ZLD technologies help plants meet discharge and water reuse requirements, enabling businesses to meet stringent discharge regulations, treat and recover valuable products from waste streams and manage produced water better. Since ZLD recycles water on site, it considerably lowers water acquisition costs and risk due to fewer treatment needs. Industries are also able to improve environmental performance by meeting stringent environmental discharge standards. ZLD enables an industry to reuse wastewater as an additional resource that can be harnessed to achieve water sustainability, considerably obviating the risk of pollution associated with wastewater discharge into rivers, lakes, and streams.

India over the past few decades, has been taking aggressive actions to curb severe water pollution, even in the holy river Ganga.In the beginning, the government came out with **common effluent treatment plants (CETPs)**

ISSN 2394 - 7780

to collect the polluted discharges from various industries at one point objectively to treat remove pollutants to an extent and then discharge the treated effluent into the rivers, lakes, ponds etc. Again this noble objective failed for two primary reasons:

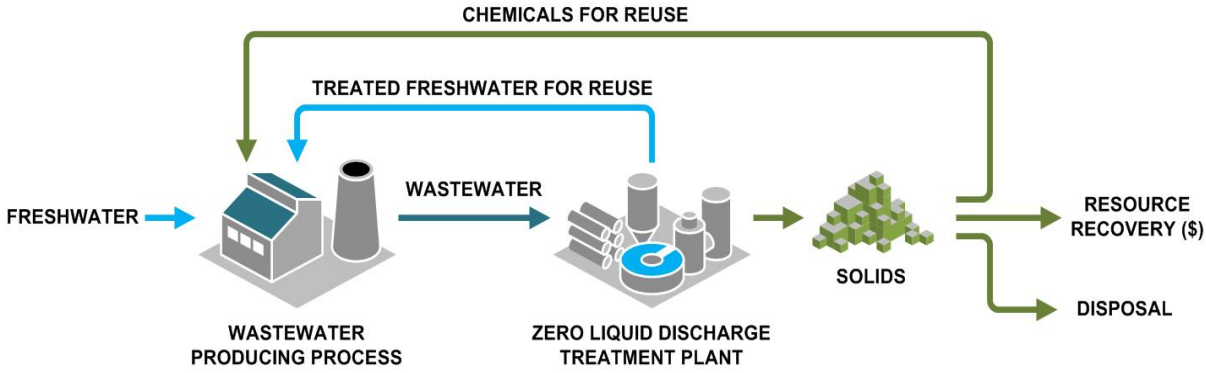
- Industries have passed the responsibility on to CETPs started sending out (discharging) severely contaminated water coupled with escalating flows.
- Administrative malfunction of CETPs management.

Finally, the apex body (related ministry/government department, pollution control boards, and equivalent body) foreseeing the future came down with a legal directive for each and every industry to install a ZLD scheme.The recent three-year target set by the Indian government, known as the "Clean Ganga" project, imposes stricter regulations on wastewater dischargeto 9 State Pollution Control Boards of states along the Ganga basin and move high-polluting industries toward ZLD. The government had issued a draft policy in 2015 that requires all textile plants generating more than 25 m^3 of wastewater effluent per day to install ZLD facilities.

4. PRINCIPLE AND WORKING OF ZLD

Early ZLD systems were based on stand-alone thermal processes, where wastewater was typically evaporated in a brine concentrator followed by a brine crystallizer or an evaporation pond. The condensed distillate water in ZLD systems is collected for reuse, while the produced solids are either sent to a landfill or recovered as valuable salt byproducts. Such systems, which have been in successful operation for 40 years and are still being built, require considerable energy and capital. Reverse osmosis (RO), a membrane-based technology widely applied in desalination, has been incorporated into ZLD systems to improve energy and cost efficiencies.

ZLD technology includes pre-treatment and evaporation of the industrial effluent until the dissolved solids precipitate as salts and residue. These salts are removed and dewatered. The water vapor from evaporation is condensed and returned to the process. It is the most "In demand" water treatment technology that can treat wastewater as the contaminants are concentrated.



In general, most of the ZLD systems in operation these days are based on stand-alone thermal processes, where wastewater was typically evaporated in a brine concentrator followed by a brine crystallizer or an evaporation pond. The condensed distillate water in ZLD systems is collected for reuse, while the produced solids are either sent to a landfill or recovered as valuable salt byproducts.

Normally the evaporation-crystallizing section receives the reject from a Reverse Osmosis (RO) section that concentrates dissolved solids. To prevent fouling during the reverse osmosis process, ultrafiltration is often used to eliminate suspended solids.

- **Pretreatment and conditioning**

Pretreatment is used to remove simple things from the wastewater stream that can be filtered or precipitated out, conditioning the water and reducing the suspended solids and materials that would otherwise scale and/or foul following treatment steps.

Typically this treatment block consists of some type of clarifier and/or a reactor to precipitate out metals, hardness, and silica. Sometimes this step requires the addition of caustic soda or lime to help with coagulation, a process where various chemicals are added to a reaction tank to remove the bulk suspended solids and other various contaminants. This process starts off with an assortment of mixing reactors, typically one or two reactors that add specific chemicals to take out all the finer particles in the water by combining them into heavier particles that settle out. The most widely used coagulates are aluminum-based such as alum and polyaluminum chloride.

ISSN 2394 - 7780

Ultrafiltration (UF)
Ultrafiltration (UF) can also be used after the clarifiers instead of the gravity sand filter, or it can replace entire clarification process altogether. Membranes have become the newest technology for treatment, pumping water directly from the wastewater source through the UF (post-chlorination) and eliminating the entire clarifier/filtration train. Out of this process comes a liquid that is then filter-pressed into a solid, resulting in a solution much lower in suspended solids and without the ability to scale up concentration treatment.

- **Phase-one concentration**

Concentrating in the earlier stages of ZLD is usually done with membranes like reverse osmosis (RO), brine concentrators, or electro-dialysis.

Reverse Osmosis (RO)
The RO train will capture the majority of dissolved solids that flow through the process, but as mentioned in a prior article about common problems with ZLD, it's important to flow only pretreated water through the RO system, as allowing untreated water to go through the semipermeable membranes will foul them quickly. Brine concentrators, on the other hand, are also used to remove dissolved solid waste but they are usually able to handle brine with a much higher salt content than RO. They are pretty efficient for turning out a reduced-volume waste.

Electro-dialysis
Electro-dialysis can also be used in this part of the ZLD treatment system. It's a membrane process that uses positively or negatively charged ions to allow charged particles to flow through a semipermeable membrane and can be used in stages to concentrate the brine. It is often used in conjunction with RO to yield extremely high recovery rates.

- **Evaporation/crystallization**

After the concentration step is complete, the next step is generating a solid, which is done through thermal processes or evaporation, where you evaporate all the water off, collect it, and reuse it. Adding acid at this point will help to neutralize the solution so, when heating it, you can avoid scaling and harming the heat exchangers. De-aeration is often used at this phase to release dissolved oxygen, carbon dioxide, and other non-condensable gases.

The leftover waste then goes from an evaporator to a crystallizer, which continues to boil off all the water until all the impurities in the water crystallize and are filtered out as a solid.

- **Recycled water distribution/solid waste treatment**

If the treated water is being reused in an industrial process, it's typically pumped into a holding tank where it can be used based on the demands of the facility. The ZLD treatment system should have purified the water enough to be reused safely in your process.

The solid waste, at this point, will enter a dewatering process that takes all the water out of the sludge with filter or belt presses, yielding a solid cake. The sludge is put onto the press and runs between two belts that squeeze the water out, and the sludge is then put into a big hopper that goes to either a landfill or a place that reuses it. The water from this process is also typically reused.

5. Important components
The most important part of ZLD is to reduce waste from source generation. For achieving this one has to go through in plant production process with influent characterization. On basis of characteristics and quantum of influent one can decide zero liquid discharge stages.

- The first part is in plant treatment or diversified usage of waste water.
- Second Part is segregation of unavoidable waste water depends on its strength.
- Third part is further sub classified in various stages

i. General Traditional ETP plant with efficient tertiary system
ii. Part of wastewater went through typical ZLD guzzlers and part typical ETP
iii. The whole waste water need to passes through typical ZLD guzzlers

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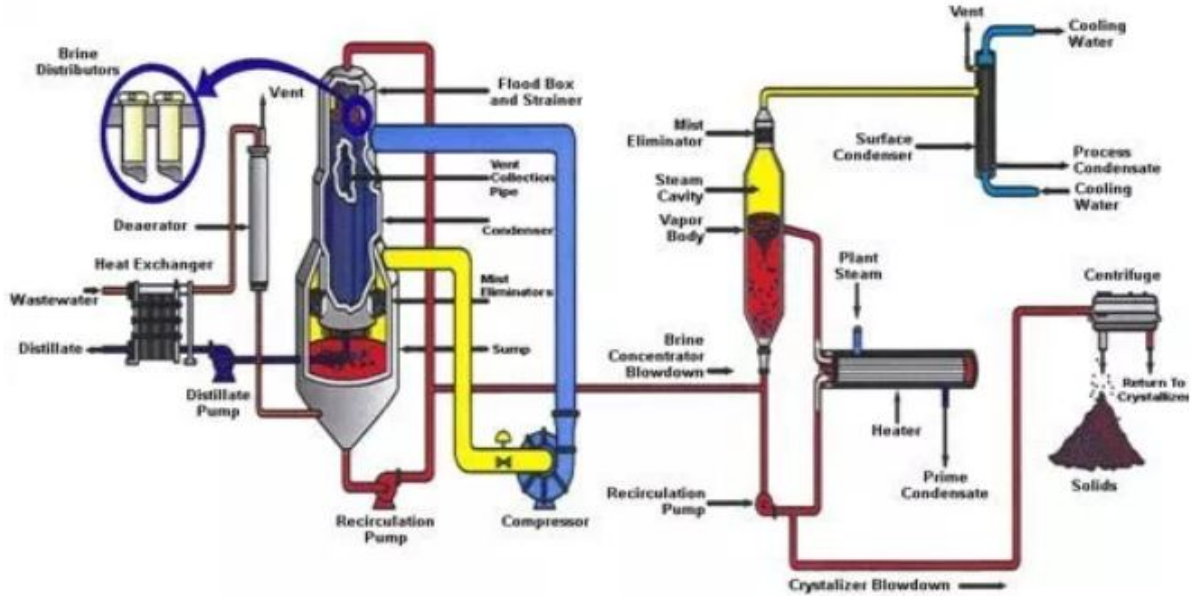

The basic structure of a properly functioning ZLD system comprises of the following components:

- **Clarifier and/or Reactor** to precipitate out metals, hardness, and silica
- **Chemical feed** to help facilitate the precipitation, flocculation, or coagulation of any metals and suspended solids
- **Filter press** to concentrate secondary solid waste after the pre-treatment or alongside an evaporator
- **Ultrafiltration (UF)** to remove all the leftover trace amounts of suspended solids and prevent fouling, scaling, and/or corrosion down the line of treatment
- **Reverse Osmosis (RO)** to remove the bulk of dissolved solids from the water stream in the primary phases of concentration
- **Brine concentrators** to further concentrate the reject RO stream or reject from electro--dialysis to further reduce waste volume
- **Evaporator** for vaporizing access water in the final phases of waste concentration before crystallizer.
- **Crystallizer** to boil off any remaining liquid, leaving you with a dry, solid cake for disposal.

ZLD is a stage-wise scheme of gradually removing suspended impurities depending in size of-of particle using grate filters, sand filters, clarifiers, UF filters etc. removing COD , BOD & Color by chemicals, oxidation & settling, removing dissolved salts by multi-stage Reverse Osmosis units to its threshold and finally Evaporators and crystallizers to separate out all salts. Newer technologies called Forward Osmosis are being tried out for lower cost alternatives.

Cost and efficiency

ZLD systems are associated with high capital investments and even higher operating expenses. More than 90% of this operating cost is incurred during evaporation, which is a very energy intensive process. This is because, after various stages of filtration, chemical treatment, and separation of water from chemicals following Reverse Osmosis (RO), the RO Reject is first evaporated and then condensed to recover the water. In some cases however, this cost can be offset by the resource recovery i.e. salt and other chemicals which can be again reused in the process. For example, in textile industries, there is enough scope to recover salts and brine solution which can be reused in the manufacturing process and reduce the impact of treatment cost on the overall cost of production.

This mandate will drive water efficiency measures in the Indian industry. Lesser waste water means lesser treatment cost and thus improving water use efficiency will have significant benefits especially for industries like Sugar and pulp and paper industry, which have a considerably large water footprint.

Merits

Environmental experts consider ZLD to be beneficial to industrial and municipal organizations as well as the environment because no effluent, or discharge, is left over. ZLD systems are capable of purifying and recycling

ISSN 2394 - 7780

virtually all of the wastewater produced and also converting wastewater from an industrial process to solids, sometimes recovering valuable resources.Targeting ZLD for an industrial process or facility holds a number of benefits like:

- Lowered waste volumes decrease the cost associated with waste management.
- Recycle water on site, lowering water acquisition costs and risk. Recycling on-site can also result in fewer treatment needs.
- Use of the most advanced wastewater treatment technologies to purify and recycle virtually all of the wastewater produced
- Some processes may recover valuable resources, for example, ammonium sulfate fertilizer or sodium chloride salt for ice melting.
- Reduces the wastewater discharge i.e. reduces water pollution
- Preferred option for industry where disposal of effluent is major bottleneck
- Separation of salts/residual solvents improve efficiency of ETP and CETP
- Reduction in water demand from the Industry frees up water for Agriculture and Domestic demands.
- Ease in getting environmental permissions
- Improved environmental performance and regulatory risk profile for future permitting.

CONCLUSION

The textile and tannery sectors in India generate the maximum amount of wastewater and have been facing a severe crunch from the government to install ZLD solutions along with conventional ETP systems as a mandate. As the severe consequences of water pollution are increasingly recognized and attract more public attention, stricter environmental regulations on wastewater discharge are expected, which will push more high-polluting industries toward ZLD. ZLD will effectively help reduce water demand from the industry and free up water for Agriculture and Domestic demands. Intensified freshwater scarcity, caused by both climate change and freshwater overexploitation, will likely facilitate ZLD implementation.

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ANALYTICAL STUDY OF CHALLENGES IN APPLICATION OF FINTECH IN BANKING SERVICES

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ABSTRACT

There has been a paradigm shift in the role …. no longer a financial service provider institution but now talking about customer delight…It's the time for the banks to understand the updated needs of the customer through the Artificial intelligence and big data analytics. issues like cyber security and hacking issues in the e banking transactions. Research studies observed that technology has become a tool that facilitates banks' organizational structures, business strategies, customer services and related functions. Digitalization changes face of branch banking and also it enhanced the scope of banking transactions

This paper aims to study the different types of challenges faced by the Banks in implementing the digitization in the Indian Banking Industry with the country's customer base and also understand the extent of usage of tech base services by customer and challenges faced by them. The research paper observed that key changes that banks need to make in their market approach should be focused in redesigning their process models, strategy to implement those ,developing expertise in predicting and analyzing signals of change in this disruptive environment, and becoming tactically focused on being operationally lean and agile in response to changing market and business scenario. As the findings of this research paper suggest that there are many challenges a new mindset is required in this direction. Really it will be big tough time for the traditional banks to completely transform in the current fintech based ecosystem. Banking sector has to make a lot of change in their ongoing approach for future banking of 2025.The choice banks have to make either to adopt with the fintech companies or partner with fintech companies ,while doing so bank has to keep in account the cost involved, business revenue model ,their culture and people ,cost of training ,availability of infrastructure and bandwidth to adopt that infrastructures, factor ,Scalability etc

Keywords: Digitization, Fintech, Technology, Customer, Banking Service

1. INTRODUCTION

There has been a paradigm shift in the role …. no longer a financial service provider institution but now talking about customer delight…It's the time for the banks to understand the updated needs of the customer through the Artificial intelligence and big data analytics

Today the technology has closely knitted with our lives. This has radically changed the way we live, work, and think. Digital has not restricted itself to a channel of banking it has emerged as banking. This huge involvement of technology is bringing the shift in banking industry from branch banking to digitization and banking services.

Legacy of traditional Banks have been disrupted with new specialized entrants and emerging business models which has erode the thin line between business and technology. Banking has moved from traditional banking services where the core task was it for lending and depositing the money and core efficiency was to creating value in Banking through growth and efficiency to the experience segmentation where a customer experience matter a lot and success and efficiency of bank lies in its ability to manifest opportunities out of the unsettling environment based on Technology and inorganic growth to create customer value will determine its success in the future. . Research studies observed that technology has become a tool that facilitates banks' organizational structures, business strategies, customer services and related functions. Digitalization changes face of branch banking and it enhanced the scope of banking transactions

Across the world, almost all banks are facing lot of challenges to find a technological solution to meet the challenges of a rapidly-changing environment.

2. OBJECTIVES OF THE RESEARCH PAPER

Digitalization demands new services new models and new approach but with this financial inclusion in mind, more and more focus on the development of small and medium enterprises how far it seems possible. The research paper aims at studying the approach of Banks and customer towards embedment of Fintech in banking sector.

In this innovative, customer centric business model, it is important to ensure regulatory compliance for effective execution of strategies in long term. The key challenge in this digital world is to ensure all customers are guarded from cybercrimes, and the most advanced cyber securities measures should be employed. The shift to digitalization will also improve the cost model and enhance the revenue of the banking industry. This will

ISSN 2394 - 7780

reduce manpower and make the system automated. This paper aims to study the different types of challenges faced by the Banks in implementing the digitization in the Indian Banking Industry with the country's customer base and understand the extent of usage of tech base services by customer and challenges faced by them.

3. REVIEW OF LITERATURE

Vally & Divya (2018) has observed that transformation towards digital payments benefits in more transparency in transactions which empowers the country's economy. In recent days many changes took place in the payment system like digital wallets, UPI and BHIM apps for smooth shift to digital payments. They studied the positive impact that Digitization of payment system has bring tin the banking world. They have studied the positive impact which introduction of digital wallets, UPI and BHIM apps for smooth shift to digital payments.

David Varga (2017) research focused to bridge the gap in the current academic literature regarding the appearance of innovation-focused financial technology (fintech) companies. Their analysis provides a conceptual overview of the key value drivers behind fintech's, including the utilization of resource-based theories, business models, human-centered design and open innovation. They have identified the various key driver which are bringing the innovation in financial technology

Devulapalli & Oruganti (2017) The discussion throughout the paper revolves around the challenges that Indian banks are facing in term of e-banking, opportunity to increase awareness and measures adopted for safe and secure e-banking. The paper further tries to discuss some best e banking practices that are prevailing in the world and discuss the various challenges which the banks have to face in the midst of these opportunities. They discussed the issues like cyber security and hacking issues in the e banking transactions. They observed that technology has become a tool that facilitates banks' organizational structures, business strategies, customer services and related functions.

Nirala & Dr. Pandey (2017) The researcher in this paper identify the various drivers of Digital Banking Transformation, also studied the contribution of Indian banks towards Digital India, facilities provided by Indian banks to make India cashless, Key barriers of Digital payment and to identify the threat for Indian bank. They observed that technology has become a tool that facilitates banks' organizational structures, business strategies, customer services and related functions. Digitalization changes face of branch banking and also it enhanced the scope of banking transactions. They discussed the various challenges which are emerging in terms of Digital payment, cyber security etc.

Gomber Peter, et.al (2017) This article appraises the current state of research in digital finance and innovative business functions. In addition, it gives an outlook on possible future research directions. As a conceptual basis for reviewing this field, the Digital Finance Cube embraces three key dimensions of Digital Finance and FinTech, i.e., the respective business functions, the technologies and technological concepts applied as well as the institutions concerned. This conceptualization ropes researchers and practitioners when orientating in the areas of digital finance, allows for the arrangement of academic research relatively to each other, and enables for the revelation of the gaps in research.

Jarunee Wonglimpiyarat (2017) This paper intends to explore FinTech and its dynamic transitions in the banking industry. In particular, this study analyses the systemic innovation nature of FinTech-based innovations which today banking industry is utilizing at various level to provide better customer service and making their revenue model more robust. The relevant contribution of this research study is the development of systemic innovation model which can be used as a dynamic tool to track the progress and pattern of technology development and diffusion. It also discusses the latest financial innovation of Prompt Pay FinTech – the e-payment system in Thailand.

Christian Haddad & Lars Hornuf (2018) This paper investigates the economic and technological determinants inducing entrepreneurs to establish ventures with the reason of reinventing financial technology (fintech). It witnesses more fintech startup formations when the economy is well-developed and venture capital is readily available. Further, the number of secure Internet servers, mobile telephone subscriptions, and the available labor force has an optimistic impact on the development of this new market segment. In addendum, the more difficult it is for companies to access loans, the higher is the number of fintech startups in a country. Overall, the evidence suggests that fintech startup formation need not be left to chance, but active policies can influence the emergence of this new sector.

Giorgio Barba et.al(2018) This research paper examines the impact of Fintech on banks. Digital innovations and technology-based business models could provide new business opportunities for incumbents, by transforming how they create value and deliver products and services. Or they could disrupt the existing

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structure of the financial industry, by blurring its boundaries and fostering strategic disintermediation. By providing new gateways for entrepreneurship, Fintech can ease the right of entry to financial services, fostering competition by new players. To survive, incumbent banks will have to react, face rising competitive pressure and adopt new strategies.

4. RESEARCH METHODOLOGY

4.1 To determine the current state of research pertaining to research topic we conducted an extensive literature review and to identify the challenges we collect the data through questionnaire and discussion with customers and banking employees.120 Customers of 3 Pvt Banks & 10 Employees of 3 bank has been interview through structured questionnaire.

4.2 Limitation: This research is conducted with limited number of people and with limited geographic boundaries.

5. TRANSFORMATION IN THE OPERATING MODEL OF THE BANKS

The operating models of the bank needs restructuring or reshaping with lean channel and organization structures in place to allow for fast reprocessing. Decision and governance process need to be streamlined with a more upgraded culture or ecosystem which can support the customer experience. To meet the above an integrated IT infrastructure, need to be created and there is a need to train the manpower or talent base of the banks so that they can adopt the new model and new technologies in a better way.

As per the experts that many Indian banks, like their Asian counterparts, are geared to use the advantage of local talent and leapfrogging technology to create forward looking digital strategies. there is a lot of space to cover on creating Omni-channel experience and enhancing processes from the customer's point of view. Customer Centricity has emerged as the new buzz word for the banking industry. Another expert believes the challenge for many banks is that they have a long - standing culture of branch- centric banking. They need to be proactive and reach out to the customer with answers through the digital channels from being branch centric to customer centric in their approach.

Some of the fintech trends that banks have implemented are given below -

1. For effective customer interaction use of chatbots are adopted by several banks (like ICICI, HDFC). These chatbots are important interface between the customers and the banks resulted in savings of efforts and time.
2. With the help of machine learning banks are able to offer better service to customers without human intervention. With machine learnings large amount of data can be analyzed and can make predictions with accuracy and efficiency.
3. With the help of the block chain transactions can be recorded and validated by banks which does not require third party authorization. Today both commercial banks and central banks across globe are implementing new technology for issuance of digital currencies and processing of payments. This practice is going to facilitate the cross-border payments (Western Union or Swift). Banks are aiming at to implement Niti Aayog and to create India's largest blockchain network to address fraud and irregularities, to increase transparency,
4. In order to enhance the smoothness in the process workflows, banks, with the help of Artificial Intelligence, are able to identify bottlenecks in the operations in order to improve the process for better customer service. Today Every bank are using the Artificial Intelligence to know the customer behaviors which can be used to provide better services to the customers.
5. Banks with its launching pf apps has connected with its customer in a bigger way. With the touch of the button customers are well connected with all the offerings by the bank offered through the apps. Such personalized service becomes friendlier and customer centric approach towards services offered by the banks.
6. With the concept of Open banking payments, banking transactions are today more simplified and are being done in a very easy manner. Banks are becoming more open in future resulting in the smoother process of payment and other banking transactions. Banks have crossed the limits of branches and now accessible from everywhere. Virtual branches are the new emergence
7. With the help of Fintech companies, today banks are reaching out to customers (high net worth individual) with strong credit background but not using various basic banking facilities. Fintech are tapping those customers for providing them with basic training for the use basic online banking facilities and to get these customers into the mode of self service (Canara Bank played a very critical role in these respect). Various systemic innovation model which can be used as a dynamic tool to track the progress and pattern of technology development and diffusion

ISSN 2394 - 7780

8. Today banks are extending their services not only to retail segment, but also robust services are offered to corporate banking and small and medium enterprises for better digitalized services which is one the major stable revenue segment for the banks.
9. Security measures are more strengthened in view of the threats to the banking sectors (hacking of the data). Preventive steps have been taken by banks in implementing various cyber security measures with encryption mode to curb hacking of the data.

Fig-1

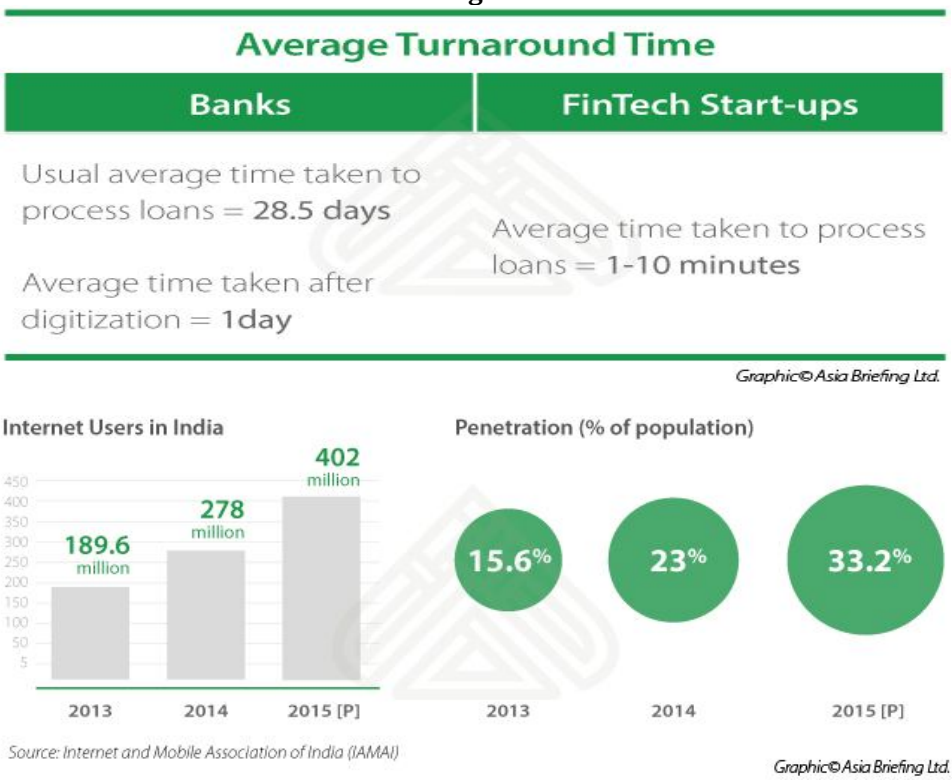
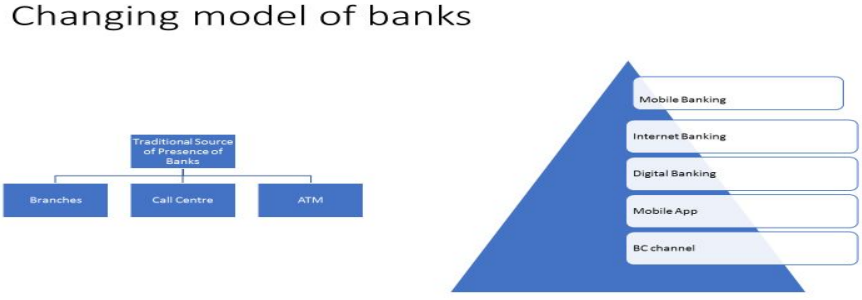


Fig-2: Digital Banking touch point

Source (Primary data and Review of Literature)

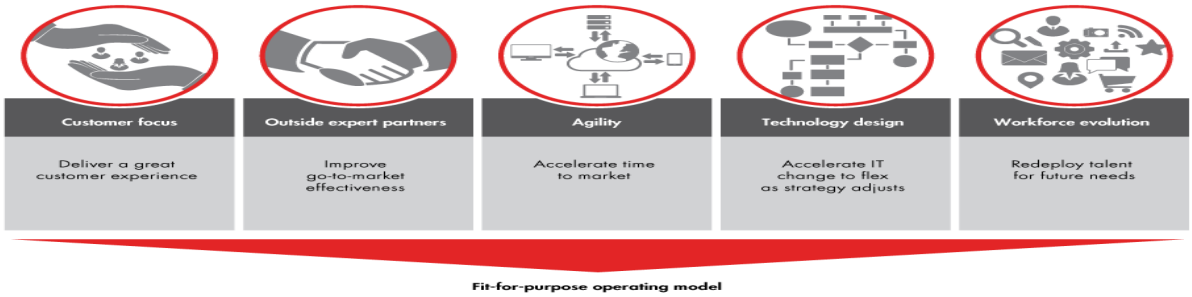
Fig-3: Enhanced presence of banks through different platforms



The way new emerging operating model will help the banks in different critical areas as per Bain and Company

ISSN 2394 - 7780

Figure 3: An operating model for the future will address five critical areas



Source: Bain & Company

With favorable regulatory framework and evolving start up, India's Fintech sector is growing exponentially. As per the NASSCOM reports, India has approximately 400 FinTech companies with an investment of around Rs. 2900 crores. This has been made possible because of the Government support and friendly regulatory framework. For example, Government of India has come out tax rebate scheme to entrepreneur for encouraging payments through digital channel (at least 50% of the payments). Again, with the introduction of India Post Payments Bank (IPPB), Government in on the verge of digital makeover of the financial sector in a big way. IPPB is also playing a pivot role in converting almost over 150000 post offices into bank branches to serve the customer in a bigger way.

HDFC banks, for example, always comes with innovative products to meet customer demand and bring new ideas for better customer service. Bank has come out with the concept 'Bank aapki mutthi mein' as part of the strategy for digital innovation. The bank is also holding Digital Innovation Summit to encourage creativity and innovation in Fintech segment to bring innovation in customer service. HDFC Bank has recently launched a robot known as "Humanoid" in their banking system. The robotic system will be deployed soon in various branches of the HDFC banks and these robots will act as an assistant to help the visiting customers in the branches.

With the demonetization move by the Govt of India of Rs. 500 and Rs. 1000 notes on November 8, 2016, Fintech industry got an impetus to move forward with e payments and e wallets system and there was a sudden spurt of 500% in terms of traffic in digital payments. Data revealed that that 1.7 Mn transactions were affected through e-wallet mode on the first month after the demonetization move. Approximately, 46% of the FinTech space are involved in the payment services business.

6. FINDINGS

A. Banker's Experience

1. 87% of Banking Employees feel that fintech will add more Value based services in terms of customer experience and in ease of providing customer specific services to the customers. As this has become the need and fact that customer is wanting innovation in every service which can make it easy for them to choose the products and service as per their needs.
2. 67 % believes that simplification is the need for hour and 33 % feels that launching of new services and products is the need of the hour .Launching of new technologies and so many services and so many ways of accessing these services have made it very difficult for customer to select and access these products and serivcce.so banker are feeling that along with launching of new innovation simplification should be the focus for the banks
3. 43% of respondents feel that application of the fintech and technology is in mature stage in terms of products and services. Launching of systemic innovation model can be used as a dynamic tool to track the progress and pattern of technology development and diffusion
4. 64% of respondent think that adding on feature will survive. Bank should focus on adding more customer centric features like banking products and services should be integrated on mobile banking and social media. Customer specific dashboard and other apps can be launched across different channels. Next Generation Core Banking Solution must be developed as a "mobile first" application while keeping in mind the security issues so in future these applications will be based on blockchain technologies.
5. Rank of Challenge which they feel in adopting to the Digital platform

ISSN 2394 - 7780

Sr No	Particulars	Rank
1	Culture and people	1
2	Organizational structure and Governance	2
3	Technology Infrastructure	3
4	Cost of Implementation	4

Bankers are facing many challenges in the adoption of digital banking platforms .However they admit the fact that crossing these challenges will lead them to the new opportunities also .financial institution are moving at fast pace when it comes to the implementation of technology and adopting new process but they find it very much difficult for their own people to implement them because of different culture prevailing across the different branches of the same bank and even within one city it varies from branch to branch

The higher authorities in institution some times are under the impression that people are working the sector from last 20-25 years and they will adopt to the new technologies but it is one of the hard core fact that people belong to non-technological background and their finding it very difficult to turn up tot new technologies and also the induction providing to them for orienting toward the new technologies and for them it is also very difficult to change their long established habits and imbibing new skills in them with just some short span of training is very difficult for them.

Banks are under immense pressure respond to new compliance also while implement the latest technologies such as cyber security issues etc, transparency, integrity Again one of the biggest challenges which banks are feeling is the creation of their technological infrastructure. They have to keep in mind their revenue model as implementing the technical infrastructure cost

Lot of innovations I are coming in banking f fields such as mobile, the Internet, the cloud and security are supporting the way people work and how consumers interact with services at banks. The challenge is to make these innovations available to the customers without impacting the business models or incurring significant investment on the part of the Banking sectors .In this competitive edge the banks have to make huge investment in their information technology infrastructure while addressing to the issue like security threats Cyber rules ,transparency ,RBI and other governing bodies guidelines .Banks need to work completely upon their architecture which should support its business model and new key process .Banks for maintaining its revenue model has to work on both aspects on one side the issue is to make technological investments to launch new innovation and process improvisation and on other side bank has to make the cost under control so that revenue should not be eroded.

6. Pros and Cons of Adopting fintech in every domain of Banking sector

Pros of Adopting Fintech	Cons of Adopting Fintech
1.Better Customer Experience (Convenience)	Lack of IT infrastructure
2.Value Based services	Lack of trained Manpower
3.simplification of services	Pricing and Revenue Model
	Culture and people

Over the past decade banking institution have given their best to adopt the fintech in every key process and launching innovation on different frontier and even for many baking banks removing the complexities of old process and adopting to new technologies will lead to improvise the customer experience which in turn will give them more customer and better business growth. So the major benefits which the customer will get from the implementation of new technologies are better customer experience in terms of ease of accessibility, simplification of process and different kind of value based survived There is complete evolution in customer expectation ,regulatory requirements ,technological infrastructure ,new category of completion that all is going to bring complete change in landscape of banking industry .The Launch of digital India campaign made by the government has given a clear objective to all the baking institution to provide benefits to all customers by improving online infrastructure and better accessibility .Here the partnership between banks and fintech companies will create win win model for both the banks and fintech companies.

Banking sector has to make a lot of change in their ongoing approach for future banking of 2025.The choice banks have to make either to adopt with the fintech companies or partner with fintech companies ,while doing so bank has to keep in account the cost involved, business revenue model ,their culture and people ,cost of training ,availability of infrastructure and bandwidth to adopt that infrastructures, factor ,Scalability etc.

ISSN 2394 - 7780

The entry of new banks only makes this process more complex. Today both banks and fintech players must engage as equal partners in each other's growth and the nature partnership have also changed a lot. It is no longer mere vendor and customer relationship but more sort customer and vendor relationship.

Along the biggest challenge is these with how much uniformity this can be implanted across the banking sector. If we see due to the prevailing cultural difference across the country even for a single bank to launch the same system and process in its different branches is very much difficult.

B. Customer Experience

1. Customer Experience about Digital Banking services

Particulars	Respondents %
Mobile banking app	56%
Internet banking	48%
Online banking Portal	50%

Digital platforms have emerged as most preferred platform among the customer but still there is a huge gap to bridge because this experience is not uniform across the all segment of the customers.

Customer centricity has emerged as a buzz word in the banking industry. While analyzing the customer experience it has been observed that Mobile banking is the platform which the customer is using the maximum because of the ease and availability of mobiles. Still in India the computer is not available everywhere and accessibility is not so comfortable as compared to app.

Customers are using the mobile banking app for fund transfer, checking their balance and payment of their services

2. Pupose which they Have used technology In Banking Service

Sr No	Question	Response
1	Transferring fund anywhere in any bank account through NEFT, IMPS, RTGS	54%
2	Payment of bills	75%
3	Recharging DTH, and Data card bills etc.	52%
4	Recharging of Mobiles	53%
5	Utilization for debit and Credit card payments	75%
6	Request for blocking of cards	24%
7	Ticket booking	52%
8	Bank Balance enquiry	76%
9	Recurring Deposit and Fixed Deposit booking	24%
10	Request for New card and cheque book	42%

Services for which digital banking platform has been used more by the customers	Services based on digital platforms which have been very less utilized by the customers
Payment of utility bills, mobile bills	Transferring fund anywhere in any bank account through NEFT, IMPS, RTGS
Credit and debit card payments	DTH, and Data card bills etc.
Account balance enquiry	Recharging of DTH, mobiles etc
	blocking of these cards in case of loss or theft
	Ticket booking
	Recurring Deposit and Fixed Deposit booking
	Cheque book request

3. Challenge they faced using Digital banking

Sr No	Challenge	Response
1	Lack of Awareness	42%
2	Trust	48%
3	Find it complicated	24%

ISSN 2394 - 7780

Important risks posed to the Indian banks by the fintech companies

Today banks are focusing on various avenues to reduce cost and in order to reduce complexities in operations, they are relying on the services of the fintech companies (relying heavily on outsourcing services). Usage of IT platforms are extensive in order to render better customer service, apps and new products involving wide range of data and services.

Banking sector relying on such outsourcing activities offered by the fintech companies are exposed to various security issues including internal control and governance. Thus, addressing risk management mechanism of identifying the mitigating of the critical risks impacting banking operations. Major areas of the risk with such outsourcing activities are payment, clearing and settlement. Banks should devise a strategy to address such risk before they enter into arrangement with fintech companies

Highlights of major risks –

Banks are facing risk of profitability because customers today are finding various schemes and alternatives available at various banks. This has impacted the banking sector due to fintech is providing the plethora of services in a scattered form. Lots of alternatives are available with customers with respect to various products of the banks for almost any banking service: saving, deposit. Personal and commercial loans, electronic transfer of money and so on. This has put pressure on the banks to meet profitability target — new players are able to introduce new and updated technology to deliver the service so as to meet customer expectations and their demand. For example, banks are offering various schemes to switch from saving accounts to FD or investment in mutual funds to provide lucrative return to the customers in short run. As a result, saving in to the banks accounts are mobilized for short term return to the customers.

Second most important risks banks are facing is the risk of outsourcing. These risks are generated outside the periphery of their operations since most of the activities are outsourced to the call centers or back office operations. It becomes very difficult for the banks to monitor the activities carried out at such outsourced centers and thus exposing themselves to various risks (including reputation risks). Control assurance functions need to be strengthened with risk management mechanism to identify and mitigate the risks.

Operational risk is another concern of the banks since there are interdependencies of the banks with other players like banks, fintech etc. This could lead to IT risk exposure of the banks and may create bottleneck in rendering services to the customers when such services are disrupted at other end.

Cloud sourcing' is one of the risk areas where banks share important resources software packages and analytics) in a cost-effective manner. This increases risks of the banks towards cybercrime, data security etc.

7. CONCLUSION: WHAT NEXT……. THE ROAD AHEAD

In one of the surveys conducted all global level India, ranked second in fintech industry with as many as 1218 FinTech firms operating in India thereby opening up job opportunities and creating attraction for investment. India is geared for cash less economy and the pace of technology is shaping up the digital transaction which is no longer is the monopoly of the bank. Non – banking entities are partnering with various banks to offer wide range of services to meet the customer demand. The support from the Government also serving as a boost for the digital economy.

New Technology platform like Aadhar enabled payment system is giving a new look to the retail payment system and has witnessed witnessed about nine-fold increase over the last five years.

To foster financial inclusion numerous initiatives has been taken by RBI to foster growth in the financial services and banking sector.

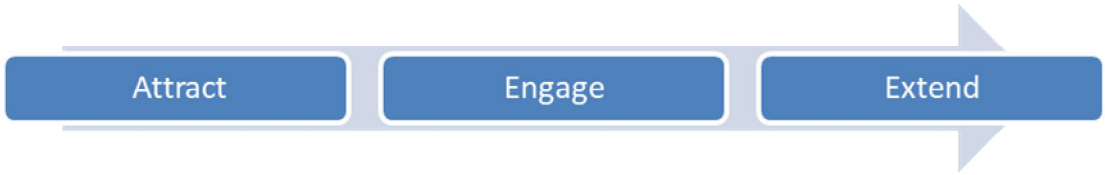
The biggest challenge is the to have a more stringent regulatory framework for the growing fintech companies and to integrate the traditional banking system with the everchanging technology driven platform for them to compete in market with other banks. To mix the two models is a bigger challenge so as not affect the customer service. Over a few decades Banks have built the trust through customer relationships and FinTech startups have just started few years back and they need to be more patient to gain the trust of the customer over the period. Hence partnership between themselves will help to retain their customers. They should come together rather than competing with each other in order to provide effective customer service.

In the coming future banks will become more digital transparency ,25 hours availability and convenience will change the traditional banking players into the innovative fintech players. As the findings of this research paper suggest that there are many challenges a new mindset is required in this direction. Really it will be big tough time for the traditional banks to completely transform in the current fintech based ecosystem.

ISSN 2394 - 7780

The identified prime applications that the customers prefer in digital banking are: 1. Transferring fund anywhere in any bank account through NEFT, IMPS, RTGS. 2. Payment of utility bills, mobile bills, DTH, and Data card bills etc. 3. Recharging of DTH, mobiles etc. 5. Credit and debit card payments as well as blocking of these cards in case of loss or theft. 6. Ticket booking 7. Account balance enquiry 8. Recurring Deposit and Fixed Deposit booking 9. Cheque book request Customers' motivation to adopt digital banking:

The need of in the banking sectors is



Prioritize making core functionality as useful, useable and understandable as possible and identify opportunities to provide advanced functionality as "enablers" that make consumers' daily financial transactions easier, faster and better Extend the experience and integrate tools and services that offer timely and relevant advice and assist customers with day-to-day financial tasks as a critical "next step" in the creation of an engaging and seamless multichannel financial hub that will become an integral part of customers' lives.

Changing dimension of competition, changing customer experience, changing technological advancements are impacting the banking industry in multifold ways than ever before. Artificial intelligence, digital transformation is providing organization access to new customer bases and route to approach new customer in many ways. Banks are now understanding the customer behaviors in better way through artificial intelligence so that they design new and innovative products for their customers which can suit their specific needs.

Banks are using technology in and out to design new products and services. This has changed the operating and process models of the bank. E branches and virtual branches will be emerging future of the banks. today banks are engaging their customers through omni channel touch points. Artificial intelligence, robot advisors, chat box, virtual banks will be the emerging reality and in this even the difference between traditional banks and modern banks have blurred a lot.

Innovation in technology is going to transform the banks and their process in drastic way. With the more and more implementation of Blockchain technology more and more transparency will be there, and integrity will come in all the transactions.

Digital disruption is all-pervasive in the present-day banking industry. The better the banks will become innovator in multifold ways the more opportunities will be there. They will be able to have a competitive advantage in terms of their products and services as said by Poornima Vasudev speed, agility and transparency has become the need for the hour. make it faster, make it agile, make it transparent.

But over and above banks have to keep in mind that in all his transformation customer should be the centricity of this digital transformation journey

Technologies like big data analytics and Artificial intelligence Big data analytics can help extend a single view to the consumer. Companies can use data from social media sites to understand their customers better. In addition to this, data available from pervious online searches and purchases can help target the right individual. key changes that banks need to make in their go-to market approach, starting with shortening their strategy cycles to months instead of years, getting better at reading signals of change in this disruptive environment, and becoming tactically focused on being operationally lean and agile in response to market condition

Initiatives by RBI

Initiatives by the RBI have focused on fostering financial inclusion. This has encouraged competition and innovation in India's growing fintech sector. The initiatives has considered both online and offline solutions to emerge and has created a safer financial system in both urban and rural areas.

Reserve Bank of India*:* The RBI has so far initiated the Unified Payments Interface and the Bharat Bill Payments System, P2P lending, as well as digital payments, and the use of automated algorithms to offer financial advice. RBI has granted licenses to 11 fintech entities to establish payment banks that provide savings, remittance and deposit, services.

Government Schemes*:* Government-led initiatives such as Digital India program, Jan Dhan Yojana, and National Payments Council of India (NPCI) have provided important enabling platforms for technology

ISSN 2394 - 7780

innovators. Other initiatives include removal of surcharges on electronic transactions, tax benefits for consumers and businesses using e-payments, and changes in authentication requirements are other examples of the government's efforts to encourage the growth of a fintech ecosystem in India.

Fintech Startup Sector*:* This is probably the greatest empowering incentive towards the expansion of fintech ventures in India. An encouraging regulatory environment has enabled the launching of more than 125 fintech startups in 2018 alone. As mentioned earlier, several national and international banks and investment groups are also investing in India's fintech startups and funding fintech solutions.

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HARMONY IN MULTICULTURAL ENVIRONMENTS: PROBLEMS AND SOLUTIONS

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ABSTRACT

Technological advances in communication, travel and transportation have made business increasingly global. This has drastically increased cross cultural communication for people at all levels of the organization. It throws certain challenges at employees and makes it imperative for them to understand the cultural nuances to work harmoniously in the organization; creating a more comfortable and productive work place. People living in different countries have developed not only different ways to interpret events; they have different habits, values and ways of relating to one another. These differences pose as primary source of problem when people of different cultures try to communicate. The differences in our frames of reference make the task of communication a tedious one. The two problem areas around which this cross-cultural examination is organized include the problem of English as a second language for Indians and gaping cultural differences in perceptions of ways of behaving. However, the paper also investigates the problem of sub-cultures, for a diverse country like India doesn't comprise a singular monolithic cultural block with values and practices applicable to people of all sub-sects of a given culture. The study aims at understanding some of the principles, problems and implications of intercultural communication.

Keywords: Culture, Communication, Language, Perceptions, Behaviour.

In today's technology enabled world, the need for dexterity in intercultural communication and its importance doesn't require spelling out. In a rapidly shrinking world where people interact in cross-cultural environs on a daily basis, it becomes imperative to have an understanding of intercultural communication and sensitivity towards it. Precious time is lost in resolving problems arising due to cultural differences and many a time important deals go bust for little misunderstandings. For increased productivity, it then becomes imperative to minimize such problems as may arise due to cultural differences. A more homogeneous work place shall be a more harmonious one and better prepared to achieve organizational goals.

The task however, is not a simple one for culture is a much contested term. In fact, according to Raymond Williams, "Culture is one of the two or three most complicated words in the English language" (Storey, 2). Many attempts have been made to define culture but the definition derived from Anthropology shall help us put the concept into perspective: Culture is "a way of life of a group of people …the stereotyped patterns of learning behaviour, which are handed down from one generation to the next through means of language and imitation" (Quoted in Lesikar & Flatley, 454). People living in different countries have developed not only different ways to interpret events; they have different habits, values and ways of relating to one another. These differences pose as a major source of problem when people of different cultures try to communicate. For effective intercultural communication it's important to understand the influence of culture in shaping one's identity as well as of those with whom we wish to communicate. But the problem remains, for it's more difficult to understand the impact of culture on one's own values, attitudes, and behaviour than to recognize the same in others. The complexity however, runs deeper than this. Most diverse countries like India or for that matter any large segment of people do not comprise a singular monolithic cultural block. Within one culture, there are multiple sub-cultures present which too are in a constant state of change/evolution. Many writers view culture as a hierarchy, with a national-level dominant macro culture as an umbrella over many subcultures or co cultures (Chaney & Martin 2007). Even within a sub-culture the townspeople differ from country dwellers, the rich differ from the poor, and the educated differ from the uneducated (Lesikar, 454). Some thinkers go to the extent of classifying culture into categories like Meta-culture, meso-culture, macro- culture, global culture and many more. (Ralf W Wilhelms, Mohammed K Shaki, Cheng-Fu Hsiao). Clearly the concept of culture is a highly complex one and requires mapping.

MAPPING CULTURE

Culture, as we have seen, is an all pervasive entity. It manifests in everything from our way of thinking and believing to our mannerisms and behaviour. The anthropologist Edward Hall (1959) described culture as an unseen but powerful force that holds everyone captive: "Culture is not an exotic notion studied by a group of anthropologists in the South Seas. It is a mould in which we all are cast, and it controls our lives in many unsuspected ways" (quoted by Jameson, 199). Communicating across cultural boundaries is a Herculean task almost equivalent to communicating across species. If we lack a commonality of 'code of understanding' it will become impossible to achieve any degree of intelligibility while communicating with people from different

ISSN 2394 - 7780

cultures. Various researchers at different times have discussed multiple variables of culture that affect communication for instance language, time, space, perceptions, non-verbal cues, behaviour etc. For the purpose of the present study I have categorized all such variables into three broad classes. The next section looks at these 'variables' of intercultural communication moving from the more concrete problem of language to the more abstract manifestations of behaviour and cognitive processes. In closing, I propose ways to bridge the chasm of culture giving suggestions which can further be taken up for empirical research.

LANGUAGE AS A VEHICLE OF CULTURE

Language is bound by and steeped in culture. Sapir-Whorf hypothesis states that, 'the world is perceived differently by members of communities and this perception is transmitted and sustained by language.' Benjamin Lee Whorf (1956), whose work was shaped by that of the great linguist Edwin Sapir, regards language as the primary vehicle of culture. In short, the language we speak influences our experience of the world, while the evolution of language also reflects changes in the predominant modes of expression. (Tubbs and Moss, 86). The problem of understanding arises not always and necessarily because of a failure to understand grammar or vocabulary but because of a failure to understand rhetoric or point of view. In language usage, words often shape perceptions and self-concepts.

The nature of language is inherently symbolic. The words (symbols) and referents (objects in real world) are associated with each other only by convention. This makes it difficult for people to attain efficacy in communicating in a foreign or second language. Many a time, it's difficult to translate thoughts into another language for the want on an exact counterpart in the target language because languages carry with them a certain cultural baggage, that can't be explained in another language. The problem is equally relevant for second language users. English, which has nearly attained the status of the official business language (*lingua franca*) of the world, too has so many varieties and dialects that mastering it with any proficiency as an L2 is an uphill task. Language, over a period of time, comes to be enrobed in distinctly cultural expressions. Many clichés, slang expressions and euphemisms are distinctly cultural in nature, and so are the paralinguistic features which are a *sine qua non* of speech. Let's take an example; certain languages like Hindi have different second person pronouns used variously to show respect or politeness e.g. *'tu' 'tum'* and *'aap'*. English, on the other hand has just one - you. Also, in certain cultures this distinction is not always followed to address people, *'tu'* is used to address people of all age groups. If such differentiation is used across cultures, people might take offence on otherwise an expression of endearment. In Portuguese, for instance, the expression for 'thank you' is dependent upon the gender of the speaker: women say *obrigada* whereas men say *obrigado.* An exchange in the usage may be humorous for the listener and embarrassing for the novice speaker. Therefore language can be both a unifying and a divisive agent of culture. Language is an expression of culture and people often use it as a tool for bonding and establishing kinship even at work. This aggravates the problem of attaining harmony; for in this form, language can be divisive in nature, acting as an agent for catalyzing formation of cliques and groups and limiting interaction among employees of different ethnic backgrounds.

BEHAVIOUR AS EXPRESSION OF CULTURE

Culture is learnt behaviour. Most nuances of behaviour are unwittingly picked-up as a part of learning and growing up. The etiquette, styles and mannerisms and all our non-verbal behaviour are imbibed than learnt. These ways of behaving are profoundly cultural in nature and are generally a greater source of misunderstandings than any other. Non-verbal communication systems vary from culture to culture just as verbal systems do, but often we overlook the symbolic nature of nonverbal communication (Tubbs and Moss, 323). Such lapses in usage of gestures, postures and usage and space and time can lead to serious *faux pas*. For instance, the usual way of greeting for Indians is saying *Namastey* and simultaneously folding hands together. For such people being greeted with a hug and a peck on the cheek can be scandalous and embarrassing. Similarly in many cultures the way of dressing, greeting and behaving with members of the opposite sex vary to show respect and if such manners are not followed, it may be considered disrespectful. For people who work together, understanding each other's expectations and behaving accordingly is a must to maintain work-place harmony and cordiality. Over-stepping the line can be seen as a serious breach of conduct. Most non-verbal cues are often interpreted unconsciously; therefore there are greater chances of giving offence. A fascinating aspect of intercultural communication studies is the distinction between high- and low-context cultures (Hall, 1976). Members of high-context cultures lay greater emphasis on non-verbal cues than words and are better at reading them too. For instance, Indians may seem overly animated to Americans in terms of their usage of gestures and facial expressions. Another dimension along which cultures/behaviours vary is the power-distance. In 1980, Geert Hofstede introduced a national cultural framework based on data collected in two survey rounds between 1967 and 1973 and developed a set of dimensions to characterize the concept of national culture. Power-distance Index and Collectivity are two key dimensions along which cultures differ. Cultures with high-

ISSN 2394 - 7780

power distance like India consider that certain members in the society are more powerful than the others and hence treat them with desired respect. At work-place, Indians, therefore tend not to question their bosses and the bosses expect them to behave accordingly. To an American such behaviour may seem counter-productive to progress and decision making. Underlying such behavioural archetypes are certain cognitive processes that shape an individual's personality and actions.

CULTURE AS A COGNITIVE PROCESS

Culture is a powerful operating force that conditions the way we think and behave (Guffey, 72). An individual is a product of his/her environment. The psyche of a person is shaped by everything that he/she sees and experiences. The biggest impediment to effective intercultural communication is Ethnocentrism. For most individuals, their own culture, their beliefs and value-systems form the yardstick against which they measure behaviours of people from all other cultures. Thus, in most of our interactions our ethnocentric attitude interferes with our perceptions of cultural groups. These attitudes can be deeply divisive and may impede communication between members of different cultures or even sub-cultures. In a country like India, rich in its diversity, it becomes a challenge for people to accept other ways of thinking and behaving and attaining a cosmopolitan outlook. We are all prisoners of our own ideationalities (world-view). The problem is more acute for the people who for most part of their lives have had very little interaction with people from diverse ethnic backgrounds. The adaptability for such individuals is considerably less than those who have had ample exposure to the clichéd 'confluence of cultures'. This is true not only of the culture/sub-culture one belongs to but also of 'work culture'. When people conditioned to work in casual surroundings are placed in work cultures that are more formal and regimented, they may experience culture shock (Guffey, 72). When one's accepted way of thinking, believing and behaving is at war with the ways of those we have to work with, harmony is elusive. So culture as a world-view, the reality that one lives by, the cognitive processes of making sense of out surroundings and people around us, can pose as the greatest threat to intercultural communication, inter-personal cordiality and a harmonious co-existence.

BRIDGING THE CULTURAL CHASM

The world as one global village is now a reality we operate in. National and even local businesses find that their markets frequently extend across borders. To be a success in such an environment, it's important for people and companies to adapt to other cultures, understand them, and modify their own behaviour and strategies to maximize benefits. The importance of communicative competence is evident from the recruiter's list which puts communication skills at near the top of essential qualities sought after in prospective employees. There shall very soon be a time when ability to communicate in multi-ethnic contexts shall be the norm. Channelizing its communication smoothly is the goal for every organization to increase productivity, for they say that an organization is as good as the communication therein.

Taking active initiatives towards achieving harmony at the work place is the way forward to progress. Helping to create tolerance, empathy and cultural sensitivity among co-workers would minimize the frustration resulting from missed signals, muddled messages and miscommunication. What can be promoted is controlled or monitored meta-communication between employees from different backgrounds. Meta-communication (Tubbs and Moss) is communicating with the other party about the style of one's communication. Most problems occur when there's no one to help correct you or point you towards the right direction. Problems arising from language usage and behaviour can be best addressed by discussion and explanation. Yuan (1997) argues that "intercultural communication theories should be interaction based, emphasizing how individuals communicate, not how cultures communicate."

One very basic move can be to provide 'cultural training' to the employees where there are a large number of people from diverse cultural backgrounds working under one roof. The employees can be trained in understanding and adhering to the larger organizational culture. Uniformity in behaviour and expectations can take care of the day-to-day mundane problems of intercultural communication. The objective is not to culturally homogenize the work-force, for it shall be counter-productive in nature since the reason why diversity is desired at work in the first place is to have multiple perspectives, leading to better results; but to iron out the superficial oddities arising due to differences in points of view. Multiethnic work-force is a double edged sword for it may help the organisation reap the dividends of diversity but at the same time may also act as a divisive force, for there are countless differences in culture and an organizational, multi-ethnic utopia, an elusive dream and a chasm so deep that evades bridging. But what's important is that we recognize the existence of cultural differences, that we look for them, that we understand them and keep working at ways to resolve them.

ISSN 2394 - 7780

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ROLE OF HR IN TALENT MANAGEMENT FOR BUILDING FUTURE ORGANIZATIONAL COMPETENCE

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ABSTRACT
Over the period of time the business environment has also evolved creating higher demand for skilled and knowledgeable employee, hence arises the requirement for high performing, high potential knowledge workers so as to achieve organizational objective in this global setup. HRM earlier focused on traditional activities of employee entry to exit and being a rigid Center of Investment less focused on Return on Investment. The situation has to evolve into an responsive Talent Management, which focuses on developing talent for future organizational leadership and competency, hence building sustainable competitive advantage. The biggest challenge faced is evolving from being cost center to being a profit center. This further redefining role of HRM in to developing model of Organizational competency management, organizational performance management and organizational leadership development understanding the future developments in the business environment. The technological development has added further to the challenges and difficulties faced. Anticipating changes and the evolution required a planned move accordingly is a key to maintain the sustainable competitive advantage. To match the pace of the globalization and the challenges posed by international companies Indian organizations will have to be creative and innovative in order to retain and attract talent, it is imperative for business organization to adapt to similar or better strategies so as to survive or beat the competition.

The research paper is supposed to understand the current talent management practices and challenges faced in the process. Also brings out role of HR in Talent Management and suggests ways to develop a strong process of Talent Management.

Keyword: Talent Management, Sustained Competitive advantage, Human resource Management

INTRODUCTION
Globalization, Technological change, Increased Competition has been posing challenge to organizations globally; Indian Organizations are also facing similar challenges. These challenges have induced the organizations to change their way of functioning. There has been continuous development in the functioning of the Organization. Every organization wants to distinguish itself from the competitor to sustain in this dynamic environment. One of the way by which an organization can make the difference through its Human resource which is unique in every organization and essential element for sustained organization growth and development. Due to which as expected, researches on **talent management** has been fast gaining its due importance at corporate level because of its strategic relevance in achievement of organizational strategic objectives.

The rapidly changing business environment and continuing insights into organizational value, organizations are thinking acutely on how organizations can realize their plan. Once the goals and objectives are defined by the organization the necessary system needs to be in place. To accomplish the set objective there has to be disciplined approach for successful implementation of strategies framed. At the same time organizations have also to cope with the changes occurring in the business environment. To withstand the above challenges organizations need to Attract, Retain and Manage talent in the organization, so as to execute plans and strategies.

HRM from its early days have been principally focused upon Recruitment, Training and Development, Employee Relations, Compensations and Benefits and Compliance. The changing business environment and perception of conviction in people competence being materialistic in achieving organization goal and objective is realized. This increases the importance of HRM to develop **future leadership and organizational competence** and actively participate in strategic framework formulation and implementation as a strategic business partner.

REVIEW OF LITERATURE
All the Organizations given from any industry present similar structure, resources, operate in similar environment, the only thing that differs is Human factor, which is integral part of every organization system and they are unique as they create value for self and organization. Human resource follows rules & regulation and policies & procedures set by organization but their actions and behaviors are governed by the policies and practices. Organizational and HRM practices are elemental to raise the motivation among the employees.

ISSN 2394 - 7780

The global business environment experiencing an era of great transformation. Organizations are racing to accelerate growth in the competitive and rapidly changing world of work. These organizations face new risk of out-dated business models, traditional organizational structures and uninspired people practices that are standing in the way of successfully executing business strategies. The globalization has produced a wave of new practices in HRM which no organization can afford to ignore. It is also apparent that most of the organizations have already moved ahead and initiated the changes only others to follow **(Budhwar & Debrah 2004).** The global competition has given rise in the need for organization to thrive and grow focus on number of factors of which mastering the change, developing an apt organizational culture and internal environment in order to foster desired result (**Barry A. Friedman 2007**). It was also observed that failure to plan and implement these change strategies, resulting high turnover especially of valuable employees (**Carolyn Kristjanson Love 2000**).

To survive this competitive business environment organizations need creative and innovative skilled employees hence talented employees are the asset to the organization and should be treated appropriately **(James M.J, 2011).**

The organizations will have to be creative and innovative in framing and implementing HR strategies. Innovative HRM practices provide a sustainable competitive advantage depending on how creatively and effectively they are interpreted and executed **(Som Ashok 2007).** The organization can achieve advantage through human resources only. It is the people who can provide the competitive edge which is the reason that Human resources systems have become crucial in conduct of business operations **(Umesh R 2011).** Organization has to understand that mutually with the employees it can be competitive. They have to create an environment where individual commits self for the organization and organization in turn responds positively to such commitment. If an employee feels otherwise it may not yield positive results and organization may end up losing the talent. **(Myszak 2010).** The field of human resource management is likely to face challenges in establishing direct relationship between the human resource policies and practices which is able to attract, retain and nurture talent. **(Kaufman 2007).** They can ensure development of talent which creates value to the organization from each individual. The asset created by organization in form of the talent force will be unique and difficult to imitate. **(Brayan and joyce, 2007).**

The **McKinsey article** ***War for talent 1998, part 2 2001 and*** **quarterly 2007**, have been instrumental in drawing attention on talent management especially among consultants, academics and professional bodies. Lack of potential leaders is the most pressing human resource challenge organizations expect to face. In a research conducted the problems faced by most of the organization were related to lack of high-potential leadership, shortage of talent at all levels **(Right Management 2012, Manpower group 2013).** One of the clear changes due to recession is that many managers will be faced with having to manage in a tough situation, something of which they may not have any experience. There is the need for change management skills and authentic leadership **(David Birchall, Nick Holley and Benjamin Reid 2008).** The organization will have to find people who are right fit in the organization or it may have adverse effect on the performance. Hence for organization to retain and attract talent in the organization will have to be the first choice. (**Deepali Bhatnagar and Durgesh Batra 2006)**. Solving talent issue is not an impossible task. But it requires an integrated, strategic approach to talent management, form planning and sourcing to training and development and retention. Insightful, integrated talent management practices can not only help an organization overcome shortage of talent, but also deliver financial results that will win the approval of all the stakeholders (**Infosys 2007**). This further brings forth the leadership role in creating value and trust among the human resource and develops a committed employee asset to sustain in the long run (**Jack W. Wiley 2009**).

TALENT MANAGEMENT EXPLAINED

Vaiman, V., Scullion, H., & Collings, D. (2012) defined Talent Management as a organizational process that systematically identifies positions which are critical for their success and sustainable competitive advantage. It is the process of measuring contribution of individuals which is not imitable by the competitors. The study has emphasized on identification of key positions in the organization and individuals fit for the position as important aspect of strategic talent management system. The view is supported by **Nilsson, S., & Ellström, P. E. (2012),** as talent management is the process of identifying potential, acquiring and maintaining talent which is pivotal for the organizational long term strategy. In a study by **Al Ariss, A., Cascio, W. F., & Paauwe, J. (2014)** have focused on global talent management where talent i.e. means to organizational productivity could be acquired from any part of the world.

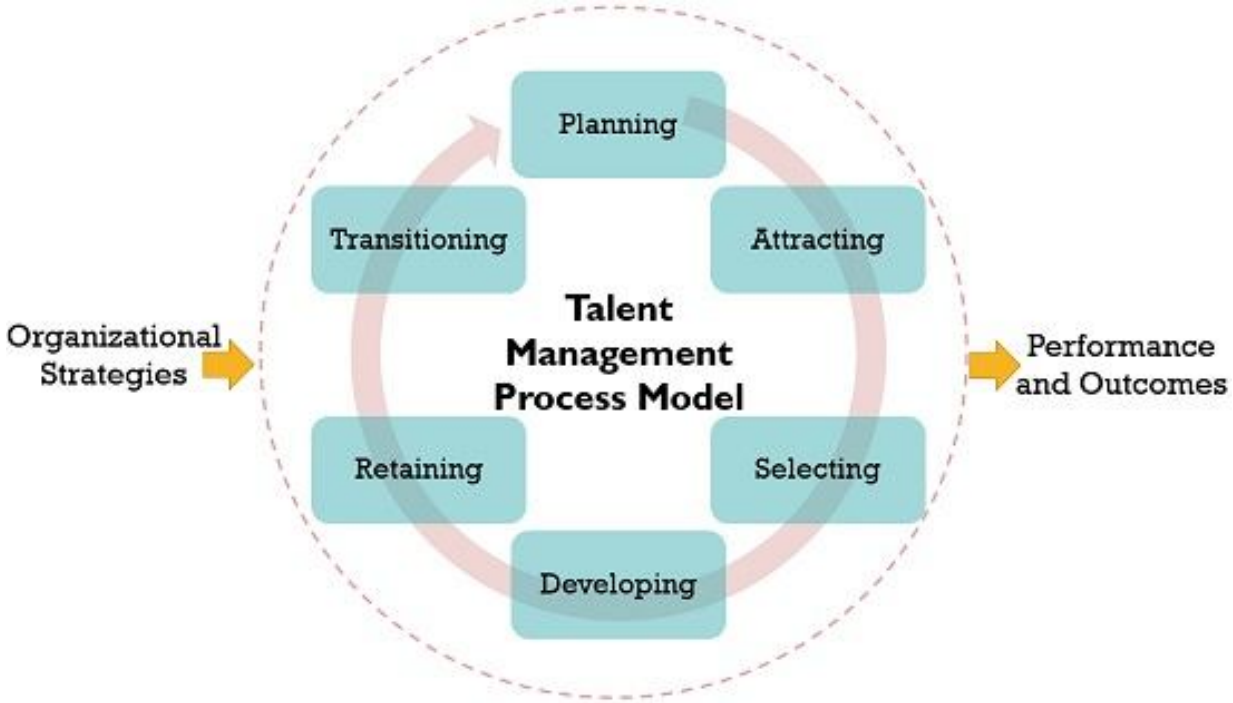
The organizations should have clear objectives set out and well articulated for successful implementation of talent management strategy. **Bethke-Langenegger, P., Mahler, P., & Staffelbach, B. (2011)** In their research found that talent management strategies focusing sucession planning only may not yield organizational

ISSN 2394 - 7780

performance in short term, as it is a futuristic strategy of the organization and a traditional view of HR operation. The study also revealed that strategies focused on attraction and retention of productive employees as a more effective strategy with better outcome and value addition by HR to the organization. Organization HR policies and practices focusing on employee needs and meeting their expectations important for sustained competitive advantage.

TALENT MANAGEMENT PROCESS

Talent management refers to the anticipation of required human capital for an organization and the planning to meet those needs. Talent management is the science of using strategic HR to improve business value and to make it possible for companies and organizations to reach their goals. Everything done to recruit, retain, develop, reward and make people perform forms a part of talent management as well as strategic workforce planning. A talent-management strategy needs to link to business strategy to make sense (**Vijay kumar Thota 2013**). **Reilly (2008)** has rightly stated that the key to effective talent management is the alignment of Talent management philosophy with the organization-employee psychological contract. This can be materialized only when the goals of talent management strategy are clear to the organization, so that they act as torchbearers. Talent management requires both systems and an organizational commitment to attract, acquire, manage, and measure the talent needed to achieve a company's business objectives. If business and talent management systems are not aligned with processes, companies not only fail to maximize their benefits, they also put their goals at risk (**Oracle White Paper, 2012**). The impact of talent management strategies has remarkable effects on human resource perceived outcomes especially on output, efficiency and productivity of organization and employees. Profitability increases automatically whenever the employees are willing to serve with a clear vision, ideology and long term sustainability approach with their parent organization(**Hanif* and Yunfei 2013)**.



Source: https://businessjargons.com/talent-management.html

CHALLENGES FACED IN MANAGING TALENT ARE AS FOLLOWING

In their study Thunnissen, M., Boselie, P., & Fruytier, B. (2013) disclose major challenge faced by talent management as per literature is putting Talent Management process to operation and achieving desired outcome. Following are the challenges faced implementing talent management process:

- Perceiving talent requirement and developing strategies to optimize talent acquisition and utilization.
- Organize and directing talent towards organizational objective
- Developing process to identify key talent and their retention
- Developing high level of employee engagement
- Developing employee motivation and commitment in organizational objective
- Developing and optimizing organizational policies and practices to match the globalized standards.

ISSN 2394 - 7780

HOW HR CAN CONTRIBUTE

HRM can demonstrate its standards by maintaining and managing knowledge and knowledge workers of the organization i.e. talent management. Talent management refers to managing knowledge skills and ability of the employee by understanding the competencies held. Talent management is an ever going concept it continues to explore current competencies within the organization, and also strives to find gaps and areas of development. It tries to acquire the essential competencies so as not to compromise with the desired organization performance. Talent is considered to be the most important factor in an organization and a critical resource to achieve organizational objectives hence with growing competition; it is a never ending struggle for an organization to get right talent so as to keep the unique sustainable competitive advantage.

Following are the ways HR can promote talent management practices.

- By recruiting right candidate at right time for right position.
- By assessment of organizational competencies and cultivating them for higher results.
- Taming and aligning talent according to organization strategy and organizational culture so as to make right fitment.
- Finding talent management process gaps and taking corrective measures.
- Talent management is not short term it is with future of organization in mind.
- Accurate and fair performance evaluation.
- Anticipate, Plan and adapt to the changing business environment
- Engage employees and maintain employee relations
- Develop retention strategies

PROPOSED TALENT MANAGEMENT MODEL

<table>
<tr><td colspan="4">Organizational Environment (Articulation of Vision/ Mission)</td></tr>
<tr><td rowspan="6">Talent Attraction</td><td colspan="2">Talent Maintenance</td><td rowspan="6">Talent Retention</td></tr>
<tr><td>Organizational culture (Building organizational trust and commitment)</td><td>Employee management policy</td></tr>
<tr><td colspan="2">Performance Management policy</td></tr>
<tr><td>Performance barriers</td><td>Effective performance need</td></tr>
<tr><td colspan="2">Human resource development Policy</td></tr>
<tr><td colspan="2">Organizational performance</td></tr>
</table>

CONCLUSION

Talent management is a strategy to create a sustainable competitive advantage for the organizations applying it. It's time for a fundamentally new approach to talent management that takes into account the great uncertainty businesses face today. Fortunately, companies already have such a model, one that has been well honed over decades to anticipate and meet demand in uncertain environments—supply chain management Cappelli, P. (2008). Organizations need to have robust processes in terms of Management support, career development and compensation and rewards strategy which engage employees in effective and efficient manner **Alias, N. E., Noor, N., & Hassan, R. (2014).**

- Top management active support: Organization management should take interest in developing talent management strategies. There is investment required for such activity, without management support and vision for future Talent management practices could not be developed.
- Lay down comprehensive expectations: Firstly top brass of the organization will have to understand the objectives and goals clearly and the same have to be framed and articulated to every one part of the organization. Each and every individual resource should know what, when and how to contribute. There has to be clear goal alignment to have long term association with employees to make for meaningful contribution.
- Invest in technology: For an organization to be competitive now and in future use of technology is very important. As per today's business environment and immeasurable possibilities it is very important to have a

ISSN 2394 - 7780

robust technology support. Organizations around the world are developing or buying technology which cuts down routine jobs and helps more focus on important matters at all levels in the organization.

- Develop organizational capability: Organizations should understand it is not just about buying technology but by developing skills and capabilities organizations can leverage technological advantage. Continuous effort is to be made to develop organizational capability critical for achieving objectives and finding gaps to avoid any obstacle in future.
- Manage and monitor performance: Organizations should manage and monitor performance habitually and systematically. Avoiding all biases accurate and fair assessment of performance management is necessary for keeping the resources motivated. Many organizations have made it in to a annual, biannual or quarterly phenomenon while it should be rigorously pursued and followed up with meaningful feedback as it is one main reason for employee resource disconnect with organization and develop intention to leave organization.
- Develop talent pool: Organizations should make an effort to develop apt talent pool to satisfy not just current requirements but keeping in mind their future requirements. If organizations lack future vision they cannot employees to align and keep short term objectives with the organizations

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AN INVESTIGATION OF COMPUTER ATTITUDE OF SECONDARY SCHOOL TEACHERS IN RELATION TO GENDER, EXPERIENCE AND EDUCATIONAL QUALIFICATIONS

Niraj Dilip Sharma

INTRODUCTION

Computer is the outcome of technological innovation. A technological innovation has become a common place phenomenon and is frequently taken for granted by contemporary society. A computer is a general purpose device that can be programmed to carry out a finite set of arithmetic or logical operations only. A computer is a general- purpose machine for storing and manipulating information. Attitudes are of chief importance not only for person‟s character formation but for his mental health and achievement as normal. Like other aspect of personality, attitudes are acquired, not innate. The success of any initiatives to implement technology in an educational program depends strongly upon the support and attitudes of teachers involved. It has been suggested that if teachers believed or perceived proposed computer programs as fulfilling neither their own or their students‟ needs, they are not likely to attempt to introduce technology into their teaching and learning.

NEED AND JUSTIFICATION OF THE STUDY

As computers are becoming very important part of human life therefore it becomes obvious that how the field of education could be untouched. Computer education is now a compulsory part in the syllabus at every level of education. The National Policy on Education (NPE), 1986, has provided for environment awareness, science and technology education to include in the syllabus for secondary education. Though the teacher is an integral part of teaching-learning process, so teachers‟ attitude towards computer becomes more important. Ultimately it is the teacher who will teach the class. If teacher has positive attitude towards use of computer in education then he will feel comfortable and interested in the use of computers in education.

STATEMENT OF THE PROBLEM

While studying the present study the investigator decided to investigate the computer attitude of secondary school teachers in relation to gender, experience and educational qualifications. Consequently, the study might be stated as **“An investigation of Computer Attitude of Secondary School Teachers in Relation to Gender, Experience and Educational Qualifications”**

OBJECTIVES OF THE STUDY

Following are the objectives of the study:

1. To study the attitude towards computer of the secondary school teachers.
2. To study the attitude towards computer of the secondary school teachers with respect to gender.
3. To study the attitude towards computer of the secondary school teachers with respect to experience.
4. To study the attitude towards computer of the secondary school teachers with respect to educational qualifications.

HYPOTHESES OF THE STUDY

In order to achieve the above objectives following hypotheses have been formulated. There were flowing hypotheses in the study.

1. There is significant difference in computer attitude of secondary school teachers with respect to gender.
2. There is significant difference in computer attitude of government secondary school teachers with respect to gender.
3. There is significant difference in computer attitude of aided secondary school teachers with respect to gender.
4. There is significant difference in computer attitude of private secondary school teachers with respect to gender.
5. There is significant difference in computer attitude of secondary school teachers with respect to experience.
6. There is significant difference in computer attitude of government secondary school teachers with respect to experience.
7. There is significant difference in computer attitude of aided secondary school teachers with respect to experience.

ISSN 2394 - 7780

8. There is significant difference in computer attitude of private secondary school teachers with respect to experience.
9. There is significant difference in computer attitude of secondary school teachers between highly experienced male and less experienced male.
10. There is significant difference in computer attitude of secondary school teachers between highly experienced female and less experienced female.
11. There is significant difference in computer attitude of secondary school teachers with respect to educational qualifications.
12. There is significant difference in computer attitude of government secondary school teachers with respect to educational qualifications.
13. There is significant difference in computer attitude of aided secondary school teachers with respect to educational qualifications.
14. There is significant difference in computer attitude of private secondary school teachers with respect to educational qualifications.
15. There is significant difference in computer attitude of secondary school teachers between doctorate male and graduate male.
16. There is significant difference in computer attitude of secondary school teachers between doctorate female and graduate female.
17. There is significant difference in computer attitude of secondary school teachers between graduate with less experience and graduate with high experience.
18. There is significant difference in computer attitude of secondary school teachers between doctorate with less experience and doctorate with high experience.

DELIMITATIONS OF THE STUDY

The study was limited to:

I. The study is delimited to teachers teaching from grade nine to twelve.

II. The study is delimited to secondary school teachers of Lucknow Division only. Lucknow Division comprised of six districts namely Sitapur, Raibareli, Unnao, Hardoi, Lakhimpur Kheeri and Lucknow.

METHODOLOGY

The present piece of work is a type of descriptive research using quantitative approach. In which survey method of research has been used.

RESEARCH DESIGN

In the present study the simple normative survey has been used. The survey method collects data from a somewhat large number of cases at a specific time. It deals with the generalized statistics that result when data are distracted from a number of individual cases. It is basically cross-sectional.

POPULATION

All the secondary school teachers of Lucknow Division constituted the population of the study. The investigator has taken six districts from Lucknow Division which is as follow: - Sitapur, Raibareli, Unnao, Hardoi, Lakhimpur Kheeri and Lucknow.

SAMPLE OF THE STUDY

In the present study the strata of the population is based upon the type of schools and gender of the secondary school teachers, yielding six types of strata-Male teachers from Government secondary schools, Female teachers from Government secondary schools, Male teachers from Aided Secondary Schools, Female teachers from Aided Secondary Schools and Male teachers from Private Secondary Schools, Female teachers from Private Secondary Schools.

ISSN 2394 - 7780

Table

Sr. No.	Name Of The Districts	Govt. Sec. Schools		Aided Sec. Schools		Pvt. Sec. Schools				
		No. Of Teachers Administered And Responses Found		No. Of Teachers Administered And Responses Found		No. Of Teachers Administered And Responses Found		**Total**		**Grand Total**
		Male	Female	Male	Female	Male	Female	Male	Female	
1.	Hardoi	14	15	14	14	14	14	**42**	**43**	**85**
2.	Lakhimpur	13	14	14	14	14	15	**41**	**43**	**84**
3.	Lucknow	14	13	14	14	15	14	**43**	**41**	**84**
4.	Raibareilli	14	14	13	15	14	14	**41**	**43**	**84**
5.	Sitapur	13	15	14	13	14	13	**41**	**41**	**82**
6.	Unnao	14	14	14	14	14	14	**42**	**42**	**84**
Total		**82**	**85**	**83**	**84**	**85**	**84**	**250**	**253**	**503**

STRUCTURE OF SAMPLE

Table shows that teachers from government secondary schools including 82 male and 85 female teachers were selected. From aided secondary schools including 83 male and 84 female teachers were selected. Likewise, from private secondary schools including 85 male and 84 female teachers were selected. In all, there were 250 male and 253 female secondary school teachers, thus 503 teachers in all. Table further indicates that for the Hardoi district 85 secondary school teachers including 42 male and 43 female teachers were selected. For the Lakhimpur- Kheri district 84 secondary school teachers including 41 male 43 female teachers were selected. For the Lucknow district 84 secondary school teachers including 43 male 41 female teachers were selected. For the Raibareili district 84 secondary school teachers including 41 male 43 female teachers were selected. For the Sitapur district 82 secondary school teachers including 41 male 41 female teachers were selected. For the Unnao district 84 secondary school teachers including 42 male 42 female teachers were selected.

VARIABLES IN THE STUDY

Following are the dependent and independent variables taken in the present Study:

Independent variable- Gender, Experience and Educational Qualifications Dependent Variables- Computer attitude

TOOL OF THE STUDY

In the absence of any standard attitude scale the investigator has developed an attitude scale namely **"Computer Attitude Scale for Secondary School Teachers."**

ANALYSIS OF THE DATA

Quantitative analysis was done on the basis of responses received from the secondary school teachers on the Computer Attitude Scale for Secondary School Teachers. T- Test was used to analyse the data regarding the responses of teachers. To calculate„t" the investigator calculated mean and standard deviation.

FINDINGS OF THE STUDY

The study was conducted to investigate the computer attitude of the secondary school teachers in relation to gender, experience and educational qualifications. The findings of the present investigation have presented here according to the hypotheses.

1. Both male and female secondary school teachers have moderately positive attitude towards computer.
2. Both male and female secondary school teachers seemed to have moderately positive attitude towards computer.
3. Both male and female secondary school teachers seemed to have moderately positive attitude towards computer.
4. Both male and female secondary school teachers seemed to have moderately positive attitude towards computer.
5. Highly experienced secondary school teachers seemed to have slightly positive computer attitude and less experienced secondary school teachers seemed to reflect highly positive attitude towards computer.
6. Highly experienced secondary school teachers have slightly positive computer attitude and less

ISSN 2394 - 7780

experienced secondary school teachers reflects highly positive attitude towards computer.

7. Highly experienced secondary school teachers have moderately positive computer attitude and less experienced secondary school teachers reflects highly positive attitude towards computer.
8. Highly experienced secondary school teachers have moderately positive computer attitude and less experienced secondary school teachers reflects highly positive attitude towards computer.
9. Highly experienced male teachers of secondary schools have slightly positive computer attitude whereas less experienced male teachers of secondary schools reflects highly positive computer attitude.
10. Highly experienced female teachers of secondary schools have moderately positive computer attitude whereas less experienced female teachers of secondary schools reflects highly positive computer attitude.
11. All the groups of educational qualifications reflects moderately positive attitude towards computer.
12. Doctorate teachers reflects highly positive attitude towards the computer.
13. All the groups reflects moderately positive attitude towards computer.
14. Post-Graduate secondary school teachers have moderately positive computer attitude on the other hand doctorate secondary school teachers have highly positive computer attitude.
15. Both the group of secondary school teachers reflects moderately positive computer attitude.
16. Post-graduates with less experience secondary school teachers have highly positive computer attitude on the other hand post-graduates with high experience secondary school teachers have slightly positive computer attitude.
17. Doctorate with less experience secondary school teachers have highly positive computer attitude on the other hand doctorate with high experience secondary school teachers have moderately positive computer attitude.

LIMITATION OF THE STUDY

The limitations of the study are as follows:

i. This study did not classified urban and rural schools of the Lucknow Division.

ii. The conclusions of the study can only be generalized for Lucknow Division.

EDUCATIONAL IMPLICATIONS OF THE STUDY

The present study has attempted to study the computer attitude of secondary school teachers in relation to gender experience and educational qualifications. A few decade earlier, major attention was paid towards the understanding of teachers. But now-a-days the situation has changed considerably. Now student is the centre of the educational process. Therefore, lacks of the attention to the studies related to the teachers are being undertaken. The educationists and psychologists have now pointed out that the study of teachers is also very important, otherwise the attempt to educate students well may fail miserably which will in turn not be conducive towards the proper development of the computer education also. The present study is a humble attempt towards the upliftment of the status of the secondary education. However, a number of implications are drawn from the analysis, comparisons and findings of the present investigative study.

This study will be helpful in investigating the computer attitude of secondary school teachers in relation to gender, experience and educational qualifications. Findings of the present study report that the ideal method for developing teachers‟ positive attitude for computer use would be to provide them with training and support to work successfully with computers. If anxiety is reduced and self- efficacy level is increased, teachers will be benefitted from their computer training and subsequently can be expected to increase their commitment to and use of computers in education. So, teachers must be trained effectively about the use of computer, which will be fruitful in their professional life. The results also showed that simply introducing computer technology resources does not guarantee teachers‟ use of these in practice. The provision of training is seen as a key factor in both changing attitudes and encouraging teachers in incorporating technology into their instruction.

Handler (1993) found that attitude towards computer usage were becoming more favourable as computers became more available in schools and colleges. Computer availability in the secondary schools is of utmost importance, without which no secondary school teacher can be able to increase his/her level of computer attitude. The governing bodies of secondary schools may monitor the computer facilities of the schools. To develop strongly positive computer attitude, teachers need to be introduced to computer technologies

ISSN 2394 - 7780

systematically and be engaged in activities that will provide them with positive experiences with regard to computer use. For this in- service training engaging teachers in computers may be helpful. Information and communication technology must be integrated into secondary education programme. Thus, secondary school teachers are expected to possess both skills in the use of computer technologies and positive belief in their capacity to integrate them into their teaching.

Clearly the results of this study have implications for both education and teaching, as Post-Graduate as for further research. Given the shift in attitudes by females from negative to positive, educators should recognize that females, as Post-Graduate as males, are suited for a full range of technology courses. Because females have a similar regard for the contribution of technology to productivity improvement and are comfortable with technology as men, they should be encouraged to pursue technology in teaching. In employment situations, managers should be encouraged to use both males and females teachers for technology assignments and teachers training activities. Their positive attitudes and comfort levels with technology may make women especially adept at creative applications of technology.

The findings of the study will further help the organizations, policy makers or managers to understand their teachers‟ computer attitude individually as well as collectively. This will enable them to modify or change their approach in dealing with teachers in the implementation of any computer program or in preparing the dimensions of any in-service training.

The tool “Computer Attitude Scale for Secondary School Teachers” constructed during the course of this study will be of immense use to educational purposes and research workers.

Inclusion of different ages or experience levels would be insightful. Replication in the work education world may be particularly helpful in determining whether biases exist because of perceptions about gender and the use of technology.

Thus, the findings of the present study will help governments, managers and social workers towards the understanding of the teachers‟ computer attitude which in turn will reduce difficulties of the implementation of the computer education at secondary level. Thus a forward looking and well balanced computer educational program may be developed for the secondary level.

SUGGESTIONS

Suggestions for Teachers

The following are the suggestions for teachers:

1. Teachers‟ interest towards computer may be developed through a relevant computer course.
2. Teachers may be encouraged to pursue any pre-service or in- service computer course.

Suggestions for Policy Makers

The following are the suggestions for policy makers:

1. Good infrastructure, like electricity supply, a techno-savy teacher, some computer sets may be provided for computer education. Infrastructure for computer education should be made stronger.
2. A proper computer course may be provided to all government, aided or private secondary school teachers.
3. More finance may be provided for computer education. More focus may be given to the computer education in the educational budget.
4. Continuous monitoring must be done to make sure that certified or trained teachers are teaching at school.
5. A good in-service and pre-service computer training program may be useful for the secondary school teachers.
6. Policy makers may be careful to provide at least one computer in each school.

Suggestions for Further Studies

The following are suggestions for further research:

1. This study was confined only to the Lucknow Division. Therefore, the study cannot claim to have comprehensiveness and its findings may not be universally applicable. It is, therefore, necessary to cross validate the reported results from other parts of the state and country.
2. The present study has been conducted on 503 secondary school teachers only. Therefore, it is suggested that

ISSN 2394 - 7780

this study may be conducted on a larger sample from the similar population somewhere else.

3. In the present study "Computer Attitude Scale for Secondary School Teachers" with 47 statements in three different areas, viz., items containing positive and negative statements about the value of computer technology, the impact of computer technology on teachers and teachers‟ comfort level with computer technology have been used. However, an attitude scale with more areas and items may also be constructed and used for the purpose.
4. Further researches on the computer attitude at different levels can also be conducted.

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AN EVENT STUDY ANALYSIS OF TWO DIFFERENT MERGERS AND ACQUISITIONS DONE BY TATA GROUP

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ABSTRACT
The following study puts forth the result of mergers & acquisition stock prices of Tata Chemicals & Tata Communication. It is going to inspect the wealth gains of Tata Communication that acquired British Salt and BT communication in December 2010 and January 2010 respectively. This study is about examining shareholder's wealth of Tata Chemicals &Tata Communication as a result of global merger and for doing so we are going to use the event study methodology (Brown and Warner, 1980&1985; and McKinley, 1997). We'll find that foreign mergers experience positive and remarkable progressive unusual returns of nearly nine percent and five percent over days when they acquire target in UK.

Using the single factor model, the study gives the average cumulative abnormal returns (commonly known as CAR) of the Tata Chemicals and Tata Communication are progressive but the statistical results calculated aren't significant. This bidder company created wealth of Rs.33.73 million and Rs.3.60 million in a day solely as a result of merger. The aim of this study is to understand the shareholder wealth effects of merger.

Keywords: Merger & Acquisition, Event Study

INTRODUCTION
Mergers and Acquisition may be referred to as high risk bearing business activity that together involves investment of million rupees and also affecting the work life of so many employees working there and stakeholder's wealth. However, it has been demonstrated that in the long term almost 50-80% of the mergers expect to fail. Although M&A seldom fails to obtain financial synergy i.e.to attain greater output on working together than on obtaining when working separately yet the popularity of this form of business has not yet diminished (Farrent 1970, Jemison and Sitkin, 1986; Brucman and Peters, 1987).

The "Event-Study Methodology "is used to evaluate the specific impacts of decisions on various shareholder wealth. This technique is used in practice to evaluate the alteration shareholder wealth via announcing some corporate events like security offerings, mergers etc. This technique is framed to audit the effect of an event on specific dependent variables. One of such is the stock price of the company. It tries to determine whether or not the abnormal stock price affects the corresponding event. From this, appropriate inference can be drawn. With the key assumption of proficient market, immediate or short term effects could be observed on the stock prices of the firm.

*E*vent Study Analysis
The events that affect a firm's evaluation can be-

1. Within the firm's supremacy such as a split in firm's stock.
2. Outside the firm's control such as macroeconomic variables that shall affect the future firm's operations in some way.

Event Study Design
The time line for a typical event study has been shown below with following details:

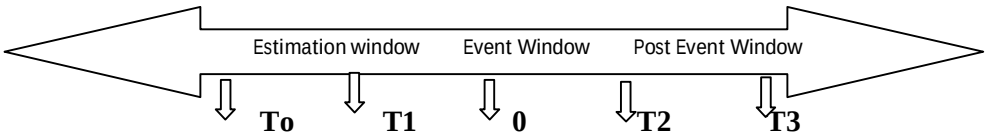
a) The interval T0-T1 is the estimation period.

b) The interval T1-T2 is the event window.

c) Time 0 is the event date on the calendar time.

d) The interval T2-T3 is the post-event period.

e) There is often a gap between estimation and event window.



ISSN 2394 - 7780

For evaluation we first need to decide on the events that we wish to see through and then accumulate information and data of that firm that has once gone through such an event. We need to gather the stock prices of that firm before and after the event. The data that we need includes the merger date (e.g. date of a merger and acquisition event), the stock prices of the company before and after the event (e.g. -140 (**To - T1**), -10 (**T1 - 0**), **0 (**Event day), +10 (**0 - T2**)).

Getting Parameter Estimates

The two determinants of the estimation period for evaluation are Alpha & Beta. Alpha is the intercept of regression line and stands for risk free rate whereas Beta is the slope coefficient of the regression line and stands for systematic risk. The formula enumerates the daily return of market index in estimation period and the average daily return of market index in estimation period. Similarly, is the daily return of individual share price in estimation period and the average daily return of the individual share price in estimation period.

Getting the Abnormal Returns

Now after evaluating alpha and beta values, the focus should lay on event period in which the daily expected return of individual share price can be obtained by replacing the estimation determinant to event period. The formula is shown in the following figure.

$E(R_s)= \alpha + \beta R_m$

Similarly, the daily expected return of individual share price can be calculated by replacing alpha and beta from estimation period here. Then the daily abnormal return in test period can be calculated by applying the following equation. Please see the equation below:

$AR_s = R_s – E(R_s)$

(Daily actual return in test period-daily expected return in test period) = Daily abnormal return of individual share price in test period. After this the cumulative abnormal return in test period and average abnormal return in test period can be calculated based on daily abnormal return in test period. The above mentioned results lead to positive and negative effect on value of the company.

Steps of Event Study

1. Find the suitable calendar event dates of a company and then set it as an event date period.
2. Estimate both the length of estimation and event date period.
3. Gather the historic information files of both share price and stock market index data. It is essential for the data files to have the calendar dates of both estimation period and event period.
4. Now one has to calculate the daily returns of both individual share price and market index data. These are the actual returns.
5. Now calculate the values of alpha and beta by using the return generating model of the data from the estimation period.
6. Now get back to the event period and using the above parameters determine the average abnormal return in event period.
7. Do not forget to carry out significant test for the authenticity of the required result.

Company Profile (1)

Tata Chemical Ltd. Is a global company that primarily focuses on the essentials of LIFE-Living, Industry, Farm Essential? The story of this company is not an ordinary one rather about prospering and achieving the goals that go much beyond business. The journey began in Mithapur, Gujarat in western India in order to raise wealth of marine chemicals from the ocean also with the potential to touch the personalized human life too. With such growth in its working sphere and humble beginnings, it had stepped in four continents across globe. The company had not only focused on its business operations but also had imprinted positively in the lives of millions of Indians across. This company was supposed to be the pioneer and market leader in India’s Iodized Salt segment. It had benefited the masses by providing them low-cost, Nano-technology- based water purified and affordable safe drinking water. It is the world’s second largest producer of soda ash with its grip over Asia, Europe, Africa and North America. World’s major manufacturers of glass, detergent and other industrial products are equipped with a range of key ingredients of the company.

Brunner Mond confirmed the acquisition of Cheshire Salt Holding Ltd (CSHL), the parent company of British Salt for $144 million through the announcement on 20th December. CSHL was previously owned by LDC, the

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UK's leading mid-market private equity firm. British Salt produces approximately half of the UK's pure salt used in applications ranging from food processing to chemicals production. The long successful history of British Salt would definitely do justice to its acquisition by Brunner Mond and would reach greater heights too.

Company Profile (2)

This company has evolved from a wholesale service provider serving the larger Indian market to a leading provider of A New World of Communication to enterprise customers and various service providers worldwide. It has its roots deep embedded in the emerging markets. It has its headquarters in Mumbai and Singapore with over 8000 employees across 38 countries. It has been enlisted in the Bombay Stock Exchange and National Stock Exchange with its earning up to $3.2 billion. It is also the flagship telecoms arms of $103.3 billion Tata Group.

Various amendments had been made in the working of the company due to technological changes. Enterprises are combining with technology resulting to:

- exponential growth of connected devices
- emergence of social media
- emergence of analytics and cloud computing
- acceptance of bring your own devices

The company had successfully created a robust digitalized ecosystem for the future with latest and best infrastructure to satisfy customer's demand. The company is well known for its transparency, control and flexibility, seeking to create an open infrastructure that the CEO requires to safeguard and enhance their organization's customer's experience and brand reputation. It is the world's only wholly owned subsea fibre network that circles the globe with the investment up to $1.19 billion. The company's service portfolio includes:

- Predictable high speed connection and global MPLS virtual private network.
- Telepresence Services
- DDoS mitigation and detection service
- Various solutions for customers in key markets like oil & gas, banking, financial services etc.

The company also expanded capabilities in the media and entertainment sector with acquisition of BT Group's Mosaic business.

Data analysis

Study based on historical data of Tata Communication share price and stock market index data with their rate of return. Historical files of both share price and stock market index data around the event date -10 <0> +10 with their return.

Figure-1: TaTa-BS UK-Chart (Statistics given in Excel Sheet)

Tata Chemicals- British Salt				
Single factor model				
Intercept		-0.0002894		
Slope		0.9800707		
R-square		0.2011875		
Standard Error		0.0186389		
Date	TATA Chem	TATA Chem return	BSE S&P 500	Return BSE S&P 500
1/3/2011	349.23	2.58%	8001.48	0.506%
12/31/2010	340.33	1.22%	7961.06	0.788%
12/30/2010	336.22	0.55%	7898.59	0.624%
12/29/2010	334.36	-1.38%	7849.48	0.912%
12/28/2010	338.99	0.00%	7778.23	0.003%
12/27/2010	338.99	0.10%	7778.03	-0.266%
12/24/2010	338.64	-0.29%	7798.75	0.377%

ISSN 2394 - 7780

12/23/2010	339.63	1.25%	7769.40	-0.195%
12/22/2010	335.4	3.51%	7784.60	-0.080%
12/21/2010	323.82	0.51%	7790.80	0.823%
12/20/2010	**322.18**	**0.46%**	**7726.96**	**-0.071%**
12/16/2010	320.71	1.49%	7732.46	0.723%
12/15/2010	315.96	-1.75%	7676.75	-1.032%
12/14/2010	321.53	3.18%	7756.42	0.801%
12/13/2010	311.46	1.42%	7694.51	1.168%
12/10/2010	307.06	2.31%	7605.17	1.576%
12/9/2010	300.06	-2.22%	7486.24	-2.912%
12/8/2010	306.8	-1.47%	7707.47	-1.456%
12/7/2010	311.33	0.00%	7820.49	-0.486%
12/6/2010	311.33	-0.53%	7858.57	-0.188%
12/3/2010	312.98	-1.93%	7873.36	-0.771%

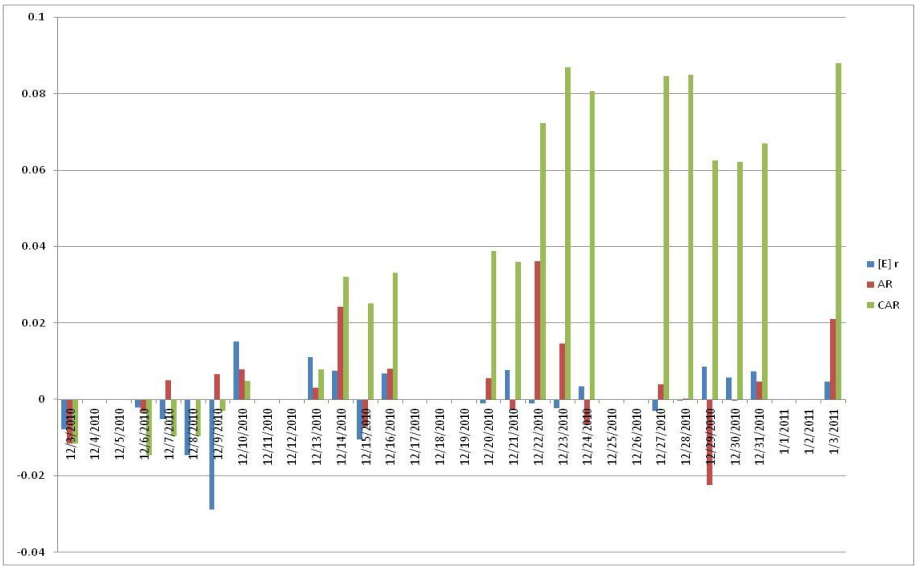

Figure-2: TaTa-BS UK-Line Chart (Statistics given in Excel Sheet)

Date	[E] r	AR	CAR	AR-t test	Significane
1/3/2011	0.00467	2.11%	8.81%	1.13	**no**
12/31/2010	0.00743	0.47%	6.70%	0.25	**no**
12/30/2010	0.00582	-0.03%	6.23%	-0.01	**no**
12/29/2010	0.00865	-2.24%	6.26%	-1.20	**no**
12/28/2010	-0.00026	0.03%	8.50%	0.01	**no**
12/27/2010	-0.0029	0.39%	8.47%	0.21	**no**
12/24/2010	0.00341	-0.63%	8.08%	-0.34	**no**
12/23/2010	-0.0022	1.47%	8.71%	0.79	**no**
12/22/2010	-0.00107	3.62%	7.23%	1.94	**no**
12/21/2010	0.00777	-0.27%	3.61%	-0.14	**no**
12/20/2010	**-0.00099**	0.56%	3.88%	0.30	**no**
12/16/2010	0.0068	0.81%	3.33%	0.44	**no**
12/15/2010	-0.01041	-0.71%	2.52%	-0.38	**no**
12/14/2010	0.00756	2.43%	3.22%	1.30	**no**
12/13/2010	0.01116	0.31%	0.80%	0.16	**no**
12/10/2010	0.01516	0.79%	0.49%	0.42	**no**
12/9/2010	-0.02883	0.66%	-0.30%	0.36	**no**
12/8/2010	-0.01456	-0.01%	-0.96%	-0.01	**no**
12/7/2010	-0.00505	0.50%	-0.95%	0.27	**no**
12/6/2010	-0.00213	-0.32%	-1.46%	-0.17	**no**
12/3/2010	-0.00785	-1.14%	-1.14%	-0.61	**no**

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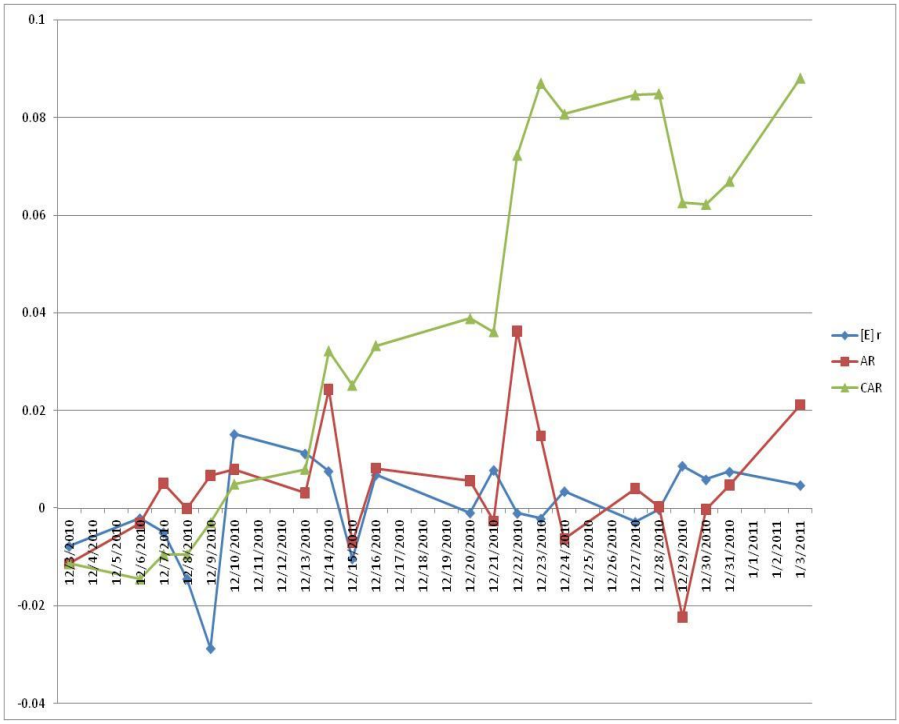


Figure-3: TaTa-BT Group-Chart (Statistics given in Excel Sheet)

Tata Communication - BT Groups					
Single Factor Model					
Intercept		-0.003551433			
Slope		0.801411488			
R-Square		0.260096083			
Standard Error		0.020664261			
Date	Volume	Tata Communications	Tata Communication Return	BSE S&P 500	Market Return
2/2/2010	127900	294.22	-3.76%	6475.02	-1.32%
2/1/2010	91800	305.49	1.69%	6561.26	0.79%
1/29/2010	239900	300.37	2.54%	6509.90	0.50%
1/28/2010	79800	292.85	-3.50%	6477.57	0.41%
1/27/2010	85300	303.29	-4.97%	6450.78	-3.43%
1/25/2010	41700	318.75	-0.34%	6676.12	-0.82%
1/22/2010	75300	319.83	-1.57%	6730.91	-1.07%
1/21/2010	70300	324.9	-2.02%	6803.12	-2.48%
1/20/2010	78100	331.53	-1.41%	6973.74	-0.13%
1/19/2010	74200	336.23	-1.96%	6982.83	-0.81%
1/18/2010	105100	342.9	-0.19%	7039.68	0.49%
1/15/2010	130400	343.56	-0.23%	7005.27	-0.01%
1/14/2010	153600	344.36	-0.79%	7006.19	0.58%
1/13/2010	299100	347.08	-0.53%	6965.35	0.52%
1/12/2010	307200	348.91	2.63%	6929.12	-0.84%
1/11/2010	103300	339.84	-0.17%	6987.84	0.44%
1/8/2010	137100	340.41	2.46%	6957.32	-0.20%
1/7/2010	47900	332.14	-0.80%	6971.42	-0.33%
1/6/2010	109500	334.82	-0.89%	6994.15	0.28%
1/5/2010	307000	337.82	5.69%	6974.49	1.02%
1/4/2010	54300	319.12	1.04%	6903.63	0.89%

ISSN 2394 - 7780

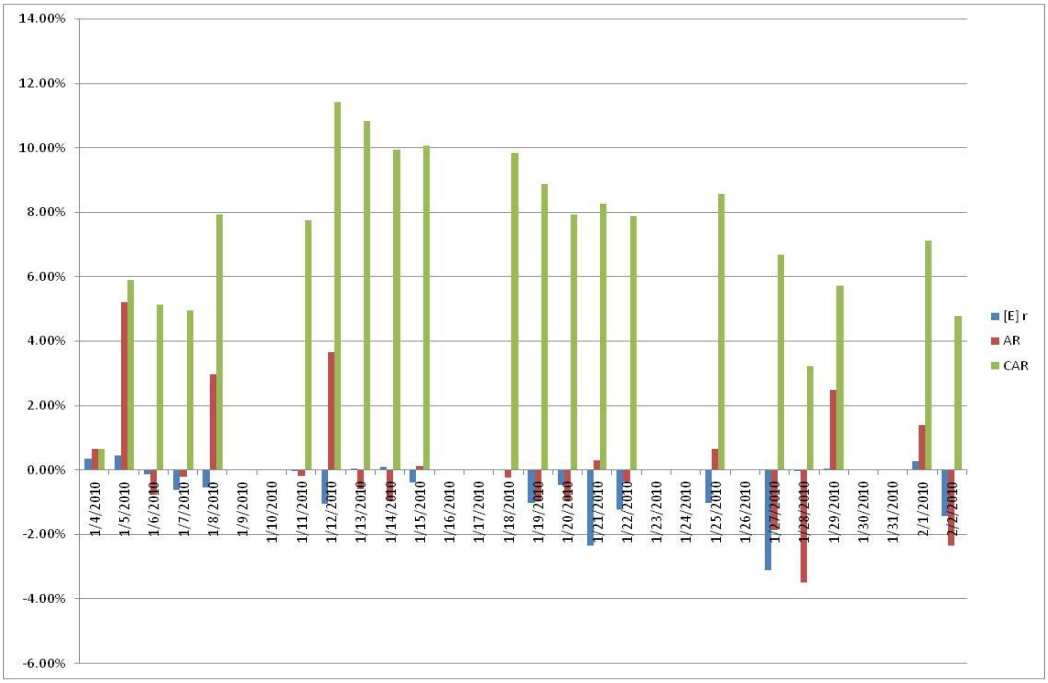
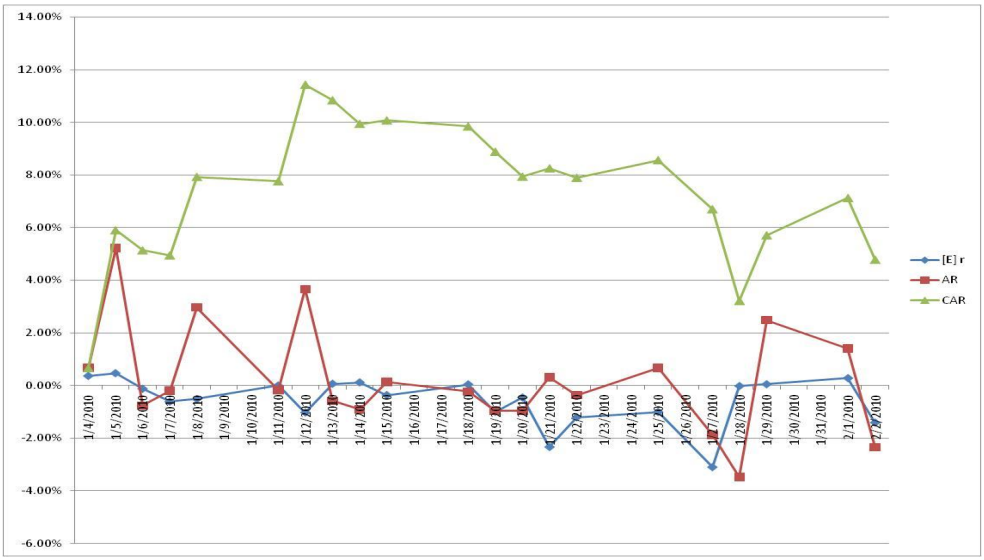


Figure-4: TaTa-BT Group-Line Chart (Statistics given in Excel Sheet)

Date	[E] r	AR	CAR	AR-t test	Significane
2/2/2010	-1.42%	-2.34%	4.79%	-1.13406	no
2/1/2010	0.27%	1.42%	7.13%	0.68502	no
1/29/2010	0.04%	2.49%	5.72%	1.20575	no
1/28/2010	-0.02%	-3.48%	3.23%	-1.68401	no
1/27/2010	-3.11%	-1.86%	6.71%	-0.90247	no
1/25/2010	-1.01%	0.67%	8.57%	0.32516	no
1/22/2010	-1.21%	-0.36%	7.90%	-0.1754	no
1/21/2010	-2.34%	0.32%	8.26%	0.15494	no
1/20/2010	-0.46%	-0.95%	7.94%	-0.45885	no
1/19/2010	-1.00%	-0.96%	8.89%	-0.46427	no
1/18/2010	0.04%	-0.23%	9.85%	-0.11123	no
1/15/2010	-0.37%	0.13%	10.08%	0.0644	no
1/14/2010	0.11%	-0.90%	9.95%	-0.4356	no
1/13/2010	0.06%	-0.59%	10.85%	-0.28487	no
1/12/2010	-1.03%	3.67%	11.44%	1.77376	no
1/11/2010	0.00%	-0.16%	7.77%	-0.07899	no
1/8/2010	-0.52%	2.98%	7.93%	1.44056	no
1/7/2010	-0.62%	-0.19%	4.96%	-0.0908	no
1/6/2010	-0.13%	-0.76%	5.14%	-0.36897	no
1/5/2010	0.46%	5.23%	5.91%	2.53159	yes
1/4/2010	0.36%	0.68%	0.68%	0.32701	no

ISSN 2394 - 7780



CONCLUSION

This methodology has been used to analyze the short term shareholder wealth of both the above mentioned companies around its M&A event dates 20th December and 18th January both in 2010. The merger of Tata Chemicals with British Salts and Tata Communication with BT Groups has been thoroughly studied. In fact, this is one of the first studies of valuation of stock market & estimation of abnormal returns and cumulative abnormal returns in the context of Indian mergers. The result profile is positive but not significant. This event increases in the value of shareholder bidder firm. All the findings through experimentation and rigorous study are found to be positive. Thus as studied it draws the inference that global merger announcement in the Indian industries has a positive but not very significant shareholder's wealth effect for the bidder firm as aforementioned.

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EFFECT OF TRANSDISCIPLINARY APPROACH: ACHIEVEMENT OF SOCIAL SCIENCE STUDENTS

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ABSTRACT
Educators are recognizing the vital significance of designing a Transdisciplinary curriculum in order to promote both teaching and learning skills of the 21st century. Transdisciplinary Research is problem focused and concerned with problem solving rather than hypothesis testing (as is the emphasis in much disciplinary research). Transdisciplinary work is therefore action oriented and aims to achieve social change by connecting knowledge to real-world solutions. Transdisciplinary Approach of learning social science have been studies in extraordinary number of field experiments of high methodological quality.

INTRODUCTION
Social Science classes do make efforts to encounter the art, music and literature of the places and times they study. For instance, to learn about the sphinx and the pyramids of Egypt, students need to see them, not just read about them.) has written, "to have a broad and deep understand. The music of slaves, myths and stories that were a part of their lives, programs like Roots, the music and dance of the period, the architecture of their quarters and those of their masters are all relevant sources for enlarging understanding" (P.551). Making such a variety of material available to students is a constant challenge to teachers pressured to find time for a curriculum that, in any given year, may stretch chronologically from the flintstones to the French Revolution and range across the entire globe. The increase of standardized testing and the proliferation of state and national standards have exacerbated this problem. "With all the required district, state and national curriculum standards, teachers often feel over whelmed. Time is a critical commodity in the classroom" (Berson, 1999, P. 85).

Transdisciplinary is a reflexive, integrative method driven scientific principle aiming at the solution or transition of societal problems and concurrently of related scientific problems that differentiating and integrating knowledge from various scientific and societal of knowledge Transdisciplinary Approach develops a new vision and a new experience of learning. The quality of learning is inseparable from the quality of teaching with in a higher education system. Dialogical, Critical and active learning requires a pedagogy in which teachers and students learn, reflect and act together, and by doing so transform themselves and the world around them (Freire 1972).

SIGNIFICANCE OF THE STUDY
Transdisciplinary learning promotes an atmosphere of metacognition within the inquiry process. When teachers gather students to analyze, synthesize and evaluate global problems, the Transdisciplinary model is the most robust approach. Effective problem solving begins with a clear understanding of the necessary competencies collaborative groups must possess in order to design and facilitate a successful inquiry process. With the help of this approach the Teachers must model these skills while interacting with the students responsible for producing new knowledge. The key competencies include: critical and creative thinking, communication and collaboration, information media and technology skills, and project based curriculum development.

NEED FOR THE STUDY
Social science also claims to be interdisciplinary in its purpose of leading students toward democratic, civic engagement. Joe Hill had a career of civic engagement that although championing causes that might infuriate many educators, had an intensity about it that would make any social science teacher proud. He joined the front lines of the debate over how much power capital should have over working people's lives and what rights and capital workers ought to retain. Social science advocates argue that any subject has a bearing on public polices, and that aspect of the subject is also properly the provenance of the social science curriculum.

Knowledge is best interpreted when it is not only processed by the brain but also by the emotions and body, by the head, heart and hand. This goes beyond knowing and involves the development of understanding. Teaching and learning to know, in this sense means integrating different methodologies, disciplines and knowledge frame works in a process by which real world relevance is maintained. It includes a greater understanding of the equal importance of tacit, lay and intellectual knowledge. Teaching and learning to know also require bridging the gap between theory and practice through a cycle of reflection, thought and action and thus to master the art of Praxis.

ISSN 2394 - 7780

DIFFERENT METHODS OF TEACHING SOCIAL SCIENCE

Studying the social sciences is vital for many reasons. It enables children • to understand the society in which they live - to learn how society is structured, managed, and governed, and also about the forces seeking to transform and redirect society in various ways. • to appreciate the values enshrined in the Indian Constitution such as justice, liberty, equality and fraternity and the unity and integrity of the nation and the building of a socialist, secular and democratic society. • to grow up as active, responsible, and reflective members of society. • to learn to respect differences of opinion, lifestyle, and cultural practices. • to question and examine received ideas, institutions, and practices.

Educators are recognizing the vital significance of designing a Transdisciplinary curriculum in order to promote both teaching and learning skills of the 21st century. Implementing Transdisciplinary-learning strategies is paramount to the contemporary learning goals of promoting global sustainability through content area instruction. If educators are dedicated to creating complex critical thinkers that will create solutions to global problems, then the institution of education must reimagine the teaching and learning competencies that occur in the 21st century classroom.

Transdisciplinary Research is problem focused and concerned with problem solving rather than hypothesis testing (as is the emphasis in much disciplinary research). Transdisciplinary work is therefore action oriented and aims to achieve social changeby connecting knowledge to real-world solutions (Kessel& Rosen field, 2008; Lawrence &Despres, 2004). Transdisciplinary Research is facilitated by ongoing knowledge exchange processes that are weaved throughout the entire research process to inform all stagesof the investigation. So that there is a "constant flow between knowledge and Practical application" (Smith, 2007, P.161).

ESSENTIAL ELEMENTS OF THE TRANSDISCIPLINARY APPROACH

The second essential feature is intensive ongoing interaction among team members from different disciplines, enabling them to pool and exchange information, knowledge and skills and work together cooperatively. This feature reflects Foley's (1990) notion of role expansion but clarifies the role of collaborative inter professional teamwork in making this happen.

The third defining feature of Transdisciplinary Approach is role release which is the most crucial and challenging component in Transdisciplinary team development. The team becomes truly Transdisciplinary in practice when members give up or "release" intervention strategies from their disciplines, under the supervision and support of team members whose disciplines are accountable for those practices.

THE TRANSDISCIPLINARY NATURE OF SOCIAL SCIENCE

Social Science classes do make efforts to encounter the art, music and literature of the places and times they study. For instance, to learn about the sphinx and the pyramids of Egypt, students need to see them, not just read about them. The music of slaves, myths and stories that were a part of their lives, programs like Roots, the music and dance of the period, the architecture of their quarters and those of their masters are all relevant sources for enlarging understanding" (P.551). Making such a variety of material available to students is a constant challenge to teachers pressured to find time for a curriculum that, in any given year, may stretch chronologically from the flint stones to the French Revolution and range across the entire globe. The increase of standardized testing and the proliferation of state and national standards have exacerbated this problem. "With all the required district, state and national curriculum standards, teachers often feel over whelmed. Time is a critical commodity in the classroom" (Berson, 1999, P. 85).

One solution to the problem of combining secondary sources (such as texts, or historian's essays) and primary sources (such as The Declaration of Independence) is the journey box. in this inquiry strategy, teachers present students with a box containing a themed set of photographs, artifacts, literature, informational texts, entries from travel journals and maps. Students investigating these materials, inter relate them, so that maps pinpoint the location of a photograph, travel journals provide an immediate experience of the Landscape, and Literature allows them a personal link to the place and time. Artifacts allow a hands-on moment that leads to hypothesizing about the purpose of the objects and the world that demanded them (Field &Labbo, 1999). This is an elegant solution that that requires either funds to purchase or time to create, and still it demands time for inquiry learning in the classroom.

STATEMENT OF THE PROBLEM

The investigator wanted to enhance the Transdisciplinary Approach on learning Social Science as he had understood through a experimental study conducted earlier by him that they lack command over Social Science learning. The investigator being an Social Science teacher wanted to do an experiment with the help of secondary school students of Kerala. He felt that the traditional methods of teaching would not support them

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acquire these learning as they do not make them learn and practice these approach very easily, interestingly and effectively.

OPERATIONAL DEFINITION OF KEY TERMS

a. Effect

The term effect stands for the outcome of the study when the influence of one factor or condition is dependent on the presence or absence of another factor

In this study, the term effect refers to the particular treatment given for a learner which produces cardinal transformation in pupil's behavior in terms of their scholastic and co-scholastic achievements.

b. Transdisciplinary Approach

An approach to curriculum integration which dissolves the boundaries between the conventional disciplines and organizes teaching and learning around the construction of meaning in the context of real-world problems or themes. Transdisciplinary is between the disciplines, across the disciplines beyond the disciplines.

The term approach stands for the act of coming nearer (relatively) or of drawing near (absolutely), in space.

Achievement of Social Science

According to this study, Social Science refers to history prescribed for VIII standard students since 2010. Achievement of Social Science refers to the motivating force for undertaking learning activities in Social Science.

OBJECTIVES OF THE STUDY

Every study must posses some objectives according to their importance. They are measurable and observable outcomes in the research process.

The objectives of the study are:

1. To develop a Transdisciplinary Approach on learning Social Science
2. To find out the significant difference, if any, in the pre-test scores of the Social Science learning of the control groups, taught by conventional method and experimental group taught by Transdisciplinary Approach with regard to the level of intelligence.
3. To find out the significant difference, if any, in the post-test scores of the Social Science learning of the sample groups with regard to the level of intelligence.
4. To find out the significant difference between the pre-test and post-test scores of the sample groups with regard to the level of intelligence.
5. To find out the significant difference between, if any, between the gain scores of the sample groups with regard to the level of intelligence.

HYPOTHESES FORMULATED

The hypothesis is a formal affirmative statement predicting a single research outcome a tentative explanation of the relationship between two or more variables (Best & Kahn, 1995; 11) The hypothesis focuses the investigation on a definite target and determines what observations, or measures, are to be used. in the light of the objectives, the following hypothesis were set up for the present study.

1. There are significant difference between the pre-test scores of Transdisciplinary Approach of the control and experimental groups.
2. There is significant difference between the pre-test scores of the control and the experimental groups with regard to the level of intelligence.
3. There is a significant difference between the post-test scores of the control and the experimental groups.
4. There is significant difference between the post-test scores of the control and the experimental groups with regard to the level of intelligence.
5. There is significant difference between the pre-test scores and the post-test scores of the control group.

Comparison of Adjusted Means of Experimental and Control group for the Total Sample

There is no significant difference between the adjusted post-test scores of the control group and the experimental group.

ISSN 2394 - 7780

Significance of Difference between the Intelligence Test Scores of the Control and Experimental Group

Group	Sixe	Mean	SD	Mean Differences	T value	P value
Control	45	45.82	6.46	1.8	1.09	0.28
Experimental	45	47.62	11.43			

In the above table, since P value is greater than 0.05 the null hypothesis is accepted at 5% level of significance. Hence, it is concluded that there is no significant difference between the intelligence test scores of the control and Experimental groups.

TREATMENT USING TRANSDISCIPLINARY APPROACH LEARNING

The Transdisciplinary Approach was administered to the experimental group by the investigator whereas, the same module, but without Transdisciplinary Approach was taught to the control group by the investigator themselves. The treatment were given in connection with regular school time table were give to both the groups for two weeks, 45 minutes a day.

The achievement scores of the sample groups were obtained for all the tests namely, Pre-test, Post-test and delayed Post-test. The delayed post-test was conducted after 10 days from the post-test.

Significance of Difference between the Transdisciplinary Approach of Control and Experimental Group in the Pre-test Scores for Total Sample

Group	N	Mean	S.D	Mean Difference	t value	p value
Experimental	45	47.62	11.43	1.8	1.09	0.28
Control	45	45.82	6.46			

In the above table, comparison of mean score is carried out for the experimental (47.62) and control (45.82) groups at pre-test level. The test yielded a slight variation in the mean difference (1.8) and a t value of 1.09. The p value obtained is 0.28 which shows the difference is statistically not significant. So the null hypothesis is accepted at 5% level of significance. Therefore, both the groups were similar at the pre-test level.

Significance of Difference between the Control and Experimental group in the Pre-test Scores for Total Sample with regard to the Level of Intelligence

Level of Intelligence	Group	N	Mean	SD	Mean Difference	t value	p value
High	Experimental	8	55.12	12.43	6.46	1.31	0.21
	Control	9	48.67	7.57			
Average	Experimental	26	48.15	11.06	2.68	1.17	0.25
	Control	32	45.47	6.14			
Low	Experimental	11	40.91	8.08	1.34	0.31	0.76
	Control	4	42.25	5.19			

In the above table, the p value ($p>0.05$) obtained for high, average and low intelligence groups shows that the difference is statistically not significant. So the null hypothesis is accepted at 5% level of significance. Hence, it is concluded that there is no significant difference between the pre-test scores of the control group and the experimental group with regard to the level of intelligence.

Significance of Difference between the Control and Experimental Group in the Post-test Scores for Total Sample

Group	N	Mean	S.D	Mean Difference	t value	p value
Control	45	55.6	10.73	3.07	3.71	0.00**
Experimental	45	50.00	7.66			

**Significant at 5% level

In the above table, comparison of mean scores is carried out for the experimental (55.6) and control (50.00) groups at post-test level. The test yielded a large variation in the mean difference (3.07) and t value of 3.71. The p value obtained is 0.00 which shows the difference is significant at 0.05 level. The result after the analysis of the data reflected that the experimental group had done well when comparted to the control group in Social Science. There was a vast significant difference seen between the mean scores of the sample group

ISSN 2394 - 7780

Significance of Difference between the Control and Experimental group in the Post-test Scores for Total Sample with regard to the Level of Intelligence

Level of Intelligence	Group	N	Mean	SD	t value	p value
High	Experimental	8	59.37	10.14	0.31	0.76
	Control	9	58.11	6.27		
Average	Experimental	26	55.73	11.00	3.09	0.00
	Control	32	48.50	6.65		
Low	Experimental	11	52.82	10.60	1.62	0.13
	Control	4	43.75	4.92		

In the above table, the p value is less than 0.05 irrespective of the level of intelligence, the null hypothesis was rejected at 5% level of significance. Hence, it was concluded that there was significant difference between the post-test scores of the control group and the experimental group with regard to the level of intelligence. The mean scores showed that the experimental group performed better in the post-test than the control group irrespective of the level of intelligence.

Significance of Difference between the experimental groups in the overall scores of delayed Post-test

Group	N	Mean	S.D	Mean Difference	t value	p value
Experimental	45	56.66	10.72	3.82	3.96	0.00**
Control	45	52.84	10.94			

**Significant at 5% level

In the above table, since p value is less than 0.05, the null hypothesis was not accepted at 5% level of significance. Hence, it was concluded that there was significant difference in the retention scores of the experimental group for the total sample. The mean scores revealed that the post-test scores were better than the retention test.

Significance of Difference between the Experimental groups in the overall scores of retention-test with regard to the level of intelligence

Level of Intelligence	Group	N	Mean	SD	Mean Difference	t value	p value
High	Experimental	8	59.50	9.75	0.12	0.14	0.89
	Control	9	59.37	10.14			
Average	Experimental	26	51.19	11.33	3.54	3.07	0.00**
	Control	32	55.73	11.00			
Low	Experimental	11	45.45	6.89	7.37	2.94	0.01**
	Control	4	52.82	3.20			

** Significant at 5% level

In the above table, since p value is less than 0.05 irrespective of the level of intelligence, the null hypothesis was not accepted at 5% level of significance. Hence, it was resulted that there was significant difference between retention-test and and post-test scores in the experimental group with regard to the level of intelligence. The mean scores show that the post-test scores of the experimental group were higher than that of retention-test scores with regard to the level of intelligence.

RECOMMENDATIONS

The findings of the study show that the Transdisciplinary Approach was a significant contribution to the process of learning Social Science in the Indian classrooms. The results of the study reveal that the Transdisciplinary Approach can be introduced to the educational institutions especially to the SCERT for the betterment of the Social Science teachers to help learning statement. It was apparent that Transdisciplinary has the pedagogical strength and it fosters easy learning and better understanding and help to hold the power of retention for a long period and hence the investigator likes to recommend educational clients to introduce this innovative and effective Transdisciplinary Approach to all the school system.

TO REGULATORY BODIES

State Resource Group (SRG) can very seriously look into the Social Science learning. In-service programme usually give training to the teachers at that time give more importance to the approach. Then cluster meeting organizers give the ideas importance and necessities of present situation. This may pave the way for cultivating

ISSN 2394 - 7780

the Transdisciplinary Approach. Merits to learning Social Science. SRG give direction to DRG (District Resource Group)

The Social Science teachers have to give the importance of learning Social Science through this method. The teacher uses this way of learning Social Science was interesting any other subjects. All schools H.M's have to recommend to teacher's write lesson plan with the help of this method. This method of learning was interest among students to achieve some Life Skills. R.P (Resource Person) gives the importance of this method of learning strategies to teachers and gives necessary direction to Social Science teaching, they try to modify their teaching strategy effectively.

DEO

The investigator recommends to D E O that the heads of all school may insist on the teachers of every school to follow new approach like Transdisciplinary in teaching their wards.

The State Council for Educational Research and Training (SCERT) is a regulatory body which monitors teacher training curriculum framing work. S C E R T may become conscious of the learning Social Science as they play an important role in the subject which is interesting, learnable and appealing to the future generation. Hence it's important that a lot of attention can be paid on the quality and the competency of Social Science learning. SCERT can insist on training how to frame curriculum for school education incorporated with Transdisciplinary Approach with regard to Social Science achievement

CONCLUSION

Studies so far analysed indicate that among the various learning techniques, that most suitable technique in a social science classroom setting is the Transdisciplinary Approach. Moreover, earlier studies reveal that students have the Transdisciplinary Approach and their academic performance is related to their method of teaching social science used. The aforesaid studies reveal that Transdisciplinary learning technique is an effective technique that can be adopted successfully among students with learning. Although effect of Transdisciplinary Approach of learning social science have been studies in extraordinary number of field experiments of high methodological quality, studies of Transdisciplinary Approach with emphasis to learning of children need further investigation.

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GOODS AND SERVICES TAX COUNCIL: A BOON TO INDIAN ECONOMY

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1. INTRODUCTION

The introduction of Goods and Services Tax (GST) is one of the biggest indirect tax reforms in India. GST is not just a tax change but it will benefit the economy as a whole and have far-reaching impact on businesses.The central idea behind this form of taxation is to replace existing complex levies like value-added tax, excise duty, service tax, and sales tax and levying a comprehensive tax on the manufacture, sale and consumption of goods and services in the country. More than 140 countries around the world have adopted the GST/ VAT framework effectively. Indian economy is getting more and more globalised. Introduction of an integrated Goods and Services Tax (GST) to replace the existing multiple tax structures of Union and State taxes is not only desirable but imperative in the emerging economic scenario. The implementation of GST would ensure that India provides a tax regime that is almost similar to the rest of the world. It will also improve the international cost competitiveness of native goods and services. The supreme authority to administer and govern GST is vested with Goods and Services Tax Council. This study is undertaken to understand the role and significance of GST Council and Challenges before it in order to effective implementation of GST.

2. OBJECTIVES OF THE STUDY

The study has the following major objectives:

i) To understand the model of Goods and Services Tax.

ii) To have insight into the overall functioning of GST Council.

iii) To know the challenges before GST Council.

3. RESEARCH METHODOLOGY

This research paper is purely based on the secondary data sourced mainly through from journals, magazines, articles, websites etc.

4. REVIEW OF LITERATURE

The First Discussion Paper on Goods and Services Tax In India (2009) drafted by The Empowered Committee of State Finance Ministers set up by the then Union Finance Minister Shri P. Chidambaram has set up roadmap for implementation of GST and invited interaction as well as suggestion with the representatives of industry, trade, agriculture and common people.

Federation of Indian Chambers of Commerce and Industry(FICCI) in its approach paper " Towards the GST" (2013) has been seeking expeditious implementation of a comprehensive Goods and Services Tax (GST) in India. FICCI believes that introduction of the GST will make Indian trade and industry more competitive both domestically as well as internationally, and contribute significantly to the growth of the economy.

Girish Garg, (2014) Studied "Basic Concepts and Features of Goods and Services Tax in India", and found that GST is the most logical steps towards the comprehensive indirect tax reforms in our country since independence. GST will create a single, unified Indian market to make the economy stronger. Experts say that GST is likely to improve tax collections and Boost India's economic development by breaking tax barriers between states and integrating India through a uniform tax rate. Under GST, the taxation burden will be divided equitably between manufacturing and services, through a lower tax rate by increasing the tax base and minimizing exemptions.

Dr. R. Vasanthagopal, (2011) Studied "GST in India: A Big Leap in the Indirect Taxation System", and found that the positive impacts are dependent on a neutral and rational design of the GST, balancing the conflicting interests of various stakeholders, full political commitment for a fundamental tax reform with a constitutional amendment, the switchover to a "flawless" GST would be a big leap in the indirect taxation system and also give a new impetus to India's economic change.

5. Why GST?

There is cascading of taxes, as taxes levied by the Central Government are not available as setoff against the taxes being levied by the State governments. Even certain taxes levied by State Governments are not allowed as set off for payment of other taxes being levied by them. Further, a variety of VAT laws in the country with disparate tax rates and dissimilar tax practices, divides the country into separate economic spheres. Creation of

ISSN 2394 - 7780

tariff and non- tariff barriers such as Octroi, entry Tax, Check posts etc. hinder the free flow of trade throughout the country. Besides that, the large number of taxes creates high compliance cost for the taxpayers in the form of number of returns, payments etc.

6. MEANING OF GST

Goods and Service Tax (GST) is a comprehensive tax levy on manufacture, sale and consumption of goods and services at a national level. In simple terms, GST may be defined as a tax on goods and services, which is leviable at each point of sale or provision of service, in which at the time of sale of goods or providing the services the seller or service provider may claim the input credit of tax which he has paid while purchasing the goods or procuring the service. It is basically a tax on final consumption. Under the GST regime, both the Centre and the State would have the powers to tax the supply of goods and services right from their primary stage to final consumption. At the centre's level, introduction of the GST will mean that it takes the place of central excise duty, service tax and additional customs duties. At the state level, the GST will take the place of State VAT.

7. GOODS & SERVICES TAX COUNCIL

GST Council is a constitutional body for making recommendations to the Union and State Government on issues related to Goods and Service Tax. The GST Council is chaired by the Union Finance Minister and other members are the Union State Minister of Revenue or Finance and Ministers in-charge of Finance or Taxation of all the States.

As per Article 279A of the amended Constitution, the GST Council which will be a joint forum of the Centre and the States, shall consist of the following members: -

1. The Union Finance Minister - Chairperson;
2. The Union Minister of State in charge of Revenue or Finance - Member;
3. The Minister in charge of Finance or Taxation or any other Minister nominated by each State Government - Members.

As per Article 279A (4), the Council will make suggestions to the Union and the States on important issues related to GST, like the goods and services that may be subjected or exempted from GST, model GST Laws, principles that govern Place of Supply, threshold limits, GST rates including the floor rates with bands, special rates for raising additional resources during natural calamities/disasters, special provisions for certain States, etc.

The Union Cabinet in its meeting held on 12th September, 2016 approved setting-up of GST Council and setting up its Secretariat.

The Cabinet also decided to provide for adequate funds for meeting the recurring and non-recurring expenses of the GST Council Secretariat, the entire cost for which shall be borne by the Central Government. The GST Council Secretariat shall be manned by officers taken on deputation from both the Central and State Governments.

The provisions of Article 279A of the Constitution of India with respect to constitution of GST Council and its mandate are as below:

8. MANDATE IN BRIEF OF GST COUNCIL

- The Goods and Services Tax Council shall make recommendations to the Union and the States on various GST related matter.
- One-half of the total number of Members of the Goods and Services Tax Council shall constitute the quorum at its meetings.
- The Goods and Services Tax Council shall determine the procedure in the performance of its functions.
- Every decision of the Goods and Services Tax Council shall be taken at a meeting, by a majority of not less than three-fourths of the weighted votes of the members present and voting.
- The Goods and Services Tax Council shall establish a mechanism to adjudicate any dispute.

9. PERFOMANCE OF GST COUNCIL SO FAR

9.1 GST Council have approved following GST Rules and Formats so far:

- Registration Rules and Formats.
- Return- Rules and GSTP Formats, Mismatch Formats, Return Formats.

ISSN 2394 - 7780

- Invoice- Debit and Credit Notes Rules.
- Payment Rules and Formats.
- Refund Rules and Formats.
- Input Tax Credit Rules
- Valuation Rules
- Transitional Rules and Formats
- Composition Rules and Formats
- Accounts and Record Rules

9.2 The following Draft GST Rules and Forms have been approved by the GST Council:

- Advance Ruling
- Appeals and revision
- Assessment and Audit
- E-Way Bill

10. GST COUNCIL MEETINGS

GST Council has met 33 times since its constitution and some important decisions taken in the GST Council meetings are:-

- Rules for conduct of business in GST Council;
- Timetable for implementation of GST;
- The threshold limit for exemption from levy of GST;
- The threshold for availing the Composition scheme;
- To compensate States for 5 years for loss of revenue due to implementation of GST, the base year for the revenue of the State would be 2015-16 and a fixed growth rate of 14% will be applied to it;
- Adoption of four slabs tax rate structure of 5%, 12%, 18% and 28%. In addition, there would be a category of exempt goods and further a cess would be levied on certain goods such as luxury cars, aerated drinks, pan masala and tobacco products, over and above the rate of 28% for payment of compensation to the states.

11. CHALLENGES BEFORE THE GST COUNCIL

GST is recent phenomenon in India hence it is in a nascent stage which will have enormous challenges in days to come which have been listed as follows :

- The moment of redemption – items to be assigned to various tax rates finalized- a task which will offer maximum challenge to the GST Council and to the Centre and States.
- A good GST structure for a country like India must be ensuring easy compliances; minimal inflationary pressures on the Central and State Governments and above all on consumers; buoyant revenue streams and above all India's population must accept it. Its indeed a challenging task.
- GST law must not be used to meet social or consumer or industrial policy objectives. It has least concern with this. If the objectives of employment; industrial policy or Make in India Policy or social engineering concerns are to be addressed.
- To convince the public at large and ensuring GST acceptance; the Central and State Governments will have to carry out a very wide "education spread" to enlighten the stake holders that GST rate is not higher than the combined Excise/VAT rates on goods. This is not easily done. The initial impression must be positive and we must ensure this.
- When products today at zero rate will be taxed in GST, say at 5 percent; then the Central Government and State Governments should ensure to tell public that why there has not been any increase in overall tax burden; lest, the impression will be negative.
- With pressures that are bond to mount on GST Council from various stake holders to ensure Common Man *(Aam Aadmi)* consumer goods and industrial inputs must be kept in the lower category, say 5 percent; and

ISSN 2394 - 7780

with many goods remaining exempt from GST; how the Compensation to States shall be paid with 14 percent annualized increment?

- The concept of "composite supply" and "mixed supply" are going to create huge mess and unending litigation.
- GST Council must ensure India's growth story is promoted with an efficient and unbiased indirect tax regime; the higher the propensity to grant exemptions; higher will be the perverted tax brackets. Stop exemptions of all kinds.

12. FINDINGS

- ✓ GST has successfully implemented in India amidst lot of chaos and confusion amongst various stakeholder.
- ✓ Though it is in a nascent or infantry stage, GST Council is striving to streamline it by having regular deliberations and discussions.
- ✓ The awareness among the various stakeholders is to be made in order to overcome the panicky situation and misconception.
- ✓ GST council endeavor to rationalize the rate of tax and it has taken various measures in that direction Due to implementation of GST there is overall increase in rate of goods and services.

13. CONCLUSION

GST is a single national uniform tax levied across India on all goods and services. GST council is expected to bring about efficiency and transparency in the indirect tax mechanism in India. Further it will have to encourage an unbiased tax structure that is neutral to business processes and geographical locations. History has proved that many countries have benefited from moving to a GST regime. In India, Implementation of GST would also greatly help in removing economic distortions caused by earlier complex tax structure and will help in development of a common national market.

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INTERFUSION OF AIRLINES BUSINESS MODELS: CASE OF SOUTH EAST AIRLINERS

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ABSTRACT
Low Cost Carrier (LCC) Business Model is very prominent in airline industry as a strategic move of airlines to sustain in dense marginal & dynamic market. There is dearth of research on systematic approaches & comparative tools for the airline business models. This paper addresses the gap & focus on systematic tool to compare the various business model of South East Asian airlines. This research has been done by using Indexing method using binary coding. The concentration of the study was to determine the interfusion magnitude of the various airline business models features in order to race against the Full service carriers and their low cost subsidiaries. Output of the study results in confirmation towards interfusion of South East Asian airlines. The research work has potential for both theoretical & industrial contribution in terms of strategic decision making in real business & theoretically, the study attempts to fill the knowledge gap in the field of research on comparison of various business models of airlines.

Keywords: Low Cost Carrier (LCC); Hybrid Strategy; Business Model Interfusion; Airline Industry

INTRODUCTION
Airline industry has changed tremendously in last few years because of emergence of new business model so called "Low Cost Carrier" or "Low Cost Airline". In addition to this, airline industry has seen various growth aspects in terms of partnership ,mergers, takeovers, strategic alliances, code sharing across various business models of airlines resulting in various options for the passengers but with slight tweaking in core traditional airline low cost business models those having following features (R Doganis, 2010) (R. Sterzenbach, 2009)**:**

- Point to Point Traffic
- Usages of Secondary or feeder airports
- Homogeneous Fleet Type
- Direct Ticketing without travel agency mode
- Single fare each time per flight
- No FFPs & Complimentary services as frills

In industry sense, business model is blurring (Taneja, 2010) & thus various divergent strategies are in practice to achieve competitive advantage & sustainability in this airline business model. Thus, the dissimilarity amongst the different business models has altered and is no longer as clear and vibrant. These aspects motivated the researcher for pursuing research on the topic to compare and analyses the ranking of different airline business models across south east Asian region.

The methodology for the same is motivated through prior research work of Richard & Ronald (Richard Klophaus, 2012) who developed the methodology of assessing and comparison of various business models of European major airlines unlike the present research which focuses on major 15 south east asian airlines as per total passenger carried published by CAPA 2016 outlook report (CAPA, World Aviation Yearbook, April , 2016)

Through the study, researcher examines the tweaking range of business models & adoption of major intra business model characteristics amongst each other. This research has been done by using Indexing method. The various business models of South East Asian airlines were ranked by denoting binary coding (0 for NO; 1 for YES) for each operating characteristics & then analyses the overall rating for the airlines. Highest rating shows the true low cost carrier business model while lowest denotes the true full service carrier.

Previous study by Mason & Morrison (Mason, 2008) also highlights the Product & Organizational Architecture approach as effective tool to compare the business models. They (K J Mason, 2011) used cost and revenue data of major six European airlines that is being published by very few airlines. Present study use secondary data

ISSN 2394 - 7780

from different sources that are publically available. The concentration of the study is to determine the tweaking of the various airline business models features in order to race against the FSCs and their low cost subsidiaries.

AIRLINE INCLUDED IN SURVEY

The following airliners (As shown in table 1.1) has been included in the survey for the purpose of this study. The airlines are selected on the basis of total number of passenger carried per annum as published in CAPA Outlook report.

Table-1.1: Airlines Included in Survey

Airline	IATA Code	ICAO Code	Year Established	Country	Passengers Carried (Millions)
Air Asia (AirAsia, 2016)	AK	AXM	1993	Malaysia	22.18 M
Indigo (IndiGo, 2016)	6E	IGO	2006	India	21.42 M
Air India (AirIndia, 2016)	AI	AIC	1932	India	12.42 M
Spicejet (Spicejet, 2016)	SG	SEJ	2005	India	11.74 M
Jet Airways	9W	JAI	1992	India	11.67 M
Mihin Lanka	MJ	MLR	2007	Sri Lanka	11.34 M
Lion Air	JT	LNI	2000	Indonesia	8.7 M
Nok Air	DD	NOK	2004	Thailand	7.62 M
Scoot	TZ	SCO	2012	Singapore	6.78 M
Go Air (GoAir, 2016)	G8	GOW	2005	India	6.2 M
Tiger Air	TR	TGW	2004	Singapore	5.8 M
Cebu Pacific Air	5J	CEB	1996	Philippines	1.53 M
Air Costa	LB	LLB	2013	India	0.58 M

Source: Center for Asia Pacific Aviation (CAPA)

LCC BUSINESS MODEL CRITERIA

Conventional LCCs model have less operating cost as compared to the full fledge carriers or flagship carriers. The mentioned Table 3.1 list down the designated criteria to evaluate whether the airline follow the low cost business model. These consist of fleet mix, point to point, ,fare class, cabin class, no code sharing , without frills, Flight Time, Frequent flyer program etc.

Table-1.2: Business Model Criterion

Business Model Practice	Criterion	Value
Single Aircraft Type	Fleet Evenness Index (FEI)	1
Point-to-point	Airline has point-to-point connections only	Yes (1)
No Code sharing	Airline has no code sharing agreement with other carrier	Yes (1)
Only one one-way fare per flight available at each point in time	Airline operating each flight with single fare only	Yes (1)
	Airline operating each flight with only two fares	Yes (1)
Class cabin - Single	Airline operating with only one class cabin	Yes (1)
Flying Distance per flight	Short Haul (Less than 4 Hours only)	Yes (1)
	Long Haul (Greater than 4 Hours only)	Yes (1)
No meal & other frills	No free in-flight service – Lowest Fare	Yes (1)
	No free in-flight service - Highest Fare	Yes (1)
	No unrestricted checked baggage – Lowest Fare	Yes (1)
	No unrestricted checked baggage - Highest Fare	Yes (1)
	No FFPs - Frequent Flyer Programs	Yes (1)
Auxiliary Services	Meals Pre-booking, Excess Baggage choice, Prompt check-in	Yes (1)
No Primacy Check-In	No Primacy Check-In - Lowest Fare	Yes (1)
	No Primacy Check-In – Highest Fare category	Yes (1)

Source: Self Compilation

ISSN 2394 - 7780

Total fleet size and type of aircraft plays very crucial role in operating cost of an airline hence are very crucial for the sustainability of an airline. Aircraft can contribute in respect of it's efficiency, less fuel cost, higher performance, higher utilization, block hours, operating performance, seating comfort, capacity breakups & distribution and so on. Airlines treat the homogeneity of fleet as a strategic move to achieve competitive advantage. Here, the Fleet Evenness Index (FEI) is calculated as the total number of air plane of the same maker to the total fleet size. If an airline have 50 airbus out of total 150 it means it has FEI is .33 (50 /150 = .33).

Point to Point connections means direct services to the city pairs. Code sharing implies the expansion strategy of the airline to cut the operating expenses on economy of scale basis. Single fare means the airline charge same ticket prices while more than one fare means charging more than one ticket price on the basis of third degree of price discrimination. If the airline offer more than one fare then the value for the particular criteria will be 0.5.

Single class cabin means if the seats are same i.e. economy class. If an airline has all the three class Economy, first class and executive class then the criteria value is taken 0.33, if it has two class services then the value is taken 0.5. Distance covered or Flight time is considered as the criteria for short haul & long Haul flights. If airline serves both short and long haul flights, its value is 0.5, if only short haul flights then its value is taken 1.*No Frills* and *No Priority Checks* define the additional ancillary services for the airline and taken as value 1 if yes.

RESULTS (REFER APPENDICES):

Table-1.3: Shows the values for LCC indexing.

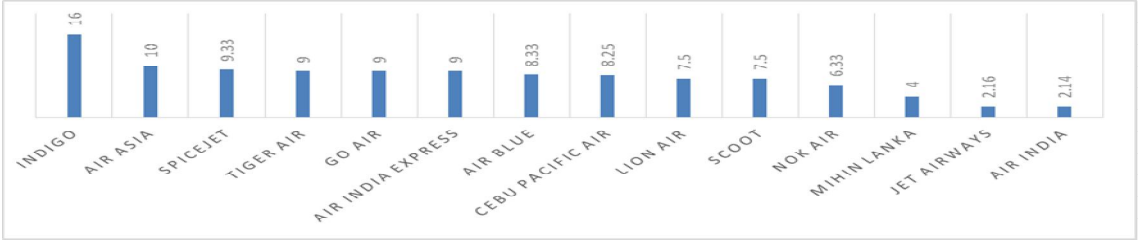
Type	Airline	Value
Pure LCC	Indigo	16.00
Hybrid Carrier with dominating LCC characteristics	Air Asia	10.00
	SpiceJet	9.33
	Tiger air	9.00
	Go Air	9.00
	Air India Express	9.00
	Air Blue	8.33
	Cebu Pacific Air	8.25
Hybrid Carrier with dominating FSC characteristics	Lion Air	7.50
	Scoot	7.50
	Nok Air	6.33
Full Service Carrier	Mihin Lanka	4.00
	Jet Airways	2.16
	Air India	2.14

Source: Self Compilation

For the determination of distinctive, airlines which have a value 16 are branded as Pure LCC Business Models, those with values between 8 to 10 are 'Hybrid Carrier with overlooking LCC characteristics', the ones with values between 5 to 7.5 are 'Hybrid Carrier with overlooking FSC characteristics' and the remaining airlines with value below 5 are branded as Full Service Carriers.From the results, one can depict that only IndiGo with an index value of 16 is a pure LCC as it is still following the traditional Southwest Business Model. As Air Costa does not have the domestic license, so we can't consider Air Costa as an LCC as it is virtuously a regional carrier.

Results shows that 42 % (Total 6 Airlines) of airlines use one type of aircraft family hence Fleet Evenness Index (FEI) ranges from 0.14 (Air India) to 1 (Indigo).Average value of FEI is 0.64.The average value of point to point & no code sharing criteria is 0.5 that means half of the mentioned airlines are using point to point network and are not indulge in any code sharing agreement with any other airlines.

Figure 1.1 - LCC INDEX VALUE



ISSN 2394 - 7780

Based on the value zero or one w.r.t each criteria, the average value is calculated. For example if an airline is indulged in code sharing the average is given .5, if any airline has three types of aircraft family then the average is given 0.33.Given equal weightage to all the criteria, the consolidated LCC index is developed as shown in table 1.4 below.

Table-1.4: Consolidated LCC Index

Airline	***Value***
Indigo	1
Air Asia	0.63
SpiceJet	0.58
Tiger air	0.56
Go Air	0.56
Air India Express	0.56
Air Blue	0.52
Cebu Pacific Air	0.51
Lion Air	0.46
Scoot	0.46
Nok Air	0.39
Mihin Lanka	0.25
Jet Airways	0.13
Air India	0.13
Average Value	**0.48**

Table displays the airline ranking conferring to the consolidated LCC index. With value 1, Indigo Airlines shadow the textbook traditional LCC business model while on the other hand Air India, Mihin Airline and Jet Airways has value as low as 0.25 and 0.13 hence these airlines must not be in the list of Low Cost Carriers. The mean value of consolidated LCC Index is 0.48 indicating a high degree of hybridization amongst the mentioned airlines. Main stream of the airlines counting Air Asia which once announced itself as a pure LCC, now are whirling hybrid though retaining dominating LCC features in order to race against the FSCs and their low cost subsidiaries.

CONCLUSION

In South East Asia, the airlines are tweaking their business model and focusing on hybrid business models in order to infringe on markets that have so far been the reserve of legacy carriers. Our study confirm the hybridization of South East Asian airlines (Through mean value of consolidated LCC index i.e.0.48).Hence few of the low cost carriers are also tweaking their core traditional low cost business model to the hybrid one & vice versa; to get competitive advantage & sustainability in airline industry.

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APPENDICES

Business Model Technicalities	**Criterion for each Technicality**	**Tiger Air** (TigerAir, 2016)	**Scoot** (http://www.flyscoot.com/en/, 2015)	**Air Asia** (AirAsia, 2016)
Single Aircraft Type	Fleet Evenness Index (FEI)	1 type: A320 family	2 type: B777-200, B787-900	A320
Point-to-point	Airline has point-to-point connections only	No (0)	No (0) : Maximum of the flights are via Singapore only	Yes (1)
No Code sharing	Airline has no code sharing agreement with other carrier	No (0) : Code sharing agreement with Cebu Pacific	No (0) : Code Sharing Partnership with Tiger Air, Australia, Silk Air, Nok Air, Singapore Airlines, Virgin	Yes (1)
Only one one-way fare per flight available at each point in time	Airline operating each flight with single fare only	No (0)	No (0) : More than 3 fares per flight - Fly, FlyBag etc.	No (0) : Two different fares - Low Fare and Premium Flex
	Airline operating each flight with only two fares	Yes (1)	No (0) : More than 3 fares per flight - Fly, FlyBag etc.	Yes (1)
Class cabin - Single	Airline operating with only one class cabin	Yes (1)	Yes (1)	Yes (1)

ISSN 2394 - 7780

Flying Distance per flight	Short Haul (Less than 4 Hours only)	Yes (1)	Yes (1)	Yes (1)
	Long Haul (Greater than 4 Hours only)	No (0)	No (0)	No (0)
No meal & other frills	No free in-flight service – Lowest Fare	Yes (1)	Yes (1)	Yes (1)
	No free in-flight service - Highest Fare	No (0)	No (0)	No (0)
	No unrestricted checked baggage – Lowest Fare	No (0)	Yes (1)	Yes (1)
	No unrestricted checked baggage - Highest Fare	No (0)	No (0)	No (0)
	No FFPs - Frequent Flyer Programs	Yes (1)	Yes (1)	No (0)
Auxiliary Services	Meals Pre-booking, Excess Baggage choice, Prompt check-in	Yes (1)	Yes (1)	Yes (1)
No Primacy Check-In	No Primacy Check-In - Lowest Fare	Yes (1)	Yes (1)	Yes (1)
	No Primacy Check-In – Highest Fare category	Yes (1)	No (0)	No (0)

Table-1.5: Analysis of South-East Asian Airlines – Tiger Air, Scoot and Air Asia

Business Model Technicalities	**Criterion for each Technicality**	**Cebu Pacific** (CebuPacific, 2015)	**Lion Airhttp://www.lionair.co.id/lion-experience/about-us**	**Nok Air** (NokAir, 2016)
Single Aircraft Type	Fleet Evenness Index (FEI)	4 types: A320, A330, A319, ATR 72	2 types: B737 family, MD-90	3 types: B737 family, ATR 72
Point-to-point	Airline has point-to-point connections only	No (0)	No (0)	No (0) : via Bangkok
No Code sharing	Airline has no code sharing agreement with other carrier	No (0): Airline has code sharing agreement with Tiger Air	No (0): Airline has code sharing agreement with Wing Air	No (0): Airline has code sharing agreement with Scoot Airlines
Only one one-way fare per flight available at each point in time	Airline operating each flight with single fare only	No (0): Airline operating each flight with Three different fares - Fly, Fly Bag, Fly Bag Meal	No (0) : Airline operating each flight with Business, Economy, and Promo fares	No (0) : Airline operating each flight with NokEco, Nok Flexi

ISSN 2394 - 7780

	Airline operating each flight with only two fares	No (0): Airline operating each flight with Three different fares - Fly, Fly Bag, Fly Bag Meal	No (0) : Airline operating each flight with Business, Economy, and Promo fares	No (0) : Airline operating each flight with NokEco, Nok Flexi also has Promotion fares at times
Class cabin - Single	Airline operating with only one class cabin	Yes (1)	No (0) : Airline operating with Economy and Business Class	Yes (1)
Flying Distance per flight	Short Haul (Less than 4 Hours only)	Yes (1)	Yes (1)	Yes (1)
	Long Haul (Greater than 4 Hours only)	No (0)	No (0)	Yes (1)
No meal & other frills	No free in-flight service – Lowest Fare	Yes (1)	Yes (1)	No (0)
	No free in-flight service - Highest Fare	No	Yes (1)	No (0)
	No unrestricted checked baggage – Lowest Fare	Yes (1)	Yes (1)	No (0)
	No unrestricted checked baggage - Highest Fare	No (0)	Yes (1)	No (0)
	No FFPs - Frequent Flyer Programs	Yes (1)	No (0)	Yes (1)
Auxiliary Services	Meals Pre-booking, Excess Baggage choice, Prompt check-in	Yes (1)	No (0)	No (0)
No Primacy Check-In	No Primacy Check-In - Lowest Fare	Yes (1)	Yes (1)	Yes (1)
	No Primacy Check-In – Highest Fare category	Yes (1)	Yes (1)	Yes (1)

Table-1.6: Analysis of South-East Asian Airlines – Cebu Pacific, Lion Air and Nok Air

Business Model Technicalities	Criterion for each Technicality	Indigo	Spicejet	Go Air	Air India Express
Single Aircraft Type	Fleet Evenness Index (FEI)	1 type: A320-200	3 type : B737-900, B737-800, Q400	1 type: A320s	1 type: B737s
Point-to-point	Airline has point-to-point connections only	Yes (1)	Yes (1)	Yes (1)	Yes (1)
No Code sharing	Airline has no code sharing agreement with other carrier	Yes (1)	Yes (1)	Yes (1)	Yes (1)

ISSN 2394 - 7780

Only one one-way fare per flight available at each point in time	Airline operating each flight with single fare only	Yes (1)	No (0) : Airline operating each flight with two fares i.e. Regular, Spice Flex	No (0) : Airline operating each flight with four types of fares	No (0) : Airline operating each flight with two fares
	Airline operating each flight with only two fares	Yes (1) - Airline operating each flight with only two fares	Yes (1) - Airline operating each flight with only two fares	No (0) : Airline operating each flight with four types of fares	No (0) : Airline operating each flight with more than two fares
Class cabin - Single	Airline operating with only one class cabin	Yes (1); Airline operating with only one class cabin	Yes (1); Airline operating with only one class cabin	No (0); Airline operating with only one class cabin	Yes (1); Airline operating with only one class cabin
Flying Distance per flight	Short Haul (Less than 4 Hours only)	Yes (1)	Yes (1)	Yes (1)	Yes (1)
	Long Haul (Greater than 4 Hours only)	Yes (1)	No (0)	Yes (1)	Yes (1)
No meal & other frills	No free in-flight service – Lowest Fare	Yes (1)	Yes (1)	Yes (1)	No (0)
	No free in-flight service - Highest Fare	Yes (1)	No (0)	No (0)	No (0)
	No unrestricted checked baggage – Lowest Fare	Yes (1)	No (0)	No (0)	No (0)
	No unrestricted checked baggage - Highest Fare	Yes (1)	No (0)	No (0)	No (0)
	No FFPs - Frequent Flyer Programs	Yes (1)	Yes (1)	Yes (1)	Yes (1)
Auxiliary Services	Meals Pre-booking, Excess Baggage choice, Prompt check-in	Yes (1)	Yes (1)	Yes (1)	Yes (1)
No Primacy Check-In	No Primacy Check-In - Lowest Fare	Yes (1)	Yes (1)	Yes (1)	Yes (1)
	No Primacy Check-In – Highest Fare category	Yes (1)	No (0)	No (0)	Yes (1)

Table-1.8: Analysis of South-East Asian Airlines – Indigo,SpiceJet,Go,and Air India Express

Business Model Technicalities	Criterion for each Technicality	Air India	Jet Airways	Air Costa	Air Blue	Mihin Lanka
Single Aircraft Type	Fleet Evenness Index (FEI)	7 types	6 types	2 types	3 types	A320, A321
Point-to-point	Airline has point-to-point connections only	No (0)	No (0)	Yes (1)	Yes	No (0)
No Code sharing	Airline has no code sharing agreement	No (0)	No (0)	Yes (1)	Yes	No (0)

ISSN 2394 - 7780

	with other carrier					
Only one one-way fare per flight available at each point in time	Airline operating each flight with single fare only	No (0)	No (0)	Yes (1)	No (0)	No (0)
	Airline operating each flight with only two fares	No (0)	No (0)	Yes (1)	No (0)	No (0)
Class cabin - Single	Airline operating with only one class cabin	No (0)	No (0)	No (0)	Yes (1)	No (0)
Flying Distance per flight	Short Haul (Less than 4 Hours only)	Yes (1)	Yes (1)	Yes (1)	Yes (1)	Yes (1)
	Long Haul (Greater than 4 Hours only)	No (0)	No (0)	Yes (1)	Yes (1)	No (0)
No meal & other frills	No free in-flight service – Lowest Fare	No (0)	No (0)	No (0)	Yes (1)	No (0)
	No free in-flight service - Highest Fare	No (0)	No (0)	Yes (1)	No (0)	No (0)
	No unrestricted checked baggage – Lowest Fare	No (0)	No (0)	No (0)	Yes	No (0)
	No unrestricted checked baggage - Highest Fare	No (0)	No (0)	No (0)	No (0)	No (0)
	No FFPs - Frequent Flyer Programs	No (0)	No (0)	Yes (1)	No (0)	No (0)
Auxiliary Services	Meals Pre-booking, Excess Baggage choice, Prompt check-in	No (0)	No (0)	Yes (1)	No (0)	No (0)
No Primacy Check-In	No Primacy Check-In - Lowest Fare	Yes (1)	Yes (1)	Yes (1)	Yes (1)	Yes (1)
	No Primacy Check-In – Highest Fare category	No (0)	No (0)	Yes (1)	No (0)	No (0)

Table-1.9: Analysis of Indian FSC & Regional carrier along with airlines from Pakistan and Sri Lanka

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MEMORY AND HISTORY IN TODOROVION PROSPECTIVE

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ABSTRACT

In recent years memory has become an important subject of study. This is not surprising as throughout the twentieth century war narratives and memoirs about the Holocaust had gradually emerged as important witness accounts in which memory played a central role. As a result, many thinkers and writers subjected the use of memory in documents, history and literature to rigorous scrutiny.

There may be a fresh question in a mind: why should we remember that "Age of Darkness" in the 21st century? The situations, conditions, problems and humans are different now. Now we don't have colonial powers. We don't have colonies. Europe is no more at the centre of the world. The world has taken a democratic shape. There is no scarcity of the arguments against the 'Memory' of the past century. An extremist may declare all attempts of 'preserving memories' of the past century as a pure pass time. One of the most significant difference between humans and other 'animals' , perhaps, is the ability of humans to 'talk' about 'past' 'present' and 'future' time.

THE MATTER

As a narratologist, TzvetanTodorov's early work pertained to the theoretical dimensions of narratives. But in the nineties, Todorov began to expand his areas of study. In the tradition of French intellectuals, he began to write on important philosophical issues. Consequently, he chose to probe into the theoretical, historical and philosophical dimensions of memory. This resulted in the writings by him of a series of books in which the theory and praxis of memory are considered in detail.

The central work in Todorov's writings in which he discusses memory is Hope and Memory: The Lessons from the Twentieth Century (2003). In it Todorov asserts that freedom is the most important value for human beings. But he considers the twentieth century as the century of death and devastation, whose memory would always remain fresh in mind due to copious records of what transpired during the period.

In Todorov's works memory remains the central thread that binds together the issues that he discusses. However, one has to distinguish between memory and history which deals with 'recorded past'. Memory is personal to an individual and usually lacks 'proof' and 'evidence'. It is highly subjective in nature. History is considered as 'factual' and 'objective' documentation of the events in reference to some 'national' 'religious' 'Geographical' referent. History always claims to be 'truthful'. It is 'recorded' by 'experts'.

In the "Foreword" to the English translation of French historian Pierre Nora's monumentalLeslieux de mémoire (Realms of Memory [1984–1992]), Lawrence D. Kritzman observes that "memory is to be understood in its 'sacred context' as the variety of forms through which cultural communities imagine themselves in diverse representational modes. In this sense 'memory' distinguishes itself from history, which is regarded as an intellectual practice more deeply rooted in the evidence derived from the empirical reality." (Quoted in Todorov 2003: ix)

In "Between History and Memory," the general introduction to his opus, Nora distinguishes between "places" and "settings" of memory, arguing that the former exist because the latter are no longer "a real part of everyday experience" (1) and that in the absence of the latter we are left with "reconstructed history" (6). He later goes on to express the tensions between history and memory: "Memory is always suspect in the eyes of history, whose true mission is to demolish it, to repress it (7) A generalized critical history would no doubt preserve some museums, medallions, and monuments as material necessary for its own work but would drain them of what makes them, for us, lieux de mémoire" (3). For Nora, historiographical reflection (the history of history, or reflection of history as a practice) is key to the liberation of history from "memory's grip" (4); only when that happens can memory "become a possible object of history" (4).

But there is a strong case in favour of those that literary and cultural critics who argue that historical memory is a way of constructing the past. Many posit in the same vein that, in any case, it involves the construction of plural memories. In the end:

What really matters about the past is its effective and affective memory, the traces that it has imprinted on individual minds and on political practices and institutions, even if it is not 'remembered.' The facts are not the truth, and many facts of the past have no bearing on the present. (Martín-Estudillo and Spadaccini 228)

ISSN 2394 - 7780

Here it is evident that memory is not a simple concept and as it is concerned with past and its reconstruction, it overlaps with many acts of retrieval. At one extreme, we hear the following warning from a scholar of memory, Siobhan Kattago in his article "The Slippery Slope of Memory" states that "Too much memory makes one slave of the past, while forgetfulness denies history and one's own link to the past." (Kattago 15)

One cannot deny that memory is subject to the competence and attitudes of the individual. One can give his/ her response to an event or condition of some place in accordance with the 'realities' known to him/her. Thus, it can be said that the memory of an individual cannot always be 'memory of masses'. One must assert that all the differentiation between memory and historyis schematic and based on simplification. It is sometimes unavoidable in order to establish a common ground on terms.

Perhaps, by "history" people mean the discipline of scholarly research and the product of that research: a work of a historian who presents a picture of the past on the basis of the analysis he or she undertakes. Memory presents a subjective picture of the past, whereas in writing history a professional historian worth his salt strives to get a picture of the past from all sides, grounded on evidence. Memory does not need evidence. Instead it needs an emotional drive to preserve some episode of history. This episode of history carries the personal and subjective 'report' of the event. While history has a distinctive temporal relationship to the past, memory lacks such a distance; it is instead distinguished by a non-temporal sense of the past in the present by its inherent "present-ness." Hence, for memory that is shared by an individual, the past is not really the past which is gone, passed away, it is rather the past which persists, passes through, haunts, heals, disturbs and thus influences the present.

History is driven by the end goal of discovery of something new which was not known before. Memory is more strategic in its essence; it is driven by ever changing present needs. Due to its relationship to diverse needs and interests of the individual or group the memory may be cultural memory. Conflicts and tensions of the individual or group are buried in memory. In light of this, no wonder it is memory that is often metaphorically presented in the research as a battlefield, struggle or even a war. What is more, memory is opposed sometimes to history by its tendency to mythologize the past and appeal to emotions.

Despite a rather long list of differences, it cannot be denied that history and memory influence each other. Historians turn their attention to memory as a result of many theoretical "turns" in humanities: cultural, linguistic, spatial, and emotional. Hence, interest in memory has always been connected to symbols, space, imagination and emotions.

THE DEPT

Todorov's writings on memory grapple with the problems that arise when it is contrasted with history, and when attention is drawn to its subjective dimensions. In this regard, Nathan Bracher discusses some of Todorov's problematic and contentious ideas about memory in 'History, Memory and Humanism in the Recent Writings of TzvetanTodorov.' (*South Central Review 15.3-4 (Fall-Winter 1998): 38-46.*)According to Nathan Bracher, Todorov prefers "exemplary memory" over "literal memory".

Todorov contrasts the dangers of "literal memory" with the advantages of "exemplary memory". Literal memory clings to the specificity of past events, retelling them over and over as if to recall them from oblivion. On a personal level, such an approach is perfectly understandable. On a collective level, however, literal memory proves to be highly problematical, particularly because of its tendency not only to isolate certain events and make them sacred, but also to refuse to examine these specific events in the context of universal history. When certain events are viewed as "belonging" to such and such group, they tend to be instrumentalized and cited as pretexts for all sorts of political agendas. The result can be the perpetuation not only of resentment and rancor, but also of fixed categories of victims and perpetrators along lines of race, ethnicity, and national origin. For Todorov, the events in Bosnia have provided a tragic example of the failure to go beyond the past and of the excesses of "literal memory." "Exemplary memory," on the other hand, revisits the past from the perspective not of the interests of any specific group but of our common humanity. "Exemplary memory" is thus motivated by a desire not just to recall the crimes and injustices, but to understand-but not excuse or trivialize-what such iniquities teach us about human nature and society. Again, it is such understanding, argues Todorov, that is best suited to combating present and future evils. (Bracher 43)

The philosopher Mary Warnock claims that memory is 'essentially emotional in character': 'Since it can be called knowledge, its object is what is true. But the truths are of the heart not of the head' (Warnock 1987, 90). Maria Holmgren Troy also refers to the emotional character of memory, referring to a specific 'mode of knowledge' that is 'non-cognitive, non-linear, and affective' (Holmgren Troy 2007: 50). One important aspect of this non-cognitive and affective character of memory is that it cannot be mediated objectively, like the

ISSN 2394 - 7780

mathematical truth 1+2=3, but has to be a part of the current context of remembering, the choice of words, metaphors, mode of narration and so on. It can be said that memory cannot be represented directly, in a pure, unmediated way, but always has to be the result of a process of 'remembering', in which distraction, associative and wishful thinking is possible. The truth represented by memory and autobiographical texts is the result of an intimate combination of fiction and fact. However, it is important to underline that Eakin does not wish to dismiss the claim of truth in an autobiographical text, but asserts the need to identify an alternative truth, a truth that he defines in terms of an 'autobiographical truth' (Fictions in Autobiography, 1985).

Eakin claims that the intimate relation between fiction and memory could be explained by the fact that memory cannot be isolated to a fixed point in the past, but has to be considered both as a fragment of an actual perception in the past, and as the result of a narrative process, evolving in present time, a process which is intimately connected with the individual's attempt to create meaning in his or her life. Eakin writes: 'I shall argue that autobiographical truth is not a fixed but an evolving content in an intricate process of self-discovery and self-creation ...' (Eakin 1985, 3).

Hence the study of memory texts such as autobiographies, testimonies and diaries, has to be related to both the documentary and poetic genres. This double extraction of memory has resulted in a consensus within memory research, defining two main functions of memory. In his introduction to The Poetics of Memory, Thomas Wagenbaur defines memory on the one hand as storage and on the other hand as a story. In agreement with current trends in memory research, he underlines the importance of the narrative and poetic dimensions of memory, in contrast to the memory's function as storage of information from the past:

The major achievement of memory is not to remember what has actually happened, but a constant distinction between recollection and forgetting. In some sort of internal monologue the brain constantly tests viable network patterns, it tests the functionality of its versions of reality constructions, i. e. its narratives. (Wagenbaur 1998 68)

This work is comprised of articles on memory with anthropological, sociological, philosophical, psychological as well as literary theoretical standpoints. The Poetics of Memory is considered in terms of a work of literature's specific ability to construct true images of the past: 'autobiographical truth', 'non-cognitive', 'affective knowledge'. The poetics of memory is also concerned with the cultural and political process of selection, in which structures of power and political interests contribute in creating grand narratives and myths. 'Poetical' patterns, inclined to affect both the collective writing of history and individual remembering. To what extent are memory and historical writing dependent on the artistic depiction of the past? How does art affect our perception of reality? As we will see, Todorov is also concerned with these questions. He also considers the epistemological development of representation and the crisis of representation in the post-modern context that is related to the political and social transformation within totalitarian and post-totalitarian countries such as Bulgaria, China, South Africa and Russia. Questions are raised by him concerning the difference/similarity between modernity and totalitarianism, post-modernity and post-totalitarianism, focusing on the crisis of representation, on the one hand, and the increasing fascination with individual memory and historical documents on the other.

'History' and 'memory' are usually considered a different critical category, since all history is memory as perceived by the author or, an interpretation of the past by the writer. Perhaps everyone agrees that there are many examples of the deliberate misinterpretation of history to satisfy certain political ends. Sometimes misinterpretation of the history is encountered to change citizen's/people's memories. Memory is only valid for the person who experiences the historical event, and is always a synthesis of facts. For example, after traumatic incidents there are often very different accounts of what happened.

'Memory' may be a collective myth shared by a group / community / society. It may be common in anti-totalitarian / postcolonial / democratic writings. These memories are not personal, but inherited through storytelling with its concomitant 'distortion' of details. Memory and history are constructions of the past, though the factual elements of mythological memory are often difficult to identify. Such myths, by a 'glorification' of the past, contribute to linking past and present in the formation of a contemporary stance, and can have a therapeutic effect. One can ask whether his / her identity is dependent on his / her history, tempered by memory and myth. Hayden White has suggested there is a tension between what he defines as the two aspects of memory, the 'traditionalized memory' which is "information about, and accounts of the past that are latently stored in its corpus of traditional lore" and 'rationalized memory' which is about "the community's past" - written and accessible (2000: 53). As people see memory and history take very different forms in postcolonial writing. For countries and peoples exposed to violent and traumatic events such as slavery,

ISSN 2394 - 7780

displacement, representation necessitates a coming to terms with the trauma. Particularly in the field of myth and memory we can thus ask whether memory is selective, leading to amnesia. Do myths and memories become a symbol of subjugation, and a way of dealing with traumas of the past? For settler emigrants, on the other hand, memory and history become conflated, and the glorification of a former life, by oneself or one's ancestors, is a key to present belonging.

CONCLUSION

The act of remembering is positive for some, whereas for others it is traumatic, as we see in Naipaul's fiction which explores the complexities of truth.

Todorov opts for this "exemplary memory" in defense of democracy and against all types of totalitarianisms. Todorov's emphasis on the need for exemplary uses of memory in defense of democracy and against all types of totalitarianisms is also shared by many who have participated in these discussions with specific reference to Spain. At the same time it is clear that democratic Spain's complex political situation—from the years of its Transition to the devolution of power to the nationalities, to its protagonism in the European Union and involvement in an uncertain global economic order—has led to various reexaminations regarding the uses of memory to illuminate and act upon the present.

(Martín-Estudillo and Spadaccini 3)

Todorov asserts that the history of the twentieth century in Europe cannot be separated from the history of totalitarianism. The original totalitarian state, Soviet Russia, arose in the course of the Great War, and as a consequence of it, and thus bears the mark of that war very deeply. Nazi Germany followed soon after. The Second World War began with the two totalitarian states in alliance and turned into a merciless battle between them. The second half of the century was structured by the Cold War between the West and the Communist world. So the century that recently ended was dominated by the battle between totalitarianism and democracy and by the shorter struggle between the two branches of totalitarianism itself.

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HYDRAULIC PERFORMANCE OF SHOWERHEADS AS WATER SAVING DEVICE AND IMPROVING THE PERFORMANCE BASED ON THE HYDRAULIC AND GEOMETRICAL PARAMETERS

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ABSTRACT

Both water and energy conservation with water-efficient technologies is extremely beneficial to the environment. The water conservation is defined as any action that reduces the amount of water withdrawn from water supply sources, reduces consumptive use, reduces the loss or waste of water, improves the efficiency of water use, increases recycling and reuse of water, prevents the pollution of water. The shower heads used in bathroom reduce the water consumption by the process of aeration. This helps to reduce the usage of water, results in non-splash flow hence these fittings in bathrooms acts as water saving device. These devices (shower head and faucet aerators) are simple to install and cost effective (Cost range between Rs.200-Rs600) for normal usage at domestic and industrial installations. If we use aerators on the faucets and shower heads, we can save money on our heating and water bills. Previous works have revealed that users' requirements include temperature stability, adequate water volume and distribution, and skin pressure, all of which are substantially controlled by the shower head.

The experiments are carried out at the Fluid Mechanics Laboratory, MVJ College of Engineering, Bangalore wherein the hydraulic test rig was installed for conducting the performance test on shower heads. The main aim of the project is to conserve the water by usage of shower head, to assess the hydraulic performance of existing commercial shower heads and to determine the most suitable type. The effectiveness of spray of water, mixing of air based on existing and modified geometry of shower heads is analysed. The computational method are used to validate the obtained results

Keywords: Air, water, conservation, hydraulic, performance, geometry, pipe, flow rate, pressure, pipeline, shower head

1. INTRODUCTION

Average home water use varies from 190 to 285 liters per person per day and breaks down as follows: toilet 42%, bathing 32%, laundry 14%, kitchen 8% and cooking 4%. Domestic water use outdoors usually amounts to 50-60% of total domestic use. The Water Saving Devices is simply defined as the diverse methods employed to emphasize water savings and water efficiency without jeopardizing convenience to the end user. The faucet aerator and shower heads reduce the water coming through these devices by mixing it with air. The shower head geometry acts as a sieve, sending a single flow of water into many tiny streams. This introduces the air into the water flow. Since there is less space for the water to flow through, the water flow is reduced. The wastage of water is avoided by giving encouragement for the usage of water-saving devices such as aerators, showerheads in hotels, residential and public toilets.

The aim is to reduce the water input (up to 50%) without sacrificing the consumer satisfaction. The hydraulic performances of commercial shower head (using experimental and numerical methods) as water-saving devices are determined and suggestions are made for improvement in water-saving devices based on hydraulic (line pressure, flow-rates) and geometrical parameters (reducing or increasing mesh size). The standard shower head are small in size but can create significant water savings. The Water Management can be divided into 2 groups:-

- System Users – Household, Industry, Agriculture.
- System Operators – Municipal, State & Local Government and Private suppliers

In the present day scenario, water conservation is a necessity. This is done by minimizing the water input.

The shower head govern the flow rate less than 10 liters/ min allowing the entrainment of air thereby result in fine droplets. Correspondingly the volume of water used is reduced. The low flow device results in water savings up to20%-50% of the normal usage.

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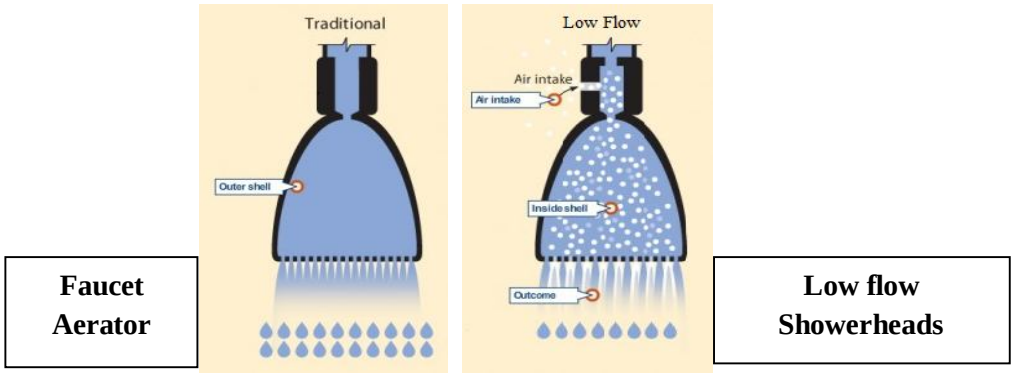

Fig-1.1: Water Saving Devices – Shower Head

Improved shower head compress the water flow into a higher-pressure discharge than regular shower head. They also introduce air bubbles into the water, making it feel like there is a larger water flow. However, the water pressure is maintained, which is why most people don't notice a difference in the amount of water coming out of a shower head.

Some shower head are coming with the flow restrictors. Essentially, this is a temporary "off" switch. A restrictor will turn the water off at the nozzle with a quick flip of a lever. When we need the water, another quick flip starts it flowing again. It's one more feature to help us save water.

The improved shower head can be used in residential and commercial buildings bathrooms as well as in public building which are installed with flushing systems, taps, shower-heads, etc.

2.0 NEED FOR THE STUDY

Laminar flow controls deliver a precise volume of water at faucets, showerheads, and hose outlets. Unlike conventional water-saving fixtures that deliver varying flow rates in response to varying line pressure – NAHB Research Center, Upper Marlboro, Maryland, 1992.

During 1994-1997, the New York City Department of Environmental Protection (DEP) has installed water-saving devices in faucets and showerheads as a part of the water conservation project. An important evaluation of project results in multi-family buildings found an average reduction in water use up to 29% or 315 Liters per apartment per day.

European Standard for faucet aerators and shower head was given by NEOPEARL, Inc.171 Mattatuck Heights Waterbury, CT 06705, in 2000 and is as given in Chart 1. Bassam Hasbini (2003) and T.Kondo (2006) has carried out experimental study on different types of faucet aerator, shower heads and highlighted the importance of faucet spray, stop valve on water and energy saving

In our country a limited study is carried-out on “water-saving devices” is mainly carried by few leading research institutions in the country like FCRI, Palakkad, and CWRDM, Kozhikode (on sprinklers). M/S Parryware and M/s Hindware companies have brought out several water-saving fixtures in the market. They have suggested the following measures along with use of water saving devices:

- Installing high-pressure, low volume nozzles on spray washers;
- Using fogging nozzles to cool product;
- Replacement of high volume hoses with high-pressure, low volume flush toilet.

Ranganathan (2007) carried a limited study on Water Efficient Faucets and Fixtures in Home. The Critical dimensions for water efficient flushing are used based on computer simulation techniques. Umesh V (2014) obtained the results for hydraulic performance of faucet aerator.

All the above study does not clarify the mechanism of water saving in a shower head. It has also not suggested any governing parameters responsible for water saving in these devices. The present study aims at the following:

- To determine the water-saving of existing shower head based on experimental investigations.
- To verify their claim for water saving.
- To suggest modifications in design to further improve their performance.

ISSN 2394 - 7780

3.0EXPERMENTAL SET-UP& METHODOLOGY

The hydraulic-rig performance tests of 3 different types of shower heads (Make: Jaguar, Kohler, Viking, Table-1) were conducted using the hydraulic-test rig at the *Fluid Mechanics Laboratory, MVJ College of Engineering, Bangalore* at different line pressures (1.2, 1.0 & 0.5 kg/cm^2). The hydraulic test rig (Fig. 3.1) consists of a recycling tank, a 1.5 HP water pump is employed to deliver the water from the recycling tank to the test outlets via the manifold at different flow rates which can be controlled using a valve provided, six steel pipes (laterals) of different diameter, located equidistant, emerge from the manifold to handle a variety of water saving devices. The diameters of the laterals provided are ½", ¾", 1", 1.25", 1.5"& 2". The time required in seconds(s) for a flow of ten (10) litres (l) was calculated for 3-different line pressures. The flow rate is correspondingly measured. Experiments were carried out with & without shower head to estimate the water savings for the three model (for ½ "pipe size) for a given pressure, and temperature. The percentage of water savings is therefore calculated for the available models, hence the determination of the most efficient model shower head.

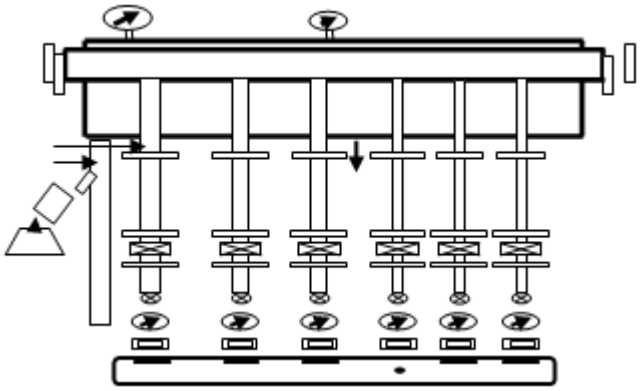

Fig-3.1: Experimental Set-Up

3.1 Shower Head Parts: A showerhead basically comprises of (Fig. 3.2):-

- A pressurized water supply path (laterals) capable of supplying pressurized water to both the pressurized water jet holes and the jet nozzle.
- A shower arm made of steel connecting the lateral pipe to the main showerhead.
- A shower head main body having one or more of ejector mechanisms each comprising of a jet nozzle and an air-liquid mixing tube provided via an air absorption member.
- Pressurized water jet holes having small diameters passing through the shower discharge member.
- An annular projecting member projecting from the shower discharge member so as to surround the discharge outlet.

Shower Head type	Physical Properties	No. of meshes	Area of air passage (cm)^2	Area of flow (cm)^2	Blockage (%)
Model1 (Jaquar)	Stainless steel body 36 small holes of 1mm	2 (dissimilar)	0.188	0.282	23
Model2 (Kohler)	Stainless steel body 67 small holes of 0.5 mm	1	0.08	0.1315	11
Model3 (Viking)	Stainless steel body 45 small holes of 0.75mm	2 (dissimilar)	0.125	0.122	10

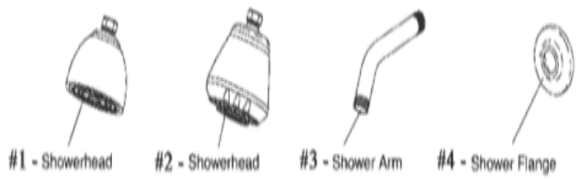

Table-1: Shower Head Type and its Physical Properties

ISSN 2394 - 7780

Fig-3.2: Hydraulic Test rig

3.1 Theory

Percentage saving is determined using the formula:

%Saving = $\frac{Q_0 - Q}{Q_0} \times 100$

Where, %Saving – is the amount of water saved (%)

Q_0 - The flow rate obtained without using Water Saving Devices m³/sec

Q - The flow rate obtained after Water Saving Devices m³/sec

A_f & A_{air} are determined using the formula:

A_f = n*a

Where, A_f - is the area out flow m²,

n – The number holes on the model,

a – The area of each hole m².

$A_{air} = \pi d_m t$

Where, A_{air} - The area through which the air passes

d_m - The diameter of the air gap around the hole,

t – The thickness of the air gap.

4.0 RESULTS AND DISCUSSIONS

The shower head tested obeyed a simple pressure-flow relationship with flow being proportional to the square root of the internal pressure at the showerhead. $Q = k\sqrt{p}$

Where Q = flow rate in cm^3/sec, and p = Internal gauge pressure (kg/cm^2) in the shower head and 'k' is a form of discharge coefficient. This is in accordance with the theory for turbulent flow through a constriction. The value of the constant 'k' will depend on the nature of the constriction (and also on the units chosen for Q and p). The collected data is analysed to determine the water saving efficiency of the three different types of shower head at different flow rates and line pressure. To obtain the desired results the line size is also varied.

Table-2: Shower Head Hydraulic Performance

Model	Line Pressure kg/cm²	Flow rate cm³/sec	Reynold's number range	% Water saving
Model 1 (Jaguar)	1.2	0.0022	261840-36423	28.59
	1	0.002	249847-30182	25.93
	0.5	0.0014	179115-29268	18.93
Model 2	1.2	0.0017	213400-29700	44

ISSN 2394 - 7780

(Kohler)	1	0.0015	182900-31800	45
	0.5	0.0011	138200-39100	36
Model 3 (Viking)	1.2	0.00179	221844-32012	41
	1	0.00639	197201-16586	49
	0.5	0.00125	155295-44856	41

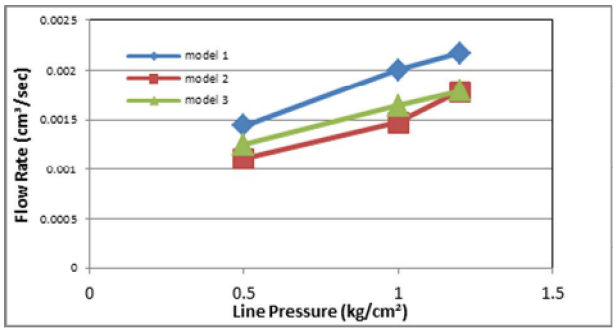

Fig-4.1: Variation of Flow Rate with Line Pressure

The above graph (Fig. 4.1 shows that, as the line pressure increases, the flow rate also increases.

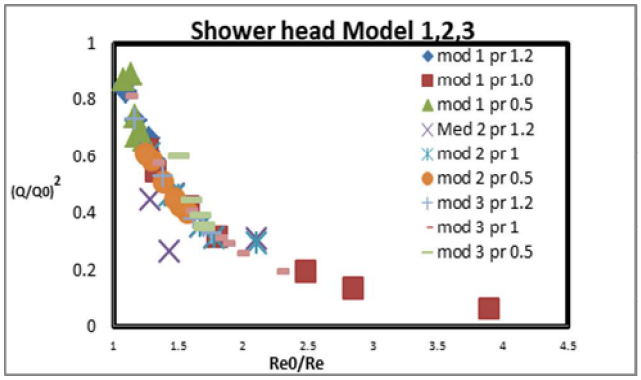

Fig-4.2: Variation of Ratio of Flow rate with Reynolds Number Ratio (With and without water saving device)

The above graph (Fig. 4.2) shows the dependence of water saving on pipe flow rate. For a given line pressure and flow rate there exist a unique value of water saving depending on the geometry of shower head, but as the line pressure increases, the flow rate and water saving percentage also increase

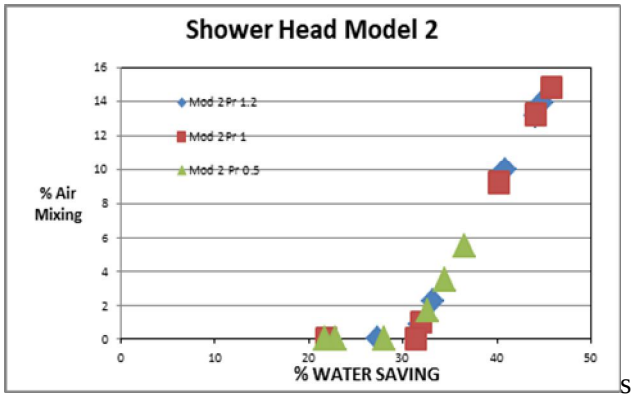

Fig-4.3: Effect of Air Mixing in Shower Head on Water saving

From the above graph (Fig.4.3) between % water saving with %Air mixing for a given shower head the graph clearly indicates that air mixes at the point where discharge in the shower head exceeds a critical value and the % water saving increases considerably. This is the point where air starts mixing with water in a shower head until this point there is no air mixing. In model 2 (Make: Kohler) we can see that air mixing starts very early compared to the other two models. Hence the physical parameters of shower head, air passage, hole size and its distribution from the centre and line pressure also plays a vital role

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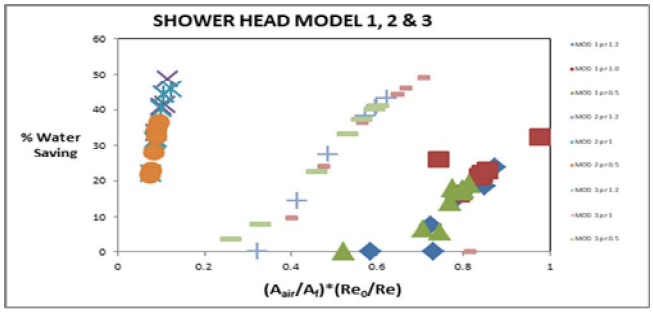

Fig-4.4: Variation of % Water Saving with Line Pressure and Flow rate

5.0 CONCLUSIONS

Based on the experimental results of the 3-shower heads of different geometrical configuration which are operated on similar hydraulic conditions (for a given pipe size) it is mesh compared to more number of mesh in shower head geometry.

- The length of air passage need to be equal to diameter of shower head for maximum saving of water for a given line pressure and flow rate.
- Figure 4.4 shows that 12.7mm pipeline is more effective as compared to 19.05mm pipeline for shower head as water saving devices. The maximum value of % water saving of 45% is reported for 12.7mm pipeline as against 32% in 19.05mm pipeline. Hence the mixing efficiency of air with water has more effect in 12.7mm pipeline for models of shower head.
- The graphical relationship is obtained for discharge with saving devices (Q) with main flow rate (Q_0) for different line pressures (1.2bar, 1.0bar, 0.5bar).
- The wire mesh of shower head should not occupy the entire portion of the flow area. For maximum saving of water the preferred ratio of pores in shower head to the total flow area should lie between 0.78-1.00.
- The mesh should have pores (hexagonal type) bearing the same dimensions to obtain a high efficiency.
- The maximum line pressure with maximum air entrainment can effectively bring about the greatest ability to save water.

6.0 ACKNOWLEDGEMENT

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APPLICATION OF REMOTE SENSING IN DISASTER MANAGEMENT WITH SPECIAL REFERENCE TO FLOODS

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ABSTRACT
Disaster has become an issue of growing concern throughout the world, whether it is of natural or anthropogenic origin. Disasters are events which occur individually or in combination with other events at different time and place. The frequency and magnitude of disasters threatens the large population living in diverse environmental impacts. Flood is one of the most destructive natural disaster causes more economic loss than other natural or technological disasters. Despite of the fact that floods cannot be ceased but damage can be minimized by proper management measures. Space borne remote sensing plays an important role in management of floods by rainfall monitoring, flood forecasting, river discharge measurement and flood depth, inundation extent, identification of elements at risk and vulnerability assessment.

Keywords: Disaster, Vulnerability, Space borne, Anthropogenic, Environment

INTRODUCTION
Natural and man-made disasters affect a huge population all over the world each year. Most of the disasters have the potential to cause grievous loss of life and destruction of property. These disasters are often unpredicted and can leave whole communities in shock.

Natural disasters are large scale geological or metrological events that have the potential to cause loss of life and property. Disaster management aims to reduce or avoid the potential losses from hazards, assures prompt and appropriate assistance to victims of disasters, and to achieve rapid and effective recovery. For this purpose there is a tool called disaster management cycle which illustrates the ongoing process by which we can plan for reducing the impact of disasters, reacting during and immediately following a disaster, and taking steps to recover after a disaster has occurred. There are mainly four phases in disaster management.

Figure-1: Disaster management cycle

Source: https://www.researchgate.net/publication/258343662_When_Disaster_Strikes_how_communities_cope_and_adapt_a_social _capital_perspective

REMOTE SENSING IN DISASTER MANAGEMENT
Remote sensing systems have been playing a great role in disaster management in areas such as flooding, cyclones, drought, earthquake and tsunami. Satellite remote sensing is largely adopted due to cost effectiveness, short temporal orbiting and large area coverage. Remote sensing technologies have been used in disaster management especially during the preparedness/ warning and response/ monitoring stage.

FLOODS
Floods are becoming more frequent around the world due to climate change, heavy rainfall, snowfall and dam failure are major causes of floods. Although it is difficult to prevent floods, it is possible to minimize their impact through proper management.

India is the country which is worst affected with floods after Bangladesh. Around 40 million hectares of land in India are subject to floods according to National flood commission, and an average of 18.6 million hectare of land is affected annually. The annual average cropped area affected is approximately 3.7 million hectares.

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FLOOD MANAGEMENT

Management of floods requires efficient planning measures, implementation and policy making decision, applications of modern scientific and communication tools for smooth functioning of the system.

Table No-1: Information required for preparing flood management plan

S.No.	Phase	Information Required
1.	Flood Preparedness (Measures to be taken before flood)	• Identification of persistent flood prone area • Proper information regarding the flood prone areas • Formulation of evacuation plans
2.	Relief and Rescue (Measures to be taken during flood)	• Identification of flood affected area • Generation of flood statistics • Updation of flood conditions
3.	Flood Mitigation (Measures to be taken after flood)	• Detection of change in river course • Estimation of flood relief and control works • Status of river bank erosion • Demarcation of flood risk zones

SPACE BORNE REMOTE SENSING IN FLOOD MANAGEMENT

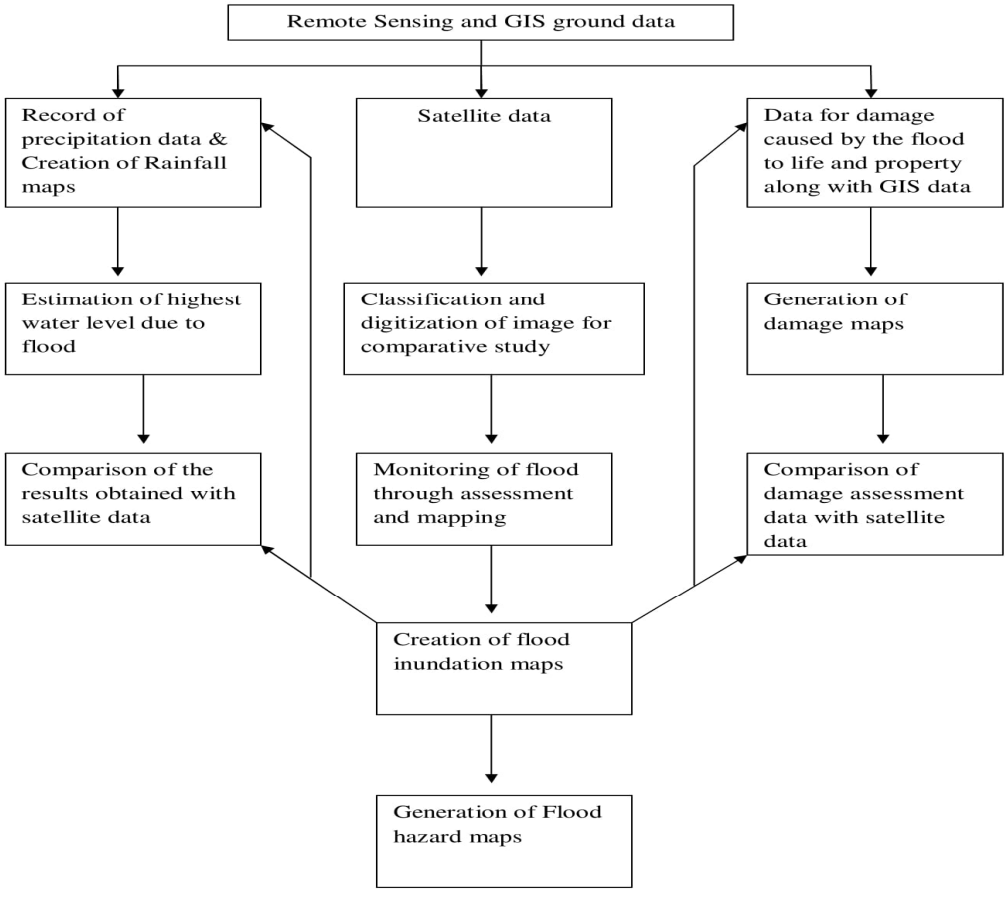
Similar to other natural hazard studies, flood risk assessment involves three broad activities like flood hazard assessment, identification of elements at risk and vulnerability assessment related to the hazard.

In recent years, flood mapping efforts synthesize the advantages of both optical and microwave remote sensing technologies for better results. In some occasions the approach also leads to the formulation of better flood management strategy.

Table No-2: Generation of Damage Statistics

Flood Layer	Village	Villages leave stranded
	Land use and Land cover	Submerged Land use and Land Cover
	Rail Network	Submerged Railways
	Road Network	Submerged Roads

METHODOLOGY FOR GENERATION OF FLOOD HAZARD MAP THROUGH REMOTE SENSING



ISSN 2394 - 7780

Table No-3: Satellites and their sensors used for flood mapping

S.No.	Satellite	Sensor/Mode	Spatial Resolution (m)	Swath (Km)	Used for
1.	IRS-P6	AWiFS	56	740	Regional level flood mapping
2.	IRS-P6	LISS-III	23.5	141	District level flood mapping
3.	IRS-P6	LISS-IV	5.8 at Nadir	23.9	Detailed level flood mapping
4.	IRS-1D	WiFS	188	810	Regional level flood mapping
5.	IRS-1D	LISS-III	23.5	141	Detailed level flood mapping
6.	Aqua/Terra	MODIS	250	2330	Regional level flood mapping
7.	IRS-P4	OCM	360	1420	Regional level flood mapping
8.	Cartosat-1	PAN	2.5	30	Detailed level flood mapping
9.	Cartosat-2	PAN	1	9.6	Detailed level flood mapping
10.	Radarsat-1	SAR/Scan SAR wide	100	500	Regional level flood mapping
11.	Radarsat-1	SAR/Scan SAR Narrow	50	300	District level flood mapping
12.	Radarsat-1	Standard	25	100	District level flood mapping
13.	Radarsat-1	Fine Beam	8	50	Detailed level flood mapping
14.	ERS	SAR	25	1060	District level flood mapping

CONCLUSION

Remote sensing data can be used very effectively for monitoring and management of floods. Flood affected areas can be efficiently mapped using satellite imagery. Microwave remote sensing data can be used to monitor extent, depth and duration of floods.

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GROUND WATER QUALITY OF RAJASTHAN WITH SPECIAL REFERENCE TO FLUORIDE

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Among the challenges faced by the world today in the area of health care, water is the greatest challenge and this is particularly true for the developing countries. A large proportion of the world's population relies on ground water as primary source for drinking and domestic use. In recent years, due to increase of population, urbanization, industrialization, use of chemical fertilizers, pesticide in agriculture, there is over increasing threat to surface and ground water quality. The indiscriminate use of ground water for irrigation and other purposes has resulted in sharp decline in ground water table and in changes in the national geochemistry of ground water. In largest areal state of the country i.e. Rajasthan higher concentration of all the three hydrochemical parameters viz. salinity, nitrate and fluoride in ground waters have adversely affected the lives of people in general and their socio-economic status in particular ground water of western, north-east part of Rajasthan is facing problem of salinity, nitrate and fluoride, whereas central and southern part is generally facing an acute problem of fluoride. Therefore, immediate action for mitigating the problems at government, semi-government or social levels are required for the welfare of countrymen.

STATE HIGHLIGHTS

Rajasthan with an area of 3.42 lakh sq.kms. is the country's largest state having 10.41% of country's area and 6.5% of the nation's population but has very low water resources i.e. 1.01% of the country's resources. In Rajasthan, drought and famine stays as unwanted guest almost every alternate year. Thus water crisis is peril and needs immediate attention of the water managers.

Rajasthan is known for its arid climatic conditions and is characterized by low, erratic and unevenly distributed rains causing frequent adverse meteorological, hydrological and agricultural conditions. The overall stage of ground water development is presently 139%. Physiologically the Aravali range of hills divide's the state in two regions. The north-west and south-east regions. Rajasthan suffers both the problem of quantity and quality of water. In most part of the state, ground water is either saline or having problem of high nitrate and fluoride. Quality-wise, more than 25% of the ground water sources have multiple problems, 16% have excessive fluorides, 15% have excess nitrates and over 9% have excess salinity, thus leaving 35% sources as potable. Overall it has 74% country's total habitations affected with two or more quality parameters. There are more than 16,550 fluorosis affected villages in the state out of 32,211 in the whole country which is more than 50%. Similarly there are more than 14,415 salinity affected villages out of 33,552 in the whole country which is 42%. Likewise, the situation for nitrate toxicity is also very grim and formidable. Therefore, for sustainable socio-economic development and welfare of the people, judicious use of this nature's gift is mandatory. In the present communication grim picture of the quality of ground water, its health effect and mitigative measures will be discussed.

GROUND WATER SCENARIO OF RAJASTHAN

The state is occupied by diversified geo-informations and hydrogeological conditions. Ground water occurs in unconsolidated formations, semi-consolidated formations and consolidated rock types. Water level is deeper in western Rajasthan reaching even more than 130 meter as in Lathi basin area. Depth to water level is relatively shallower in eastern Rajasthan. However, rising trends in ground water levels have been observed in parts of IGNP canal command areas. Major parts of the State witness rapidly declining water levels. Severe water level declining districts are – Jaipur, Sikar, Jhunjhunu, Pali, Jodhpur, Jalore, Nagaur, Dausa and Barmer.

Factors responsible for water scarcity : These are as follows :-

1. Low and erratic rainfall.
2. Frequent occurrence of drought and famine.
3. Less availability of fresh water.
4. Deep and declining water levels.
5. Hard rock area.
6. Dispersed population.
7. Undependable energy supply.

ISSN 2394 - 7780

8. Formidable water quality problems.
9. Lack of water and environmental education.

QUALITY OF GROUND WATER RESOURCES

It is obvious that from developmental, environmental and health point of view quality of ground water is of immense importance. Ground Water Department is a pioneer department for ground water studies in the State, has carried systematic studies of ground water by periodically monitoring the quality of nearly 15,000 water samples per annum using latest analytical and instrumental techniques (APHA, AWWA 1980). Since drinking is the prime importance of water, therefore, for judging the suitability of ground water for drinking purposes, three main constituents viz. Total Dissolved Solids, Nitrate and Fluoride are of utmost significance. Ground water of Rajasthan is free from arsenic iron and cadmium problem (Ozha et.al 1993).

1. **T.D.S.** : As per survey carried out by P.H.E. Department nearly 21190 villages/habitations are affected by salinity problem which comprises nearly 23% of total surveyed samples. The district of Barmer, Jaipur, Nagaur, Bharatpur, Alwar, Churu, Jaisalmer, Sriganganagar, Hanumangarh and Bhilwara are worst affected. Banswara, Dungarpur and Bara districts are least affected with this problem.
2. **Nitrate** – Rajasthan is considered as a major nitrate affected state in the country (Gopal et.al 1983) and (Ozha et.al 2003). Nitrate levels in ground waters of Rajasthan have caused a great concern particularly in arid and semi-arid regions.

Nitrate is one of the severe inorganic pollutant contributed by nitrogenous fertilizers, human and animal wastes and industrial effluents through the biochemical activities of micro-organisms. Excess use of nitrogenous fertilizers in agriculture has been one of the primary sources of high nitrate in ground water (Schepers et.al 1985). In Rajasthan highest nitrate value of 2870 mg/l was observed in Hanumangarh district against the permissible limit of 45 mg/l. Depending upon the distribution of nitrate the whole state can be classified into five quality zones. Each district was divided into a number of blocks and these blocks were further categorized into following four zones.

Zones	Zone	Type	Nitrate Level mg/L
1	Zone I	Safe zone	0 – 20
2	Zone II	Mild problematic	21 – 45
3	Zone III	Moderately Problematic	46 – 100
4	Zone IV	Highly Problematic	Above 100

The percentage of zonewise distribution of nitrate is depicted in Table-1.

Table-1: Percentage of different zones of nitrate

District	Nitrate			
	0-20	21-45	46-100	Above 100
	Zone-I	Zone-II	Zone III	Zone IV
Ajmer	19.13	25.17	30.20	25.49
Alwar	26.78	31.15	24.04	18.03
Banswara	36.78	41.15	20.04	3.00
Barmer	22.14	31.07	10.21	36.58
Bharatpur	21.26	35.27	23.67	19.81
Bhilwara	40.21	13.98	30.79	15.02
Bikaner	14.86	27.93	22.53	34.68
Bundi	40.17	23.17	30.81	5.85
Chittorgarh	38.21	15.98	20.33	25.43
Churu	6.12	12.24	15.65	65.99
Dausa	42.11	34.74	15.79	7.37
Dholpur	29.57	26.96	29.57	13.90
Dungarpur	30.57	27.96	31.57	10.90
Ganganagar	29.13	15.53	25.24	30.10
Hanumangarh	12.99	16.88	41.56	28.57
Jaipur	33.47	30.05	22.88	14.02
Jaisalmer	12.14	41.37	31.77	14.71
Jalore	7.66	26.58	21.62	44.14

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District	Nitrate			
	0-20	21-45	46-100	Above 100
	Zone-I	Zone-II	Zone III	Zone IV
Jhalawar	26.76	35.35	25.25	12.63
Jhunjhunu	21.58	28.42	26.84	23.16
Jodhpur	3.58	25.34	33.61	37.47
Karauli	4.85	20.39	56.31	18.45
Kota	15.85	35.41	32.33	16.40
Nagaur	5.35	26.75	32.92	34.98
Pali	13.08	32.69	29.23	25.00
Rajsamand	11.08	30.69	31.23	27.00
Salumber	15.08	30.69	31.23	21.00
S. Madhopur	13.89	22.22	44.44	19.44
Sikar	24.69	24.07	34.57	16.67
Sirohi	12.42	32.77	36.16	18.64
Tonk	20.13	26.17	30.20	23.49
Udaipur.	25.13	31.00	33.37	10.40

It is quite evident from Table-1 that severity of nitrate toxicities are observed in Jodhpur, Nagaur, Barmer, Tonk, Jhunjhunu, Sikar, Sawai Madhopur, Alwar, Bharatpur, Barmer, Bhilwara, Bikaner, Churu, Jalore, Karoli, Sri Ganganagar and Hanumangarh district.

TOXIC EFFECT OF HIGH NITRATE

1. **Methaemoglobinamemia**: It is a disease which reduces capacity of blood to carry enough oxygen for proper functioning of the body. When nitrates are reduced to nitrite by microflora of intestine, nitrite reacts with haemoglobin leading to formation of methaemoglobin.

Haemoglobin, an oxygen carrier in the blood, is a protein of molecular weight 68,000 with 4 identical sub-nits, each containing a polypeptide chain (globin) and a hemo group. Each heime- group contains at its centre an atom of iron. In haemoglobin, iron is in bivalent state (Fe^{+2}, Ferrous). Methaemoglobin is the oxidized product of haemoglobin in which the iron is in trivalent state (Fe^{+3}, Ferric). On transition from ferrous to ferric, the capacity to combine with oxygen is lost and the supply of oxygen to the body through blood is reduced. In fact, conversion of haemoglobin to methaemoglobin takes place all the time in body but the quantity of later is maintained at a low, steady state level mainly by the activity of enzymes.

As different parts of the body get deprived of oxygen, clinical symptoms of oxygen starvation start to appear, the main being cyanosis (derived from the English word “Cyano”, measuring dark blue, Gr. Kyanos). Lip, while in severe cases, the skin, starts to take a blue colouration wherefrom the disease derives its name, the “Blue Baby Disease”.

In infants, where the diet is normally carbohydrate, coliform organisms are though to be primarily responsible for conversion of nitrate to nitrite in the digestive tract. Infants are more susceptible for methaemoglobinemia during their developmental stage. The syndrome may also appear when babies are fed with milk preparations made with water containing high nitrate.

High risk of Cancer: Nitrate itself is not carcinogenic, but instead it acts as a “procarcinogen”, i.e. it reacts with other chemicals (amines and amides) to form carcinogenic compounds (N-nitroso) compounds. The physiological studies provide strong support indicating the association between nitrate contamination of drinking water and increased cancer rates (Weyer, 2001 and XU, 1992). N-nitroso compounds has been associated with 15 different types of cancers, including tumours in the bladder, stomach, brain, esophagus, bone and skin, kidney, liver, lung, oral and nasal cavities, pancreas, peripheral nervous system, thyroid, trachea, acute myeleocytic leukemia and T and B cell lymphoma[10]. More than one hundred of these N-nitroso compounds have been tested for carcinogenicity in animals and 75-80% of them have been found to be carcinogenic.

Abortions: Spontaneous abortions in animals due to ingestion of high nitrate contaminated water have also been observed. It has also been observed that in many herbivorous animals excess of nitrate ingestion through fodder and drinking water causes severe ailments. Therefore, it has been suggested that women who are pregnant or trying to become pregnant should not consume water containing high levels of nitrate (Fewtrell, 1992).

ISSN 2394 - 7780

Other diseases: Cases of incidence of type-I diabetes, thyroid and cardio-vascular system disorder and embryo toxicity have also been observed due to drinking of high nitrate water (Van Mannen2000).

ENVIRONMENTAL HAZARDS OF NITRATE

Due to increased level of nitrates in water bodies, nutrient enhancement occurs. This results in enormous growth of aquatic filamentous green algal leading to eutrophication. This huge algal growth creates unaesthetic conditions in water body. Some of the blue green algal species are reported to be toxic. Anaerobic conditions are developed in water bodies due to oxygen uptake during night time which is not compensated by photosynthesis and also decay of dead cells. Such oxygen scarcity conditions may result in fish killing during critical hours. In Rajasthan, surface water bodies in several areas have been afflicted owing to eutroplication and consequently it has caused fatal of several aquatic animals, mostly fishes.

3. **Formidable Fluoride** – Fluoride is one of the main contaminants in ground water. Excess concentration of fluoride in water causes serious health problems. The diseases are known as dental and skeletal fluorosis. Rajasthan is an endemic state with respect to fluorosis. All 32 districts have been declared as fluorosis prone but the ground water of Jaipur, Jalore, Pali, Tonk, Alwar, Churu, Pali, Barmer, Jodhpur, Nagaur, Dausa, Bhilwara, Rajsamand, Tonk, Ajmer are worst affected. Fluoride distribution in ground water of Rajasthan along with highest value and categorization of fluoride affected districts are shown in Table-2 and Table-2 respectively.

Table-2: Fluoride Distribution in Groundwater of Rajasthan.

S. No.	District	% samples having F> 1.5 mg/l	Maximum value/ village/block
1.	Ajmer	59.8	17.4 Bharai (Kekri)
2.	Alwar	15.3	7.1 (Kishangarh)
3.	Baran	5.0	2.6 Bhaonra (Chhabra)
4.	Barmer	45.1	19.6 Nosar (Sindari)
5.	Banswara	14.0	6.4 Bilari (Sajjangarh)
6.	Bharatpur	25.1	6.0 Tilakpuri (Kaman)
7.	Bhilwara	43.0	8.1 Dhuliakhurd (Shahpura)
8.	Bikaner	54.4	16.0 Charanwala (Kolayat)
9.	Bundi	13.2	5.9
10.	Chittorgarh	8.6	7.4 Tana (Bhopalsagar)
11.	Churu	37.7	30.0 Bhimsar (Sujangarh)
12.	Dausa	39.3	5.1 Malema (Dausa)
13.	Dholpur	9.3	5.2 Bajna (Rajakhera)
14.	Dungarpur	26.7	6.2
15.	Ganganagar	49.6	9.2 Pipran (Sauratgarh)
16.	Hanumangarh	40.8	35.0 Raiko Ki Dhani (Nohar)
17.	Jaipur	34.4	5.6 Manoharpura (Shahpura)
18.	Jaisalmer	35.9	14.6 Satyaya (Jaisalmer)
19.	Jalore	62.0	14.0 Dhanpur (Jalore)
20.	Jhalawar	0.6	1.6 (Golana (Khanpur)
21.	Jhunjhunu	41.7	14.5 Nathasar (Alsisar)
22.	Jodhpur	48.2	22.0 Daikara (Mandore)
23.	Karauli	-	5.0 Mirzapur (Todabhim)
24.	Kota	25.8	4.8
25.	Nagaur	65.3	34.8 Datiad (Jayal)
26.	Pali	69.7	12.0 Gogra (Sumerpur)
27.	Rajsamand	26.0	5.9 Amratiya (Kumbhalgarh)
28.	S. Madhopur	27.4	4.3 Mitrapura (Bonli)
29.	Sikar	47.2	13.0 Dukia (Danta Ramgarh)
30.	Sirohi	33.2	11.6 Gola (Sheoganj)
31.	Tonk	36.2	7.6 Kareriya (Niwai)
32.	Udaipur	14.4	4.9

ISSN 2394 - 7780

Table-3: Categorization of fluoride affected District

S. No.	Category	No. of District	Name of District
1.	50% and above villages having excess fluoride	9	Tonk, Churu, Barmer, Pali, Sirohi, Jalore, Rajsamand, Ajmer, Nagaur
2	25-50% villages having excess fluoride	12	Jaipur, Dausa, Dholpur, Sikar, Jodhpur, Jaisalmer, Banswara, Dungarpur, Bhilwara, Bikaner, Hanumangarh, Sawai Madhopur
3	10-25%% villages having excess fluoride	9	Bharatpur, Alwar, Jhunjhunu, Udaipur, Kota, Chittorgarh, Jhalawar, Karauli & Sri Ganganagar
4	Below 10% villages having excess fluoride	2	Baran, Bundi

It has been observed that 11909 villages and 11388 other habitations are having fluoride level in their ground water in concentrations of over 1.5 mg/l. Likewise, 4250 villages and 3449 habitations are having fluoride concentration more than 3.0 mg/l. (PHED 2001). During the course of study, it was observed that high fluoride water in ground water is normally associated with high alkalinity to calcium ratio, generally 10,000 calcium to fluoride and magnesium to fluoride ratios below 10. Higher values of Residual Sodium Carbonate (RSC) were also common in high fluoride bearing ground waters.

CAUSE FOR HIGH FLUORIDE CONCENTRATION

Presence of abnormally high fluoride concentration in ground waters of all districts of Rajasthan is not due to anthropogenic reasons. It is due to natural cause of higher abundance of fluoride bearing minerals in the host rocks and sediments (Choubisa 2017). The important rocks are granites, gneisses, mica, schists, limestone, sandstone, phosphorite, shales, clays, acid igneous rocks, basalts, alluvium etc and these contain fluoritic minerals accounting for fluoride in the range 180-3100 ppm (average). Their chemical behaviour like decomposition, dissociation, dissolution and interaction with water is considered to be the main cause of fluoride in ground water (Gupta et al 1993).

TOXIC EFFECT OF FLUORIDE EXPOSURE

Consumption of fluoride enriched water over long periods leads to chronic exposure to fluoride ingestion and results in its accumulation in hard tissues such as teeth and bones causing diverse adverse changes that appear in the form of dental fluorosis and skeletal fluorosisin humans Alder (1970) and animals Choubisa (2012). Besides these maladies, gastrointestinal discomforts, neurological disorders, impaired endocrine and reproductive functions, teratogenic effects, renal effects, genotoxic effects, apoptosis, excitotoxicity etc have also been reported in humans as well as in domestic and laboratory animals (Choubisa 2013). These harmful effects are owing to chronic fluoride exposure in soft tissues of the body and is known as non-skeletal fluorosis.

MITIGATING STRATEGIES

Indeed the diseases caused by alarmingly increased hydrotoxicants in ground water are non-contagious but remedial measures and mitigating strategies are immensely required for the welfare of human beings, livestocks and societal upliftments. These are as follows :

1. Top priority should be given to water quality monitoring and surveillance, low awareness about the importance of water quality at all levels is a major constraint. The innovative approaches such as involving communities in water quality surveillance, creating awareness about water quality and designing separate agencies for WQM&S should be considered.
2. The practices and skills associated with traditional water harvesting devices should be encouraged.
3. Prevention is better than cure. Many potential problems can be prevented by safe guarding the integrity of a drinking water source. Ground water management against over withdrawal, of ground water would check further deterioration of ground water quality.
4. The indigenous technologies should be adopted to make water fit for drinking after treatment. For example the villages which are affected only by excessive fluoride while other parameters are within the limit, the different defluoridation techniques based on Nalgonda. Activated Alumina etc. should be tried. The hand pump attached defluoridation plants based on activated alumina have been found quite successful.
5. A detailed survey of water quality of all the sources should be undertaken. Potable source should be high lighted and painted green while un-potable source may be painted red. The water quality status of all the sources of the village should be available in the gram-panchayat and properly displayed in the village.

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6. Awareness regarding water quality and sanitation should be generated through different IEC activities.
7. WQM & S should be intensified during out break of water borne disease, fairs & natural calamities such as floods and draughts.
8. Scope for R & D Interventions in Context to Rajasthan.

a. Disinfection of drinking water in rural areas.

b. Defluoridation techniques.

► Domestic defluoridation

► Community defluoridation

c. Denitrification

d. Desalination

e. Field test kits for WQM & S in Rural Areas

f. Rain water harvesting structures

g. Ground water recharge

h. Epidemiological studies on fluorosis and cyanosis

i. Rejuvenation of traditional water sources.

j. Water Treatment

k. Removal/Prevention of salt deposits in pipe lines.

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IDENTIFICATION OF SUITABLE GROUNDWATER RECHARGING LOCATION USING VES AND GIS TECHNIQUES: A CASE STUDY OF LUCKNOW DISTRICT OF UTTAR PRADESH, INDIA

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ABSTRACT
The rapid rate of groundwater table declination is one of the major problems in the Indo - Gangetic plain of India, especially in cities. Various techniques have been employed to enhance the ground watertable. Artificial rainwater harvesting system is one of the most popular techniques for groundwater recharge but due to the scarceness of sufficient rain and untimely heavy rainfall, the recharge of groundwater aquifer is not sufficient by using on-farm rainwater harvesting technique. A new technique has been proposed that shows that artificial groundwater recharge can also be done by using excess wastewater overflowing from the canal, pond or any other clean water reservoir. The study also emphasizes delineation of a suitable location where artificial groundwater recharge structures can be made. In this study, various remote sensing& GIS tools and vertical electrical sounding (VES) technique have been used. Based on these techniques groundwater prospects map have been prepared and its area has been also calculated. The result obtained by this study showed the both of this technique can effectively delineate the area where artificial groundwater recharge system can be installed with the better use of various water resources available in an area.

Keywords: Artificial Groundwater recharge, VES, Remote Sensing & GIS Techniqe

INTRODUCTION
Groundwater is available under the different surface of the earth crust. The total estimated volume is approximately 23,400,000 cubic Kilometer i.e. 1.69 % of total water presence on earth (Gleick *et al.,* 1993). Due to the excess use of groundwater, the declination of the water level has arisen. The worst effect of groundwater depletion in major regions of North Africa, the Middle East, South, and Central Asia, North China, North America, Australia, and India has been encountered (Leonard *et al*, 2005). India is one of the largest users of groundwater in the world and an estimated 230 cubic kilometers per year (World Bank Study and Technical Assistance Initiative on Groundwater Management in India, 2011). Around 84 % of the total addition to the net irrigated area has come from groundwater. In India, the rate of groundwater table declination in an urban area is much more than rural area due to huge application of groundwater for domestic and irrigation use. On another hand, the large paved area in the cities restricts the infiltration of rain water. The problem is becoming critical in among almost all the densely populated cities in India and worldwide.

A lot of research has been done in past to solve the problem of groundwater recharge in cities and few techniques have been developed by the researchers. An artificial groundwater recharge system for recharging the groundwater aquifer is highly popular and accepted for the groundwater aquifer recharge (Narjary *et al.*, 2014). In addition with, clean water from any reservoir can also be directly injected into the aquifer for recharging (Tamer *et al.,* 2008), (Nasiri *et al.,* 2012). In almost all over the world, the artificial groundwater recharge was purely depended on the rainwater because the rainwater is available in one of the purest forms during the monsoon season. It is one of the good sources of water for the recharge but most of the rainfall flow as runoff due to the paved area of the cities and associated with drains and streams. The recharge rate also depends upon the hydraulic conductivity, geomorphology of the surface, soil type land use and other different factors (Entekhabi *et al*, 2006) (Tweed *et al*, 2006).

The continuous withdrawal of groundwater and less recharge of the aquifer is one of the main factors for the lowering the groundwater table. To overcome this situation a study has been carried out to find out the various sources of water for recharge the aquifer, Proper site for making the recharge structure and continuous supply of water into it to it throughout the year. Some similar studies have been done in the past which recommend the remote sensing & GIS technique and VES techniques is suitable to delineate the potential area for artificial groundwater recharge (Anbazhagan *et al*, 2005; Rodell *et al*, 2006; Chowdary *et al*, 2008; Hashemi *et al*, 2013; Singh 2013; Owusu *et al*., 2014, Gupta 2015; Kaliraj 2015; Prabhu *et al.,* 2015; Senanayake, 2016). The use of remote sensing and GIS provide potentially powerful tools to study groundwater resources and design a suitable exploration plan (Fredrick *et al*, 2006), (Imran *et al.,* 2010). Remote sensing & GIS technique it is easy to classify the suitable area for artificial groundwater recharge (Leblance *et al*, 2006), (Satapathy *et al.,* 2015).

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Vertical electrical sounding (VES) technique provides one of the better results among others method for profiling of subsurface layers (Joseph, 2012). This technique can be used for various soils (Onimisi *et al.* 2013, Ruth *et al.*, 2014*).*

In this study, we have used both remote sensing & GIS tool and VES technique for finding the possible location for installation of artificial groundwater recharge structure and also a continuous supply of water to recharge structure form the available sources such as overflow ponds & lakes, seepage water from the canal, low lying ponds etc.

Study Area – For the development and testing of the methodology is was necessary to have a proper study area with having a huge population and a large paved area. It was also necessary to have different types of waterbodies that may me use further for recharge plan. After analysis, the land use of most populated cities of India, Chinhat block of Lucknow district, Uttar Pradesh, India have been selected. The Chinhat block is one of the worst populated cities in Lucknow district and has different types of water bodies such as canals, rivers, lakes, forests, etc. The watertable declination is one of the biggest problems in this area since the past few decades. (Groundwater Yearbook, Uttar Pradesh (2014-2015). The Lucknow district has nine blocks and Chinhat block has largest paved area among all of them.

LOCATION MAP OF STUDY AREA

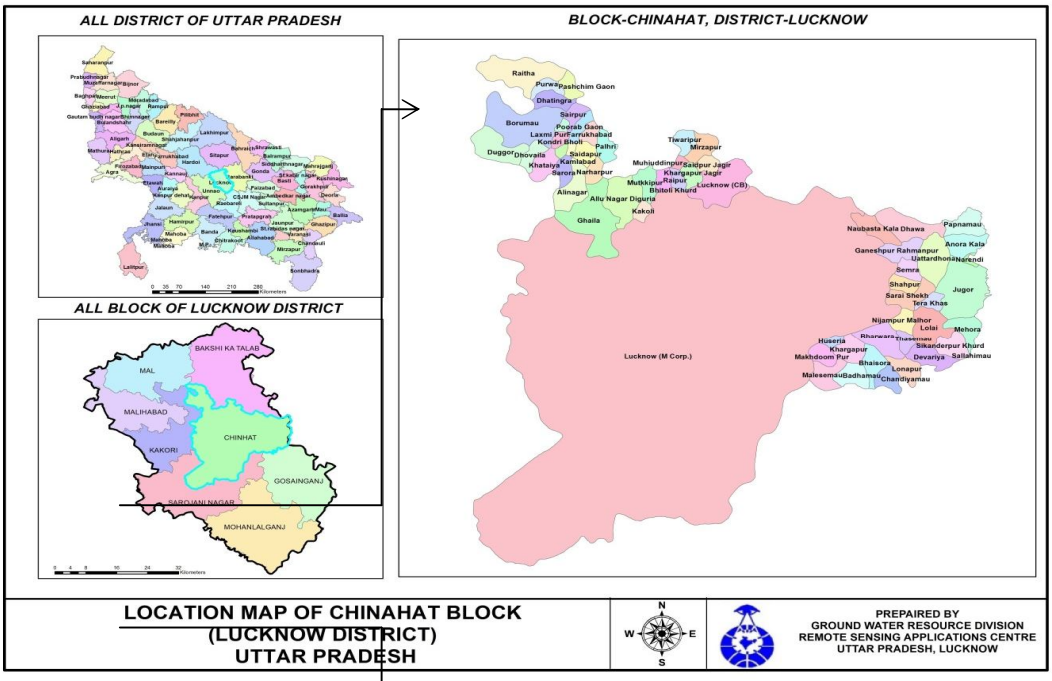

Fig-1: Location Map of Study area Chinhat block, Uttar Pradesh, India.

The study area is located in the Chinhat Block of Lucknow district, Uttar Pradesh, India. The annual rainfall of this area is 990 mm. The maximum temperature is 47°C and minimum temperature is 4°C. The Gomti River divided this block from the center, which is one of the good sources of water. Coordinates in Decimal Degree. Top-N 27.01, E 80.83, Bottom-N 26.718, E 80.84 Left -N 26.86, E 80.79, Right-N 26.88, E 81.12.

The overall aim of this study is to make a prospect map that can be used for the finding of a specific location to install the artificial groundwater recharge structure and also find the alternate source of water for continuous recharge of the aquifer. The step involved in this study is represented in the form of flowchart & procedure is discussed below**.**

MATERIALS AND METHODS

2.1. The complete study has been divided into five segments.

- Making of the various thematic layers by using survey of India topographical map of scale 1:50000.
- Use of Landsat and LISS III & IV, ASTER, SRTM datasets making various surface layers.
- By using geophysical resistivity survey technique making various subsurface layers.
- Providing rank and weightage to each layer and map.
- Selection of best possible site from the output provided by the model.

ISSN 2394 - 7780

METHODOLOGY FLOW CHART

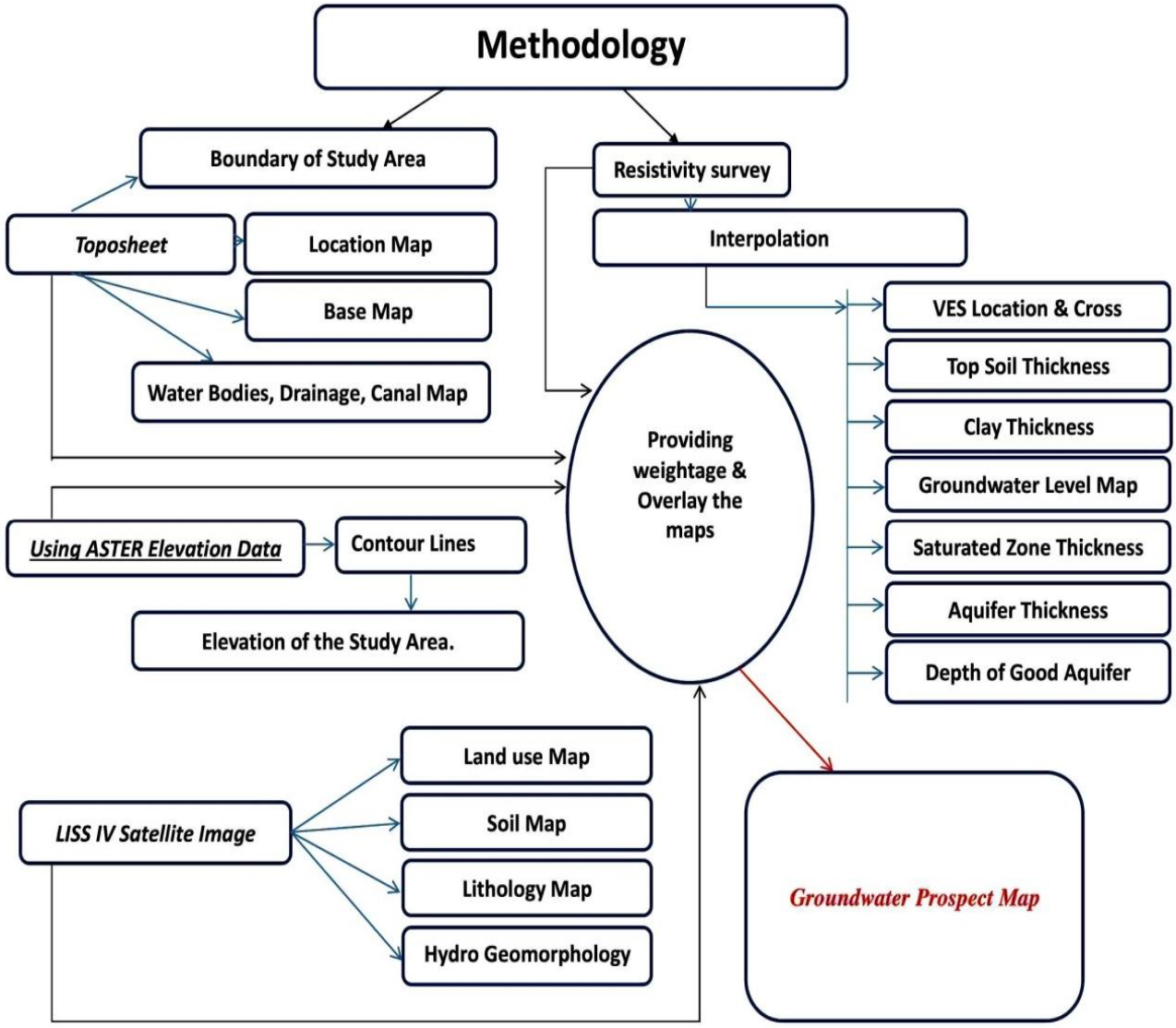

Fig-2: Methodology and steps involve in this study.

2.2. Maps used for this study

This study is based on the integration of surface and subsurface water data sets. To achieve this goal various maps have been required i.e. presented in Table**1**. The brief description of some important procedure adopting while making the maps used in this study is also described below.

Table-1: Maps and layers made for the study.

S. No	*Surface*	S. No	*Sub Surface*
1.	Base Map	1.	VES Sampling Location
2.	Slope and Elevation	2.	Water Level
3.	Water bodies	3.	Top Soil Thickness
4.	Hydro Geomorphology	4.	Clay Thickness
5.	Lithology	5.	Aquifer Thickness
6.	Soil	6.	Saturated Thickness
7.	Land Use Land cover	7.	Depth of Good Aquifer Zone

BRIEF DESCRIPTION OF THE MAPS AND ITS FORMATION

Base Map – It contains only necessary outlines and information of the study area. In this study, the base map (Fig. **3**) has been prepared from the topographical map of the survey of India. The topographical map has been scanned and then further used in Arc GIS 9.3 software for making different layers for the base map separately. The various layers used in base map i.e.is road & railway network including different national & state highways, river, canal, airport, floodplain area racecourse village boundary.

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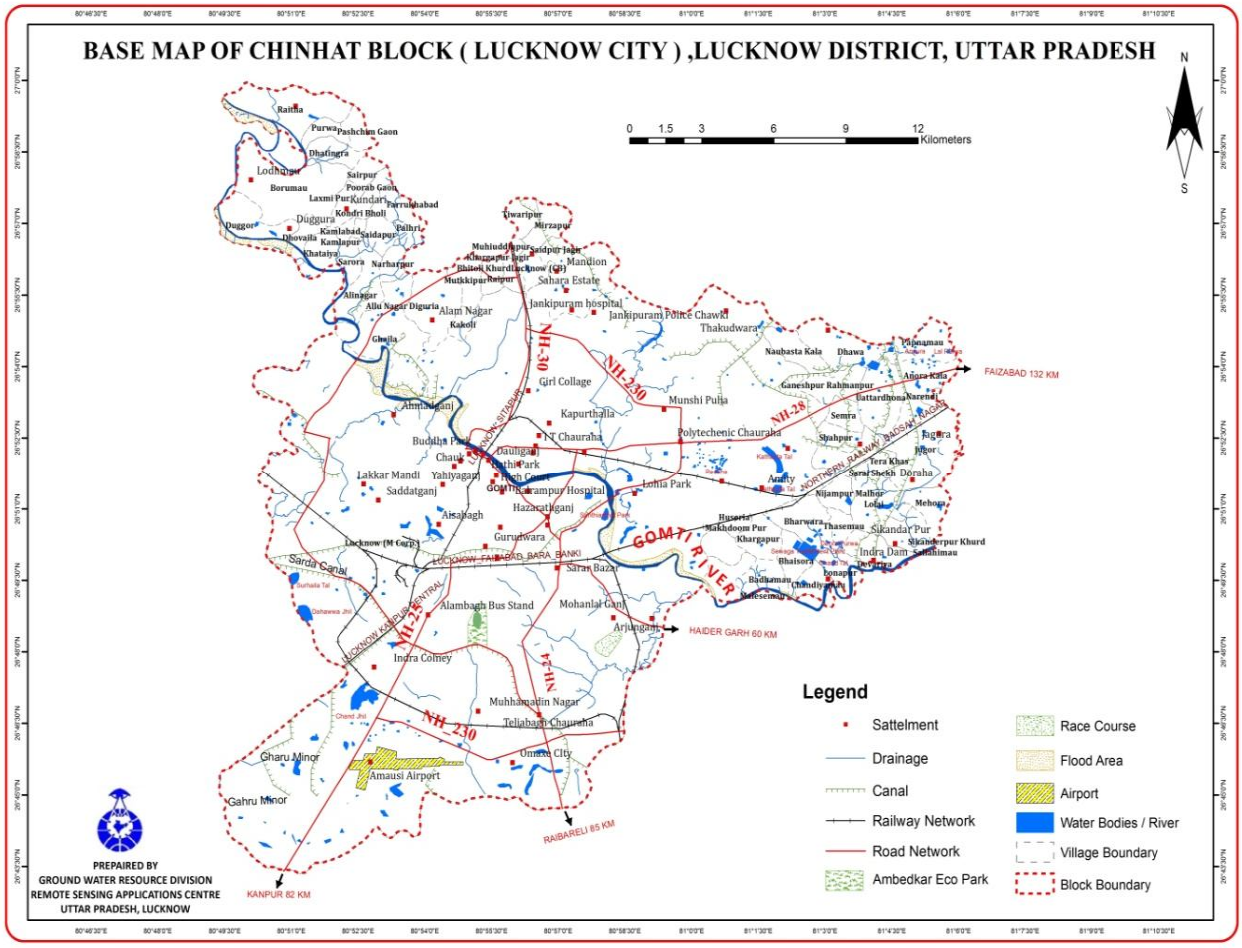

Fig-3: Base map of study area.

Slope & Elevation map – The minimum and the maximum elevation of the study area is 98 and 142 meters respectively (Fig. **4**). The elevation and slope map of the study area has been created by using digital elevation model data of 30-meter spatial resolution (ASTER DEM). The elevation map provides the information of the height of the surface above from mean sea level.

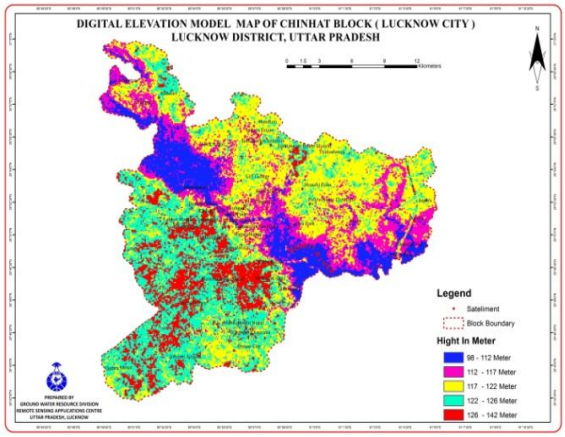

Fig-4: Slope and Elevation map of study area

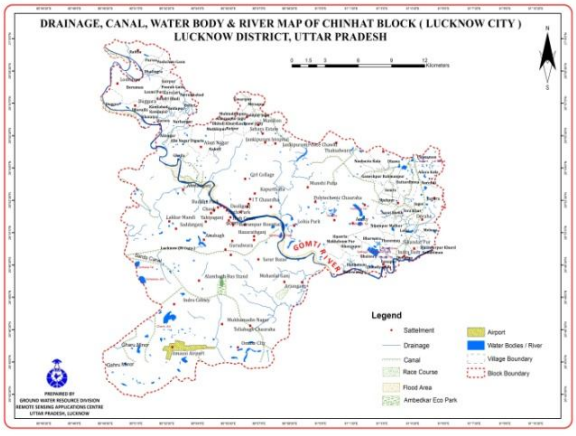

Fig-5: Water bodies map of study area

Water bodies map – This map is used to identify the local waterbodies, canal natural drains, any reservoirs, rivers, lake, ponds etc. This map has been made by using the NDWI tool, Image from Google earth software etc. This map is highly useful during a survey of local water bodies. The Gomti River is one of the good sources of water which is flowing from the center of the study area shown in (Fig.**5**).

Lithology- In this study, the lithology map has been made to identify the local geological formation on in the study area e.g. rock, hills, and mineral composition etc. In this study, Lithology map has been made by using various thematic layers in (Fig.**6**).

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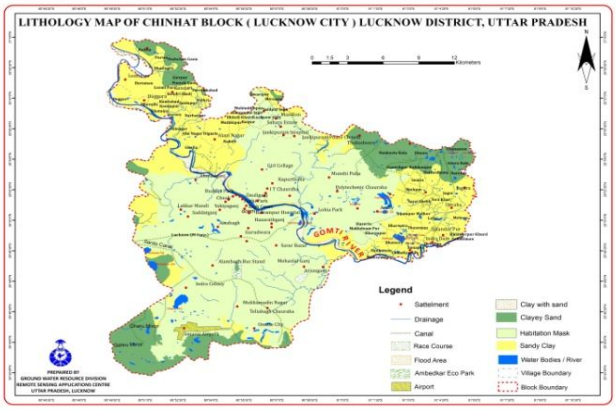

Fig-6: Lithology map of study area.

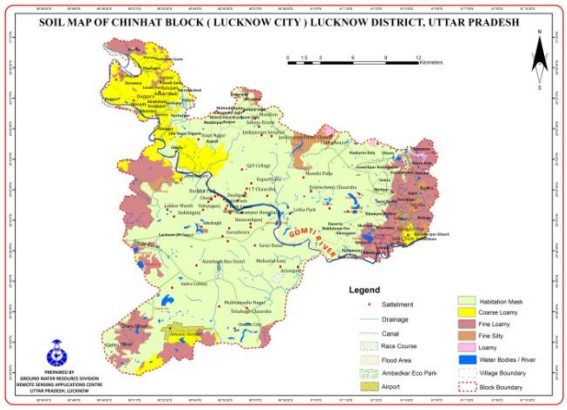

Fig-7: Soil Map of study area.

Soil Map –In this study, the soil map has been created by taking the soil sample at various locations. Total depth of 30 centimeters has been taken and sieve analysis has been done to determine the particle size of soil. This map indicates the types of soil and at various locations in the study area (Fig. **7**)

Hydro-geomorphology –Every year during the monsoon, the flood extent of the river becomes wider to the normal. First few days the erosion of the bank starts and washes out the top soil layers. Due to high rain, natural drain appears and discharge for water as runoff occurs. Many small water bodies and drainage network have been identified and mapped. This map has been made by using the digital elevation model (ASTER) 30-meter resolution and satellite images, and various layers (Fig. **8**)

Fig-8: Hydro-Geomorphology Map of study area.

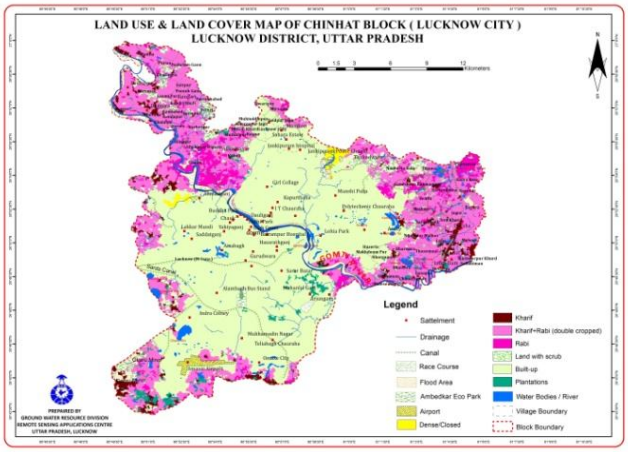

Fig-9: Land Use Land Cover map of study area.

Land use land cover- The study area is one of the most urbanized areas of Uttar Pradesh, India. It was necessary to identify the land use of the study area such as Forest, Permanent Settlement, Agriculture, Wetland, etc, The land use and land cover map have been made by using LANDSAT series satellite image by using supervised classification technique (Fig. **9**).

2.3 Geophysical Resistivity Survey

VES - Vertical Electrical Sounding technique (VES) is used for geophysical exploration of the soil layer. It is one of the easiest methods for determining the depth of the soil layer at the same location without disturbing the soil strata. This method is based on Werrer and Schlumber array technique (CardimonaS. 2002, Sampat *et al* 2014), (Eqn.1).

$$pk = k\,\frac{UMN}{IAB}$$

Where K = Geometrical factor.

UMN = Voltage between electrode M and N

(Distance between two points)

IAB= Current in line AB.

ISSN 2394 - 7780

The measurement of the potential difference between the two nodes is recorded. The spacing of the nodes is directly proportional to the depth of the soil strata. In this study, about 16 locations have been selected and the VES technique have been applied (Fig. **10**). The name of the village is shown in Table **2**. The resistivity survey has been done for only for sixty-meter depth. The data obtained by survey shows the thickness of the different soil layers at a different village in the study area. This data has been further used for making of different maps such as Top Soil Thickness, Clay Thickness, Aquifer Thickness and Depth to good aquifer thickness map.

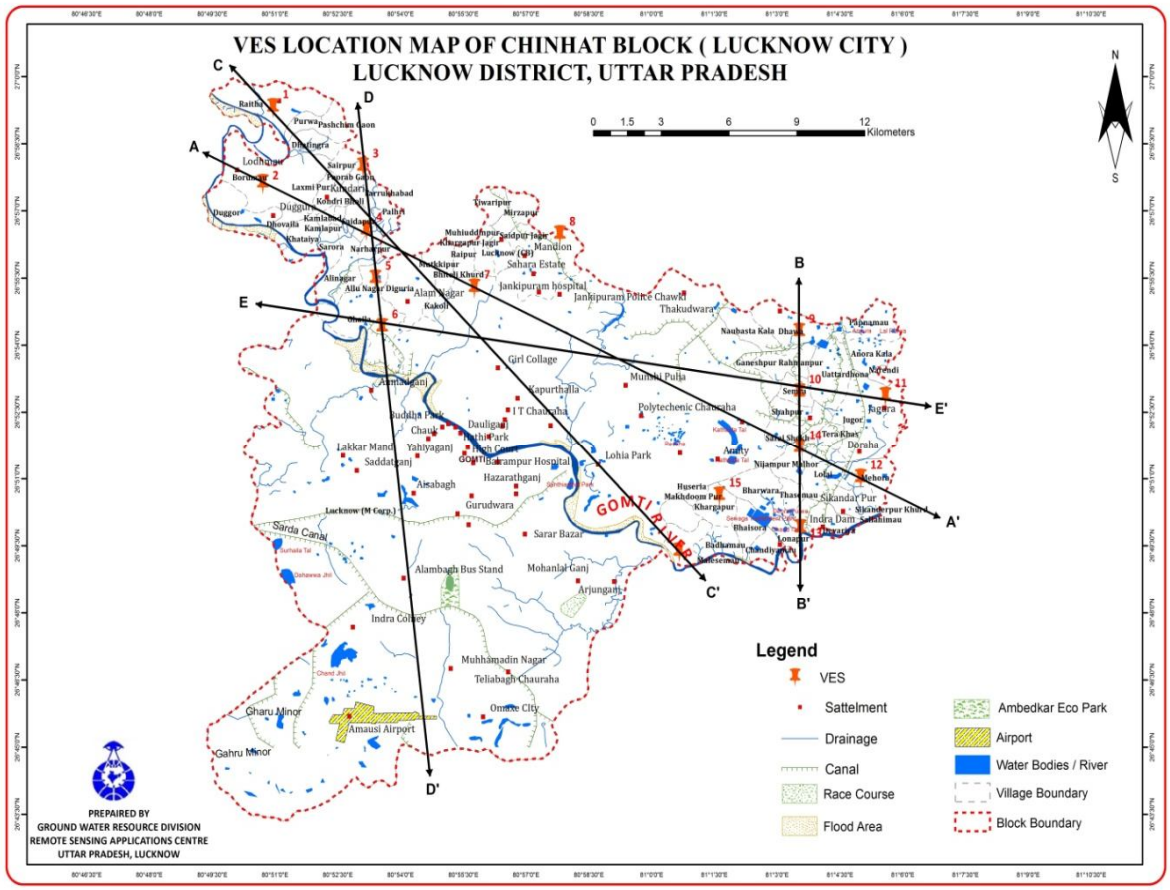

Fig-10: The maps of study area showing the location where vertical electrical sounding (VES) technique has been used.

Table-2: Village Location & Soil Layer Thickness information of study area.

S. No	Village	Total Depth	Top Soil Thickness	Clay Thickness	Water level Depth	Saturated Soil Thickness	Aquifer Thickness	Depth to Good Aquifer
1	RAITHA	60	2	27	14	46	33	39
2	BOROMAU	60	1.5	23	12	48	37	36
3	PURAV GAON	60	2	24	14	46	36	38
4	SHAIDA PUR	60	3	21	12	48	39	38
5	ALLU NAGAR	60	2	28	15	45	32	42
6	RAIPUR	60	2	29	14	46	31	40
7	KALAGHAT	60	3	33	16	44	27	44
8	JAGAUR	60	2	32	15	45	28	38
9	GHATHELA	60	2.5	31	16	44	29	44
10	USHARIYA KHARGAPUR	60	2.5	35	17	44	27	42
11	SHAMERA	60	3	30	14	46	30	39
12	NIRMAPUR	60	3	33	16	44	27	42
13	KHARGAPUR JAJIR	60	2.5	27	15	45	33	38
14	SHIKANDARPUR	60	2.5	29	13	47	31	37
15	LONA PUR	60	2	28	14	46	32	39
16	MELSEMAU	60	2.5	33	16	44	27	41

ISSN 2394 - 7780

2.4 Subsurface map by using VES Technique

In this study, various surface and subsurface map has been made. The subsurface map has been made by using VSE technique. This map is useful to determine the geological formation under the topsoil layer. This map also provides the thickness of the different zone. The depth and area of various layers are presented in Table 8 and depict in Fig. 11- 16.

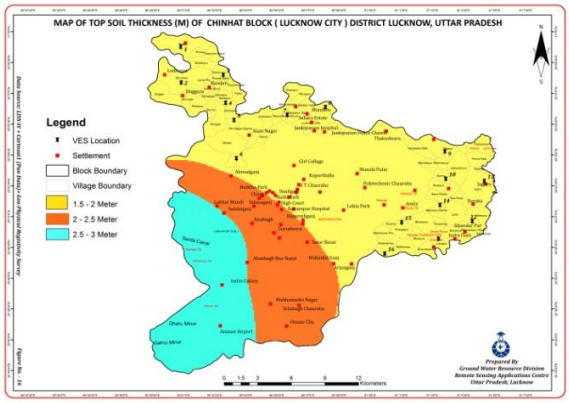

Fig.11. Top Soil Thickness map of study area.

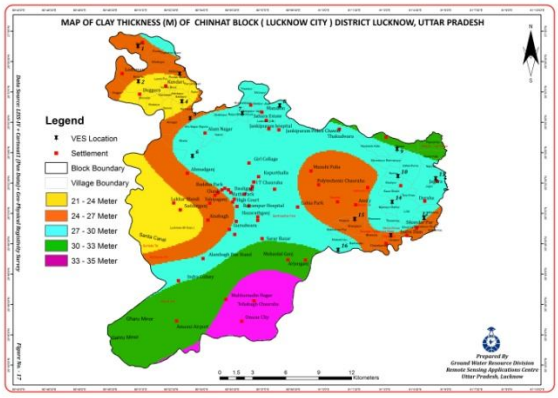

Fig.12. Clay soil thickness map of study area.

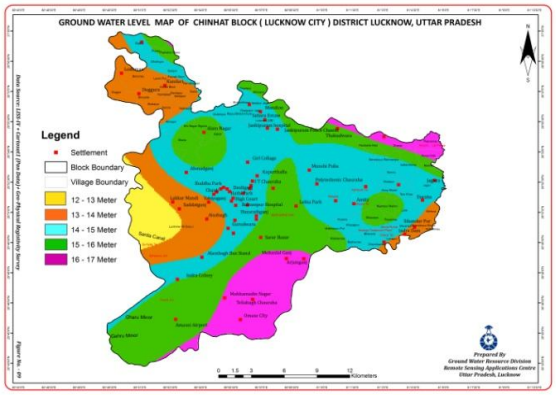

Fig. 13 Groundwater level map of study area.

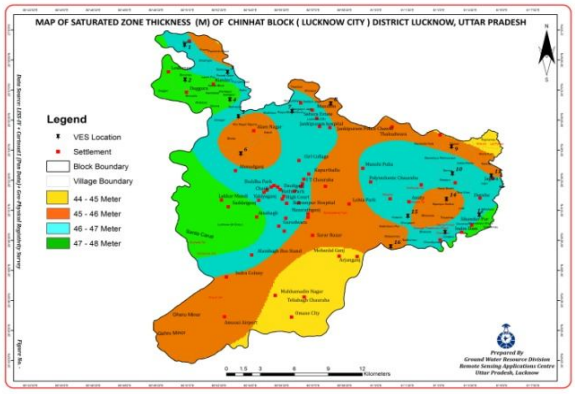

Fig. 14. Saturated thickness map of study area.

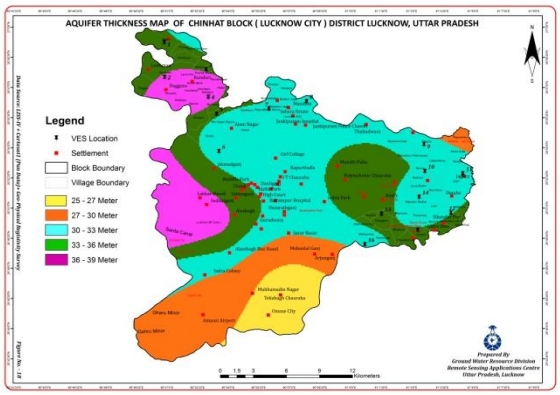

Fig. 15. Aquifer thickness map of study area.

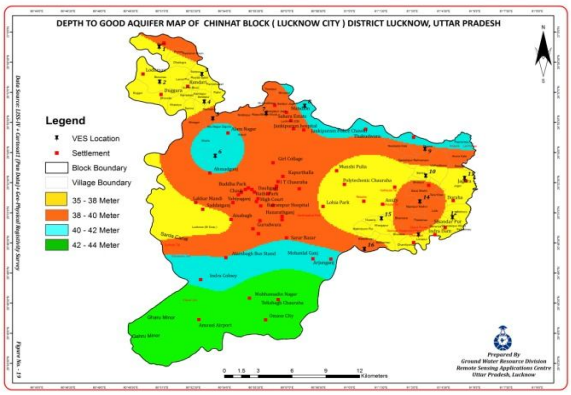

Fig. 16. Good Aquifer map of study area.

2.5 Assigning Weightage to maps

The assigning the rank and the weightage is one of the most important tasks in this study. It helps the models to find the suitable place for recharge structure by using various thematic and maps. In this study, the rank provided from (1 to 5) to layer to the maps according to their infiltration & percolation behavior. 1 is assigned to poor infiltration and percolation behavior of the layers and 5 are for excellent respectively.

The weightage separates the maps according to the overall behavior of infiltration as well as percolation of surface water to the aquifer from the top surface of the earth. In this, study and weightage have been assigned to the various maps from the range of 12.5 to 20 in Tables **3**. The value 12.5 has assigned for those maps in which the infiltration of water starts first. The value 15 and 20 has been assigned in which the percolation takes place (Saraf and Chowdhury 1998).

ISSN 2394 - 7780

Table-3: Rank & Weightage to the Sub Surface layers and Maps.

Topsoil Thickness	Depth	Rank	Weightage
Topsoil Thickness	1.5 – 2	5	20
Topsoil Thickness	2.2 - 5	4	20
Topsoil Thickness	2.5 -3	3	20
Clay Thickness	21 – 24	5	20
Clay Thickness	24-27	4	20
Clay Thickness	27-30	3	20
Clay Thickness	30-33	2	20
Aquifer Thickness	25 -27	5	20
Aquifer Thickness	27 - 30	4	20
Aquifer Thickness	30 - 33	3	20
Aquifer Thickness	33 - 36	2	20
Aquifer Thickness	36 - 39	1	20
Depth of Aquifer from Surface	35 – 38	5	20
Depth of Aquifer from Surface	38 - 40	4	20
Depth of Aquifer from Surface	40 - 42	3	20
Depth of Aquifer from Surface	42- 44	2	20

RESULT AND DISCUSSION

The results obtained from this study are described below in the following section.

- Surface map and its area.
- Subsurface map and its depths.
- Groundwater Prospect maps.

3.1 Surface map and its area

In this study, the various surface and subsurface maps have been used. These maps are useful to find the location of various sites for the construction of artificial recharge structure and also to analyses the various features on the earth surface. By using these maps the area of various features has been also calculated Table **4**.

Table-4: Surface layers and its area calculated in study area.

Maps	Layers	Color	Area in Sq. Km.
Land Use Land Cover	Built-up	Light Green	242.8
Land Use Land Cover	Forest	Green	3.0
Land Use Land Cover	Water bodies	Violet	1.0
Land Use Land Cover	Wastelands	Light blue	3.7
Land Use Land Cover	Wet Land	Light blue	0.1
Land Use Land Cover	Agriculture	Pink	170.2
Lithology	Sandy Clay	Blue	127.9
Lithology	Clay with sand/silt	Pink	0.5
Lithology	Gravel/Sand, Silt	Light blue	0.6
Lithology	Clayey Sand	Light Pink	61.8
Lithology	Water Body	Violet	5.3
Lithology	Habitation Mask	Light Green	247.3
Soil	Sand Clay	Blue	1.5
Soil	Fine Loamy	Violet	371.8
Soil	Fine Silt	Light Green	12.7
Soil	Coarse Loamy	Yellow	51.0
Hydro Geomorphology	Ox-bow lake	Brown	0.8
Hydro Geomorphology	Floodplain	Light Yellow	0.2
Hydro Geomorphology	Ravenous land	Navy blue	0.3
Hydro Geomorphology	Older alluvial plain	Yellow	66.6
Hydro Geomorphology	Younger alluvial plain	Light green	370.5
Hydro Geomorphology	Forest	Green	4.2
Hydro Geomorphology	Water Logged	Blue	1.1

ISSN 2394 - 7780

Hydro Geomorphology	Water Bodies	Blue	0.7
Hydro Geomorphology	Sand Bar	White	0.0
Hydro Geomorphology	Swampy/Marshy Land	Red	0.2
Hydro Geomorphology	River width	Blue	0.1

3.2 Subsurface map and its depths.

The vertical electrical sounding technique helps to make the subsurface layer of the study area. In this study, the maximum depth of sixty meters below the surface has been taken because in indo –Gangetic plain area the most of the aquifer lies in this depth. This technique was helpful to delineate the subsurface information at various depths. The main focus was to identify the various layers of geological formations and its depth under the soil surface.

Table-5: Subsurface layers and its area calculated in study area.

Maps	Depth in (m)	Color	Area in Sq. Km.
Top Soil Thickness	1.5-2	Yellow	266.1
Top Soil Thickness	2-2.5	Brown	95.6
Top Soil Thickness	2.5-3	Blue	81.5
Clay Thickness	21-24	Yellow	52.5
Clay Thickness	24-27	Brown	104.5
Clay Thickness	27-30	Blue	181.0
Clay Thickness	30-33	Green	73.0
Water Level	12 13	Yellow	19.3
Water Level	13 -14	Brown	66.5
Water Level	14 -15	Blue	167.6
Water Level	15- 16	Green	46.1
Water Level	16-17	Pink	7.5
Saturated Thickness	44-45	Yellow	51.7
Saturated Thickness	45-46	Orange	167.4
Saturated Thickness	46- 47	Blue	158.0
Saturated Thickness	47-48	Green	66.3
Aquifer Thickness	25-27	Yellow	32.4
Aquifer Thickness	27-30	Orange	73.0
Aquifer Thickness	30-33	Blue	181.0
Aquifer Thickness	33-36	Green	104.5
Aquifer Thickness	36-39	Pink	52.5
Depth to Good Aquifer	35-38	Yellow	121.2
Depth to Good Aquifer	38-40	Orange	176.8
Depth to Good Aquifer	40-42	Blue	64.7
Depth to Good Aquifer	42- 44	Green	80.6

3.3 Groundwater prospect map

In this study, the groundwater prospect map has been made to identify the best possible location for artificial groundwater recharge. The rank and weightage were provided to each layer and map made for this study. The output comes as in the form of a raster image that shows the various color patches at various locations in the study area (Fig.**17**). By using the pixel value range from one to five. The interpretation has been done. The range one was selected for the excellent zone and five has been taken for poor zone respectively. The map has been categorized into five different zones i.e. Excellent by Orange, very good by dark Green, good by light Green, moderate by Red and poor by Yellow color respectively. The area of the different zone for the excellent zone is (2.354), very good (162.46), good (221.721), moderate (54.596) and poor zone (2.765) Km^2 respectively. The star mark on the map shows the selected location where the artificial groundwater recharge structure can be made. In this study, mostly recharge structure has been proposed near the canal representing an excellent and very good zone for groundwater recharge.

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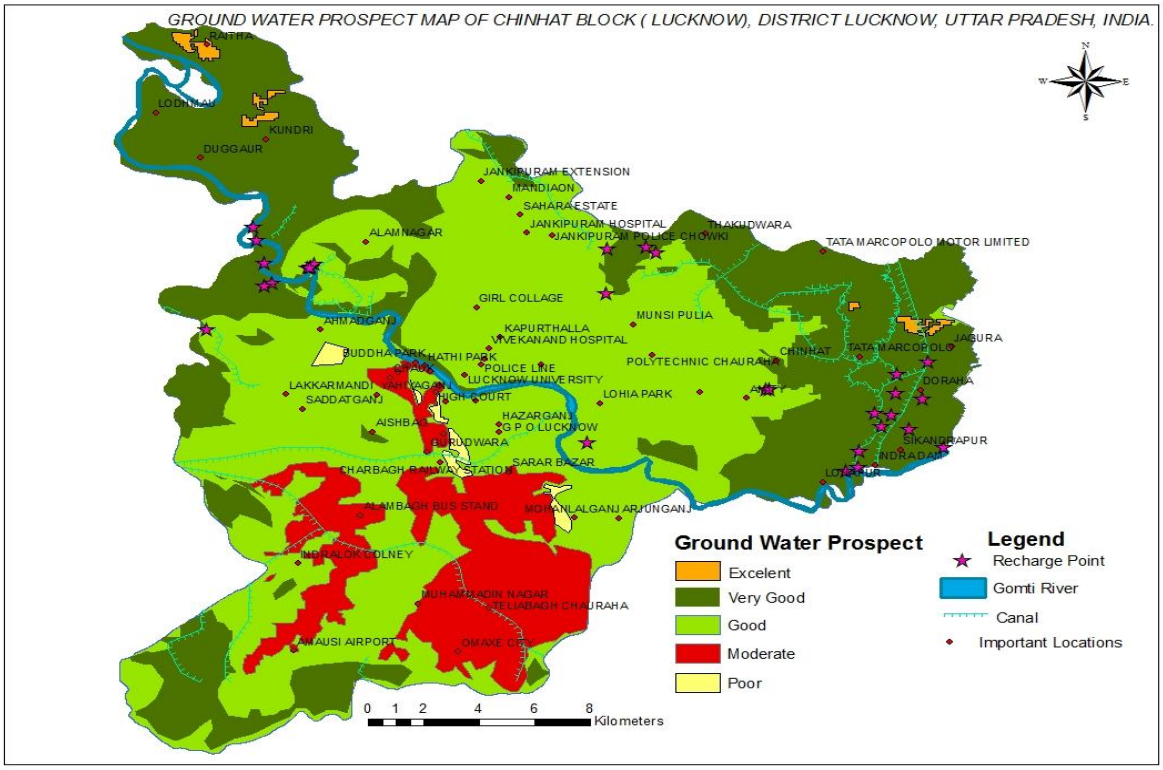

Fig-17: The location where the artificial ground water recharge system can be made after classifing & separating the area according to overall recharge potential

3.4 Conclusion

The rapid delineation in the groundwater table is one of the major problems in Chinhat block of Lucknow, UP, India. Using only rainwater harvesting technique retardation of groundwater depletion rate is not possible in this area. Artificial groundwater recharge is one of the promising techniques to reduce water depletion rate. Surface water in the form of canal seepage, Clean Pond, Lake, and river water can be used for the recharge the aquifer. For the success of this technology, selection of suitable sites for finding out a potential site for artificial is a prerequisite. Therefore, the present study was conducted to find out a potential site for artificial groundwater recharge structure using remote sensing and GIS and geophysical resistivity techniques. In this study, various surface and subsurface layers map have been prepared and overlaid to one another for delineation of potential groundwater recharge sites. It has been found that excellent groundwater recharge zone exists near to the surface water resources. These results obtained by this study showed the effeteness of remote sensing & GIS and VES technique for delineation of potential groundwater recharge area by artificial recharge technique.

3.5. Acknowledgement

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PHYTOCHEMICAL ANALYSIS OF SOME SALT TOLERANCE PLANTS FOR RO WASTE DISPOSAL

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ABSTRACT
Reverse osmosis (RO) Technology has been use in various industries to purify drinking water and to treat the waste water to pure water in use of industrially process. A number of traditional as well as advanced techniques has been employed to reduce or treat the waste produced by this purification method.

The ZID or Zero liquid discharge is considered as one of the best technology for solution of waste water treatment and RO reject management. It could be achieved through different modes like Multi effect evaporators, solar evaporation ponds system, machanical evaporation system, mist Evaporation system etc.

Water is considered as one of the most important resource for life on the earth. In desert climates it becomes much more significant to reuse it several times to avoid wastage.

As mentioned above we would select some plants which are adapted in saline environment and plant them with the supply of RO waste as a nutrient, as it is rich in minerals. It would serve a better multitasking results.

The current paper is based on some phytochemical aspects with economic importance of five plants viz. Capparis decidua, Ziziphus zuzuba, Salvadora persica, Acacia nilotica and Terminerea catappa species which are salt tolerant in nature.

All the above species are common in our zone and easy to cultivate. These provide a number of valuable products with great economic importance. There is a bright scope of these plants as a treatment of waste with environment concern.

Keywords: Reverse osmosis (RO) Technology, salt tolerant plants, Desert climate, Waste of RO, Economic importance.

INTRODUCTION
Water is considered as the most precious natural resource, and called the elixir of life. With the increasing industry, agriculture, and domestic demands result into water scarcity and environmental problems. Over population explosion and water exploitation combines to make serious issue of water resource development.

The use and reuse of water is only cure of these problems. The economy of India is based on agriculture so water becomes more significant resource especially for a developing and agrarian country, the demand for water supply increasing continuously. Water conservation awareness and increasing health regarding updates are working simultaneously in the same direction. Government with environmental norms have been increased the monitoring of water use in industries at all possible levels.

The application of non-conventional methods like desalinated seawater may serve a good option to solve these problems. A systematic policy of reusing the treated wastewater for irrigation purposes is required to implement new methods of reuse and recycling of saline and waste water to make it consumable. Ultra-filtration and reverse osmosis are two commonly applied techniques for this purpose. In these techniques salts are concentrated and pure water is obtained. The by product releases a huge amount of concentrated salts and termed as RO reject.

A number of methods have being applied to get rid of this waste. The zero liquid discharge or ZLD system involves a range of advanced waste water treatment technology to recycle, recovery and reuse of the treated wastewater and thereby ensure there is no discharge of waste water (liquid and soiled) to environment Ponds evaporation system, Mechanical evaporation system, Spraying Evaporation system, Multi effect evaporators are some commonly applied methods. The reject concentrate can be used for irrigating salt tolerant species of plants, shrubs, trees or any other form of vegetation.

The present paper is based on the scope to use RO waste to irrigate the salt tolerant plants and studies of their phytochemical composition. On the basis of geographical distribution of plants in arid zone of Rajasthan a vast variety of plants have been reported to have this specific property. The phytochemical aspects with economic importance of five plants Capparis decidua, Ziziphus zuzuba, Salvadora persica, Acacia nilotica and Terminerea catappa species have been studied with reference to salt tolerant nature. All the above species are common in

ISSN 2394 - 7780

our zone and easy to cultivate. These provide a number of valuable products with great economic importance. There is a bright scope of these plants as a treatment of waste with environment concern.

MATERIAL AND METHODS

A detailed literature and field survey was done to seek the salt tolerant plants in arid/semi-arid zones of Rajasthan.in the course of our research since last 18 years we have studied as well as analysed more than 200 species of plants from different zones of Rajasthan. The initial step is the identification, classification and distribution of these species which proceed in scope to the economic importance and engineering applications.

The selected species were identified and their economic importance were analysed.

The importance were categorized in medicinal, industrial, ornamental, environmental and ethical values.

ECONOMIC AND MEDICINAL VALUES OF SPECIES

Species 1: Capparis decidua: It is a deciduous, bushy shrub growing in dense tufts, with height 4 - 5 metres and grown up to a small tree with green vine-like leafless branches, hanging in bundles. Short lived very small leaves only appear during the rainy season.

It is considered one of the important multipurpose tree species of desert and arid regions of the Indian subcontinent, Africa and Saudi Arabia. It provides vegetative cover in dry, hot, sandy desert areas where little else grows.it can tolerate 5 - 48°c.

Both the ripe and unripe fruits are eaten. They can be made into a bitter-tasting pickle. The unripe fruit is cooked and eaten. Flower buds are cooked and eaten as a potherb, or pickled. The ash of the burnt roots of this plant is used as a salt.

The very bitter roots have been reported with significant bioactivity in the Indian and Farsi pharmacopoeia. The root bark is applied to cure swollen joints.

As agroforestry importance, it is considered as one of the best species for establishing shelter belts to check the movement of sand in the Thar Desert of India. Drought resistant and withstands neglect, this species could be particularly useful in arid areas as a live hedge providing edible fruits.

The wood is very hard and used to make water pipes and water troughs and also for charcoal and firewood in its native range.

Species 2: Ziziphus jujuba:It is a genus of various species of Ziziphus. Extracts from the fruit of Ziziphus jujube are used as dietary supplement and the fruit of certain species can be consumed and the fruits are taken as a whole food. Typically applied as a folk remedy for anxiety,asthma, diarrhea, fatigue,fever, high blood pressure,inflammation,stress etc. In alternative medicine, it is said to increase strength, stimulate appetite and enhance liver health. When applied directly to the skin, promotes wound healing, treat dry skin, ease sunburn, and reduce wrinkles and other signs of aging.

According to the report in Journal of Agricultural and Food Chemistry in 2013, it may help reduce inflammation, fight obesity, stimulate the immune system, improve gastrointestinal health, and boost antioxidant capacity.

Additionally, a preliminary study published in Natural Product Communications in 2013 found that Ziziphus mucronata may have anti-diabetic benefits. In tests on cells in culture, scientists found that Ziziphus mucronata may fight diabetes by helping cells to properly utilize blood sugar (and, in turn, protect against elevated blood sugar levels).

Species 3: Acacia nilotica - It is a medium sized tree distributed mainly in the dry parts of Africa, India, Australia, Arabia and also known as the Indian gum Arabic tree. It is used African herbal medicine and in Ayurvedic and Siddha medicine, in India. All of the plant parts including the seedpods and flowers are useful. The bark, roots, leaves and gum are used for healing. It is taken to reduce fevers and stop excessive bleeding. Research in animals supports its traditional Ayurvedic use against parasitic worms. It is also utilized to treat diabetes and is widely employed against all types of infections.

Leucorrhoea treatment is another significant use of this miraculous plant. Due to presence of good amount of tannin in the bark acts as an astringent, tightening and toning tissues.

Placing the ground leaves of the plant on the eyes at night is a common conjunctivitis treatment. Teas are made from the leaves and bark to ease the symptoms of colds and pneumonia.

ISSN 2394 - 7780

Acacia nilotica extracts have been reported to contain phytochemicals containing antioxidant properties. These procedures have shown that many substances are unique and found rare in universal distribution in the plant kingdom. The phytochemicals are alkaloids, volatile essential oils, phenols and phenolic glycosides, resins, oleoresins, steroids, tannins and terpenes . The plant extracts have been reported to contain physterols, fatty acids, fats, phenolic compounds, flavonoids and saponins. The stem bark of the plant contains terpenoids, alkaloids, saponins and glycosides. Gallic and ellagic acid, isoquercitin, leucocyanadin, kaempferol-7-diglucoside, glucopyranoside, rutin, derivatives of (+)-catechin-5-gallate, apigenin-6,8-bis-C-glucopyranoside, m-catechol and their derivatives have been reported as phytochemicals.

Species 4: Salvadora persica- Salvadora persica L. belongs to family Salvadoraceae and is a small genus of evergreen tree/shrubs. In India, Salvadora persica L. is widespread to plains and low elevations up to about 900 m. It occurs in dry water courses and rocky depressions and more widely found in arid and semi-arid regions. The tree can grow in desert situations in sandy and barren lands, under low rainfall and dry weather conditions. The climate of arid zones is often characterized as hot and dry summers, subhumid monsoon, and cold dry winters. The most common application of this tree is to make natural tooth brush having good cleansing ability.

Species 5: Terminalia catappa: It is a small tree. The plant is grown in houses and also found on road sides. The leaves and seed coat is a source of red organic dye. The fruits are edible and a good source of protein and oils. Some flavonoids have also been reported in the fruits. Terminalia contains ingredients that help stimulate the heart. And it also helps the heart by lowering cholesterol and blood pressure.

RESULTS AND DISCUSSION

The above studies indicates that selected plant species contain a verities of useful phytochemicals. These are not only bioactive but important from environmental point of view also. These verities would be a better alternate to decrease the salt concentration in the soil due to discharge of RO wastes.

Further all the species belongs to arid or semi-arid zone of Rajasthan so their cultivation on large scale would provide useful products as well as provide Zero Disposal waste.

TABLE-1: BOTANICAL DETAILS OF SELECTED SPECIES

Species number	Botanical name	Common name	family	Plant type
1	Capparis decidua	karira	Capparaceae	Branched shrub
2	Ziziphus zuzuba	ber	Rhamnaceae	Small sized tree/shrub in early stage
3	Salvadora persica	Meswak , pilu , Salvadora indica, or toothbrush tree, mustard tree, mustard bush	Salvadoraceae	Branched tree with shining leaves
4	Acacia nilotica	'Babul' or ' Kikar	Mimosaceae	proverbial, medium sized tree
5	Terminerea catappa	country-almond, Indian-almond, Malabar-almond, sea-almond, tropical-almond false kamani	Combretaceae	Branched tree with flat circles of branch whorls

SPECIES-I: CAPPARIS DECIDUA

ISSN 2394 - 7780


SPECIES-II: ZIZIPHUS ZUZUBA


SPECIES-III: SALVADORA PERSICA


SPECIES-IV: ACACIA NELOTICA


SPECIES-V: TERMINARIA CATAPPA

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WATER SCARCITY: REASONS OF ITS DEVELOPMENT AND METHODS TO IMPROVE IT

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ABSTRACT

Water is one of the most vital resource at our disposal detrimental for living existence. It has been identified as a basic human right all over the globe. Since its distribution is disproportionate, its availability has become a major concern. Fresh water needs to be used in efficient and in an effective manner in order to save it for future generations. There are various sectors such as agriculture, construction, among other industries where fresh water is heavily utilized. Water ranks at first place for the highest consumption of any resource. After years of being exploited extensively, the term water stress has become a major relevant factor. Water Stress by definition is the impact of high water use (either withdrawal or consumption) relative to water availability. A rise in Water Stress trends indicates towards water scarcity. Thus if water is not used in a proper, sustainable manner, it will be exhausted in the not so distant future.

Water Scarcity has been defined by the United Nations as "the scarcity in availability due to physical shortage, or scarcity in access due to the failure of institutions to ensure a regular supply or due to a lack of adequate infrastructure."

Availability issues occur when the rate at which water exhausts is more than the rate at which the source gets recharged. This can be due to improper rainfall patterns, depletion of water table, natural calamities among others.

This paper aims to deal with the term water scarcity and different terms and technicalities associated with the same such as Water Stress, Water Crowding Index, among others while also discussing methods and techniques to better understand aforementioned concepts and make an effort towards listing various techniques implemented throughout the world to ameliorate the problems associated with water scarcity.

Keywords: Scarcity, water stress, water shortage

1. INTRODUCTION

1.1. Water Scarcity and water distribution

According to World Economic Forum in 2015, Water is listed as the largest global risk in terms of potential impact over next decade. Water scarcity is defined as the lack of available water in order to fulfil demand within a region. It affects each and every continent. 70% of the earth surface is covered with water, which amounts to 1400 million cubic kilometres (m km^3). However, 97.5% of this water being sea water, it is salty. Fresh water availability is only 35 m km^3. Out of the total fresh water, 68.7% is frozen in ice caps, 30% is stored underground and only **0.3%** water is available on the surface of the earth. Among various continents, Asia has 36% of the available fresh water reserves, with over 60% of the world population where water is a scarce commodity. In fact compared to Asia, Africa is in a better situation, where 13% of the population has access to 11% of the fresh water reserves. Australia has plenty of water with 1% population 1 owning 5% of the fresh water reserves, followed by North and Central America, with 8% population and 15% water reserves and South America with 6% global population and 26% fresh water reserves.

1.2. Water Use

Fresh surface water is mainly used across the globe as it can be easily extracted. It has recently been estimated that the approximately 69% of worldwide usage of water is for agriculture, mainly in the form of irrigation; 22% for industrial purposes, eight percent (8%) for domestic purposes, and one percent (1%) for recreational use.

1.2.1. Agriculture

Approximately 70% of the world's irrigated land occurs in Asia, which accounts for approximately 35% of the area of cultivated land. The water used in agriculture is solely used in irrigation. About 15-35 percent of water extracted for irrigation is used in non sustainable manner. The significant increase in population will require a huge increase in food supply and energy generation. Food demand can be satisfied with agriculture only. It causes huge pressure on water resource and lead to water scarcity.

1.2.2. Industry

Industrial water usage is the second-largest consumer of water in the world. The consumers include economic entities such as mines, oil refineries, manufacturing plants, as well as energy installations using water for the

ISSN 2394 - 7780

cooling of power plants. The demand for water by the industrial sector of a country is generally proportional to the average income level of its people. Industrial water withdrawals constitute five percent (5%) in low-income countries as opposed to the above 40% in some high income countries. A number of countries in Asia are now developing their economies around industrial development so that water usage in this sector will increase over subsequent years. The industry that uses the most water is the energy sector. Energy and water are intricately connected. All sources of energy and electricity require water in the production process, while energy is also required to make water available for human consumption through pumping, transportation, treatment, desalinisation and irrigation.

1.2.3. Domestic use

Domestic activities account for eight percent (8%) of the world's water consumption and constitute the third-largest water consumer across the globe. This category includes drinking water, bathing, cooking, sanitation and gardening activities. The estimated basic household water requirements are at around 50 L per person per day but excluding water for gardens. Approximately 2 L of the 50 are used for drinking, 20 L for sanitation, 15 L for bathing, and 10 L for cooking. This estimate is however exceeded by most countries.

1.2.4. Recreational use

Recreational water use accounts for only one percent (1%) of the world's water consumption but this proportion is increasing slowly. This type of water use is associated with reservoirs. The water is categorised as recreational if the reservoir is kept fuller for storage purposes than it would otherwise be.

2. THREATS POSED BY WATER SCARCITY

Water Scarcity poses a number of threats, both for the present and the not so distant future

2.1 Hunger, poverty and education

Apart from dehydration due to the obvious lack of drinking water, hunger is one the most serious effect of water scarcity. Water shortages have a direct impact on crops and livestock, which can lead to food shortages and eventually starvation. As well, because of water shortages some people cannot shower, wash their clothes or clean their homes properly.

In the poorest countries, some children can't go to school; because they are either too sick or they have to walk for a long time to reach a water source. Even when they can attend, many children cannot learn because of their fatigue, heavy responsibilities and worries for their families.

2.2 Sanitation issues and diseases

Water scarcity generates sanitation problems by forcing people to drink unsafe water. In fact, when water is scarce people tend to store it at home, which increases the risk of domestic water contamination and creates breeding grounds for mosquitoes, which transmit dengue and malaria.

Lack of water causes other diseases such as trachoma (an eye infection that can cause blindness), plague and typhus.

2.3 Conflicts

Having access to water has become a powerful global economic issue that could become one of the main causes of international tension. Local conflicts - sometimes resulting in warfare - are triggered over scarce water resources. With the burgeoning global population and growing needs, these tensions could multiply in the future.

2.4 Biodiversity loss

Water scarcity has different negative impacts on rivers, lakes, and other freshwater resources. It harms the environment in several ways including increased salinity, nutrient pollution, and the loss of floodplains and wetlands. Ecosystems and biodiversity (e.g. freshwater fish) are threatened by the scarcity of water resources.

3. WATER STRESS AND WATER SHORTAGE

Water scarcity can be divided into two parts water shortage and water stress. Water shortage is referred as low water availability per person i.e. in a crowded area, there is less amount of water available per person as more people have to use available water in that specific area. Water stress is referred as impact of high use of water relative to water availability. These concepts are accessed independently of each other despite of being used together for understanding of water scarcity.

$$\frac{water\ use}{population} = \frac{water\ use}{water\ availabilty} \times \frac{water\ availibilty}{population}$$

$$Per\ capita\ water\ use = stress\ indicator \times shortge\ indicator$$

ISSN 2394 - 7780

There are multiple ways in which each of the terms can be defined, yielding different families of indicators for shortage and stress. For example, *use* can refer to consumption or withdrawals. *Availability* might refer to water from different sources, of different quality, or at decadal, annual or seasonal time scales. The *population* in question might be that which is dependent on a resource, which is physically located within a region or only that which has access to the resource.

Given the complexity of the impacts, these are clearly crude indicators of actual impacts involved in stress and shortage. There is substantial uncertainty in determining at what value of the stress and shortage indicators, stress and shortage impacts actually occur. Even when justified thresholds are selected, the value of the indicator is typically also reported, so that the reader can form their own opinion of whether stress and shortage have really occurred

A widely used, simple indicator of water scarcity, the water crowding index , relates water resources to population at the country scale. Defined originally as the number of people depending on a given resource unit, we use the inverse (i.e., annual mean water resources per capita). Considering only supply-side changes, this indicator is suitable for assessing the impact of climate change on physical water scarcity, whereas the actual water stress experienced by people will also depend on changes in per-capita water requirements and uses

4. REASONS FOR DEVELOPMENT OF WATER SCARCITY:

As mentioned above, overexploitation of water is the main cause of water scarcity but there are some other reasons to it too such as pollution and climate change.

4.1. Overuse of water

The misuse of water is one of the leading factors leading to water scarcity. The use of water whether it is for agriculture use or industrial or domestic use causes a large amount of waste water. Considering we are wasting more water than ever causes lot of stress on water resource.

4.2. Pollution

Pollution causes the degradation of water making it unfit for any useful purpose thus increasing shortage as well as stress on resource. Pollution is becoming largest source of water scarcity.

4.3. Climate Change

Due to global warming, the available water resources are decreasing thus causing water scarcity. Melting of glaciers and ice caps also affect the available freshwater resources.

5. CALCULATION OF WATER SCARCITY

Water Scarcity or Water Stress can be measured through a variety of set indexes and indicators.

There are numerous indicators and indexes based on usage with limitations and advantages associated with them. Common indexes include but are not limited to:

- Falkenmark indicator
- Basic Human Needs Indicator
- Social Water Stress Index
- Water Poverty index
- Agricultral Water Poverty index

In this paper we will be discussing the most commonly used indexes for calculation.

5.1 Falkenmark Indicator or Water Stress Indicator

In 1989, Swedish water expert Falkenmark developed one of the most widely used indicator to measure water stress, the indicator is based on the measure of water availability per capita per year within the country or region. In order to define the water stress, the classes presented in Table 1 were developed. The level of 1,700 m3/capita/year is used as threshold, and the countries or regions that fall into the categories under 1,700 m3/capita/year are considered to experience water stress.

Index(m3/capita/year)	Class
>1,700	No Stress
1,000-1,700	Stress
500-1,000	Scarcity
<500	Absolute Scarcity

Table-1: Water barrier differentiation proposed by Falkenmark (1989).

ISSN 2394 - 7780

The Falkenmark Indicator is commonly used to assess the water stress on the country scale; therefore, usually the required data is easily accessible and the results are straightforward, easy to use and interpret.

5.2 Basic Human Needs Index

The Basic Human Needs Index is a water stress index developed by Gleick (1996) evaluates instead of water availability the water used to satisfy the basic human needs such as water for drinking, cooking and hygiene. It is assumed that in total 50 litres of water per day is required, of which approximately 5 litres/person/day for drinking, at least 35 litres/person/day for sanitation and hygiene, and 10 litres/person/day for cooking. These minimum requirements are suggested as thresholds for water supplier's regardless the demand determined by culture or climate.

Like the Falkenmark Index, the Basic Human Needs Index is assessing the water use on country scale, therefore, disregarding the regional variations and water quality. Since it takes into consideration just households' water requirements (where the data is usually unreliable and deficient), it ignores the other water uses such as industrial, agricultural or environmental.

6. REMEDIAL PROCESSES

Water Stress and Scarcity poses an immense threat to both the present and to the foreseeable future. Some techniques have proved to provide remedial relief against water scarcity. They are discussed as follows:

6.1 Sustainable Water Management

Improving water infrastructure must be a priority, as water conservation and efficiency are key components of sustainable water management. Solar desalination and smart irrigation systems are great examples of clean technology for water efficiency and control. That obviously applies even more to the agriculture and farming sector - the largest consumer of water.

6.2 Reclaimed Water

Rainwater harvesting and recycled wastewater also allows to reduce scarcity and ease pressure on groundwater and other natural water bodies. Groundwater recharge, that allows water moving from surface water to groundwater, is a well-known process to prevent water scarcity.

6.3 Pollution Control and Efficient Sewage Treatment

Without proper sanitation, the water becomes full of diseases and unsafe to drink. That is why addressing pollution, measuring and monitoring water quality is essential. Besides, improving the sewage systems in specific areas is another way to prevent water scarcity from becoming any worse.

6.4 Awareness & Education

Education is critical to solve the water crisis. In fact, in order to cope with future water scarcity, it is necessary to radically reform all forms of consumption, from individual use to the supply chains of large companies.

7. CONCLUSION

In this paper we discussed the concept of water scarcity and the threat it poses to survival of life. These threats can grow tenfold if left unchecked. The relevant techniques that can be used to assess the threat level have also been discussed. Such analysis offers us a realistic estimate of the current scenario and imminent future. Effective mitigation measure can then be drafted to identify the problem sectors and employing counter measures. The remedial measures have also been discussed.

Water Scarcity posses a lingering threat which might not be apparent instantly but has long drawn out repercussions. Thus it is essential to identify and draft out plans to counter water scarcity. This will help in establishing a better tomorrow and thus a sustainable future.

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ASSESSMENT OF SEDIMENTATION IN KHARKHARA AND PARALKOT RESERVOIR USING DIGITAL IMAGE PROCESSING TECHNIQUES

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ABSTRACT

Dams or reservoirs have proven to be very beneficial for the sustained development of human beings since its evolution. The usefulness of dam depends upon its capacity to store water which is affected constantly by incoming sediment. The sedimentation is a process which involves deposition of silt carried by flowing water from erosion of soil of upstream catchment area. The sedimentation has proven to be very detrimental for the capacity of dams or reservoirsresults in huge loss of storage capacity of dams or reservoirs thus reducing its life. Many methods have developed to measure the reservoir sedimentation like hydrographic survey, inflow-outflow approaches, remote sensing method etc. Out of these, remote sensing method is widely used as it is very simple and involves very less human survey thus reducing the chances of error. In remote sensing method, revised water spread areas at different levels of reservoir are calculated and used for computation of loss of capacities between these levels. The present study has been carried out on Kharkhara and Paralkot reservoirs situated in Chhattisgarh state. Multi–date satellite data of IRS-P6, LISS-III is used for Kharkhara dam while LANSAT8, OLI is used forParalkotdam to estimate revised capacities. The normalized difference water index (NDWI), band ratioing technique (BRT) and false color composite (FCC) along with field truth verification were used to differentiate water pixels from rest of the images. As the revised water spread at dead storage and full reservoir levels were not available, best –fit curve has been used to get revised spreads on these levels. From the analysis, it has been observed that Kharkhara reservoir has lost 8.41 MCM of gross storage against its total capacity of 169.54 MCM during 50 years(1967-2017) while 3.53MCM of gross storage of Paralkot reservoir has been lost against its total capacity of 66.25MCM during 36 years(1981-2017). The rate sediment may be about 4.36 and 7.96 ha-m/100 km^2/yr for Kharkhara and Paralkot reservoirs respectively.

Keywords: Sedimentation, NDWI, BRT, FCC, Remote Sensing.

INTRODUCTION

Soil is eroded due to rainfall and wind, resulting in sediment movement into watercourses by flood and storm waters. Sediment particles originating from erosion processes in the catchment arepropagated along with the river flow.The soil erosion, transportation and subsequent deposition are natural processesthat reduce useful storage, availability of water, operation and overall benefits from reservoir. A great amount of sedimentis carried annually by the Indian rivers to reservoirs, lakes, estuaries, bays, and theoceans. When the flow of a river is stored in a reservoir,the sediment settles in the reservoir and reduces its capacity. After arrival of sediment-laden flow into a reservoir, the coarser particles settlefirst in the upper reach of the reservoir due to the decrease in the flow velocity.

Subsequently, the finer sediment material deposits further into and along the reservoirbed. Sediment deposition into reservoirs built for hydropower generation has severalmajor detrimental effects which include loss of storage capacity, damage to orimpairment of hydro equipment, bank erosion and instabilities, upstream aggradation. The sediment also influencesdownstream water quality, conveyance capacity of canals, biotic life and ecosystem. The assessment of revised capacity which is an indicative of sediment deposition is essential to determine present availability of water, modification in reservoir operation, necessity and intensity of soil conservation in the catchment. To estimate reservoir sedimentation conventional techniques like hydrographic survey, inflow-outflow method, bathymetric survey are used which are time consuming, laborious, risky and cumbersome. An alternative of traditional methods, the digital image analysis of remote sensing data is commonly used which is less time consuming, needs less manpower, less risky and economical. The remote sensing (RS) based technique of revised capacity estimation is essentially based on principle that the deposition of sediment reduces the water spread at any level which can be demarcated with the help of image processing of multi-band RS data in geographic information system (GIS) software (Fig.1). The revised water-spread areas determined from image analysis and elevation data are used to compute reduced volume of water which ultimately provides revised cumulative capacities on these levels. The computed revised capacities can be compared with the original capacities to find out changes in capacity and percentage losses between these levels.

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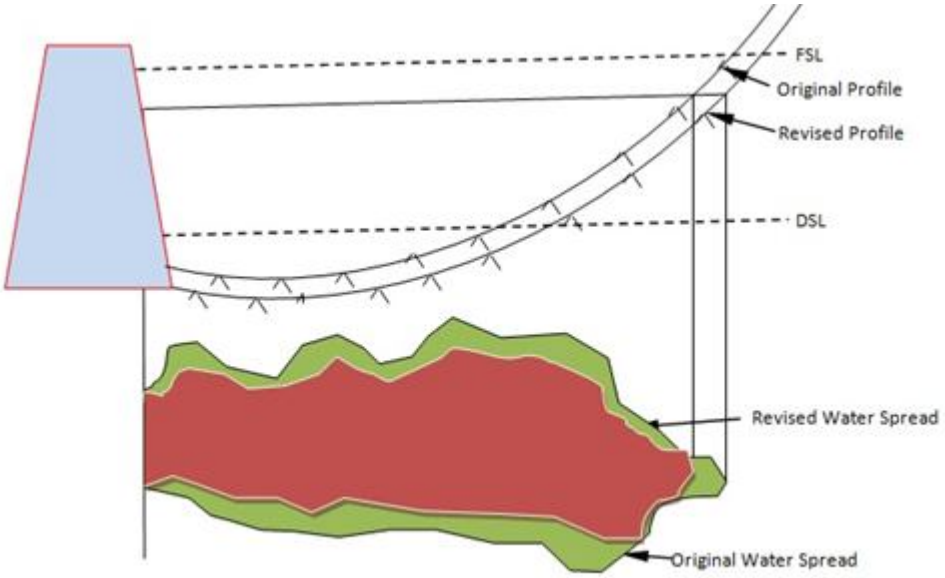

Fig. 1 Principle of assessment of sediment in digital image classification technique

RESERVOIR SEDIMENTATION STUDIES USING REMOTE SENSING DATA

The methodology adopted for this study involves pre-processing of satellite data,identifying the water pixels and computation of the capacity of the reservoir.In India, the water level in a reservoir is likely to be near the full reservoir level (FRL)by the end of the monsoon season (September/October) before it gradually depletes tolower levels towards the end of the drawdown cycle (May/June). To quantify the volume of sediments deposited in the reservoir, the basic informationthat needs to be extracted from the satellite data is the water-spread area of the reservoirat different water elevations.The surface area of the entire reservoir is determined by totalling all pixels classified aswater. Due to deposition ofsediments in the reservoir, the water-spread area at an elevation keeps on decreasing.Using the remote sensing approach, the water-spread area can be determined atdifferent reservoir levels and a revised elevation-capacity curve can be prepared. Bycomparing the original and revised elevation-capacity curves, the amount of capacitylost tosedimentation can be assessed. With the availability of high-resolution satellitedata, capacity surveys of reservoirs by remote sensing technique are gainingrecognition and acceptance.Clearly, an analysis of the data of a year that has maximum variation in the reservoirwater level will be most useful. The satellite imagery can be analysed by either visualor digital techniques to determine the water-spread area. Knowing the water-spreadarea from a particular image, the periphery of the water-spread area is obtained usingimage processing techniques. Elevation values are assigned to such water-spreadboundaries and contours corresponding to different water spreads are overlain to representthe revised conditions in the zones of study. The reservoir capacity between twoconsecutive levels is computed using the prismoidal formula and a revised elevationcapacitytable is generated. Comparison ofrevised and original elevation-capacitytables gives the capacity loss due to sedimentation in various zones of the reservoir.

DESCRIPTION OF KHARKHARA DAM AND PARALKOT DAM

Kharkhara Dam

Kharkhara dam is situated at 80° 58’ 19” E longitude and 20° 48’ 00” N on river Kharkhara in Mahanadi basin near Balod city of Chhatisgarh. It is Major Irrigation Project completed in 1967. The Kharkhara dam is an earthen dam of 1463 m in length having design flood of 1133 cumecs. The dam is designed to supply water for irrigation of 6939 culturable command area and part supply of water to Bhilai Steel Plant. A pictorial view of Kharkhara reservoir is presented in Fig. 2.

Fig-2: Pictorial view of Kharkhara reservoir

ISSN 2394 - 7780

Paralkot reservoir

The Paralkot reservoir is also known Kherkatta Reservoir, is a man-made lake about 12 km north of Pakhanjore in Kanker District situated in Goadvari Basin on river Deoda. The Paralkot dam is constructed on river Deoda in Godavari basin. The Paralkot dam is 1.2 km long earthen dam with ogee type of spillway of 232 m length to pass 974 m^3/sec design flood. The gross storage capacity of Paralkot reservoir is 66.25 Mm^3. The pictorial view of Paralkot reservoir is presented in Fig. 3.

Fig-3: Pictorial view of Spillway of Paralkot dam

DATA AVAILABILITY

In the study, LISS III data of pass of path 101 and row 57 of IRS 1D/P6 satellite were identified for Kharkhara (Table 1) whereas path 146 and row 43 of LANDSAT8 satellite were identified for Paralkot (Table 2). The original elevation capacity tables were used for comparison and estimation of loss.

Table-1: Remote sensing data used for Kharkhara Sagar reservoir

S.N.	Date of pass	Elevation (m)	Path/Row	Satellite	Sensor
1	03-Jun-17	327.44	101/57	IRS-P6	LISS-III
2	21-May-15	328.48	101/57	IRS-P6	LISS-III
3	16-Apr-17	329.88	101/57	IRS-P6	LISS-III
4	23-Mar-17	330.76	101/57	IRS-P6	LISS-III
5	27-Feb-17	331.80	101/57	IRS-P6	LISS-III
6	03-Feb-17	332.44	101/57	IRS-P6	LISS-III
7	09-Jan-15	333.11	101/57	IRS-RS2	LISS-III
8	18-Oct-16	333.44	101/57	IRS-RS2	LISS-III

Table-2: Remote sensing data used for Paralkot reservoir

S.N.	Date of pass	Elevation (m)	Path/Row	Satellite	Sensor
1	03-Jun-17	337.35	146/43	Landsat8	OLI
2	30-May-15	340.18	146/43	Landsat8	OLI
3	17-Apr-17	340.80	146/43	Landsat8	OLI
4	16-Mar-17	345.09	146/43	Landsat8	OLI
5	28-Feb-17	345.97	146/43	Landsat8	OLI
6	12-Feb-17	346.66	146/43	Landsat8	OLI
7	06-Jan-15	347.01	146/43	Landsat8	OLI
8	23/10/2016	348.69	146/43	Landsat8	OLI

IDENTIFICATION OF WATER PIXELS

Remote sensing provides land resource data in the form of digital magnetic types and in different bands of the electromagnetic spectrum. For any given material, the amount of solar radiation that it reflects, absorbs, transmits, or emits varies with wavelength. This important property of matter makes it possible to identify different substances or classes and to separate them by their individual spectral signatures. In the visible region of the spectrum (0.4 - 0.7 μm), the transmittance of water is significant and the absorption and reflectance are low. The reflectance of water in the visible region scarcely rises above 5%. The absorption of water rises rapidly in the near-infrared (NIR) band where both, the reflectance and transmittance are low. The reflectance of various objects present on the earth is different than water and this reflectance recorded in digital format by the sensors mounted on satellite. The digital data obtained from the sensors can be used to extract water spreads at different levels. The normalized difference water index (NDWI), band ratio and slicing has been used to identify the water pixels in the images. The *NDWI* and band ratio (B*R*) for identification of water pixels can be written as:

ISSN 2394 - 7780

$$NDWI = \left[\frac{GREEN - NIR}{GREEN + NIR}\right] \quad (1)$$

where, GREEN = Band-II data of IRS 1D/P6 satellite, NIR = Band IV data of IRS 1D/P6 satellite.

$$BR = \frac{NIR}{GREEN} \quad (2)$$

The slicing operation of the NDWI and band ratio images is carried out to extract water pixels from the rest of the image. In the slicing operation, the FCC, NDWI and BR images should be examined carefully where knowledge of spectral characteristics and ground truth information play an important role to decide the upper limit above which all the pixels can be classified as water.

DISCARDING OF EXTENDED TAIL AND CHANNELS

The main river at the tail end of the reservoir and numerous small channels joining the reservoir from distinct directions around its periphery are also classified as water during digital image classification. However, the elevation of water in these channels and the main river can slightly higher than the water surface of a reservoir receiving inflow through perennial streams inflow. So, these extended tail and channels must be separated from the point of termination of spread. The choice of truncation point is subjective and may be depend on the difference between the water levels in the subsequent date scenes.

COMPUTATION OF REVISED CAPACITY

After extracting water spread area from rest of the image, the histograms were built to determined revised water spread directly. As water level in the reservoir seldom goes below dead storage level (DSL), in the present study a graph has been plotted between revised water spreads and reservoir levels. A curve has been fitted and extended backward to determine revised bed of reservoir. The reservoir capacity between two consecutive reservoir elevations was calculated using the cone formula.

$$V = \frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 * A_2}\right) \quad (3)$$

where, V is the volume between two sequential elevations, A1 and A2 are the water spread areas at sequential elevations and h is the difference in the elevations. The revised cumulative capacities can be computed by adding the revised volumes between consecutive intervals which in turns used to estimate losses in revised capacities.

ANALYSIS OF RESULTS

Kharkhara Reservoir

To determine revised capacities of Kharkhara reservoir, eight different remote sensing scenes were analyzed and revised water spreads were computed. The false color composite (FCC), NDWI and extracted water spread for few dates of Kharkhara reservoir have been depicted in Fig. 4. As water level seldom goes below dead storage level and some time it is not possible to get a scene on full reservoir level, a scatter graph was plotted between reservoir elevation and revised water spread area and a best-fit curve was fitted to evaluate revised water spreads on these levels. The best-fit curve for revised water spreads suggested that the revised bed of Kharkhara reservoir can be considered as 318.27 magainst its original bed as 309.37 m. With the help of revised spread areas, the revised cumulative capacity and percentage loss in cumulative storages at different levels have been estimated and presented in Table 3. The graphical representation of original capacities in the year 1967 and revised cumulative capacity in the year 2017 for Kharkhara reservoir has been presented in Fig. 5.The result of study suggested that that 8.41 Mm^3 of gross storage has been lost due to deposition of sediment in 51 years (1967 to 2017) and if the uniform rate is considered, the sedimentation in this reservoir comes out to be 0.16 Mm^3/ year. It can also be confirmed that nearly 80% dead storage and 1.5% of live storage of this reservoir have been lost in the last 51 years of operation of reservoir.

Paralkot Reservoir

The revised capacity of Paralkot reservoir was computed using eight different scenes of Landsat data covering whole range of live storage. The FCC and extracted water spreads for few levels of Parakot reservoir have been presented in Fig. 5.9. As revised water spreads below dead storage level (DSL) was not available, a scatter graph has been plotted as done for other reservoir between reservoir levels and revised water spreads. A best-fit curve has been plotted and extended below DSL to compute revised water spreads on these levels. From the analysis, it has been found that present river bed at dam site of Paralkot reservoir can be considered as 335.31 m in place of original bed of 327.29 m. It shows that the storage between these two levels has completely lost due

ISSN 2394 - 7780

to deposit of sediment material brought by the river. The computation of revised cumulative capacities and loss in gross storages has been presented in Table 5.5. The graphical representation of original and revised capacity curve for Paralkot reservoir has been presented in Fig. 5.10. From the analysis, it has been found that 3.53 Mm^3 (5.33%) of gross storage and 2.28 Mm^3 (84.1%) of dead storage have been lost in 37 years (1981 to 2017) from Paralkot reservoir. The rate of deposition in Paralkot reservoir may be computed as 0.10 Mm^3/year if constant rate is considered

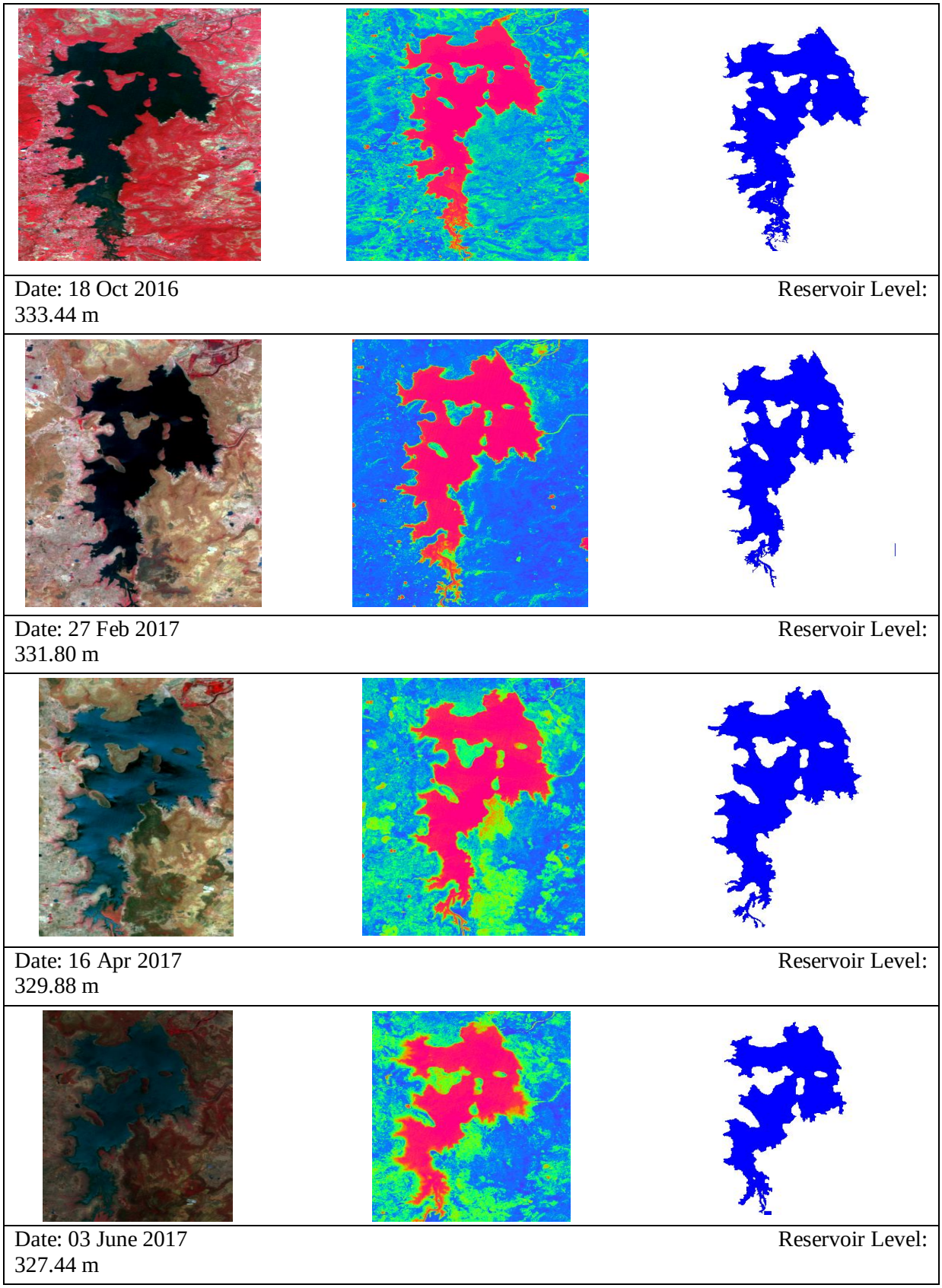

Fig-4: FCC, NDWI and extracted water spreads of few dates for Kharkhara reservoir

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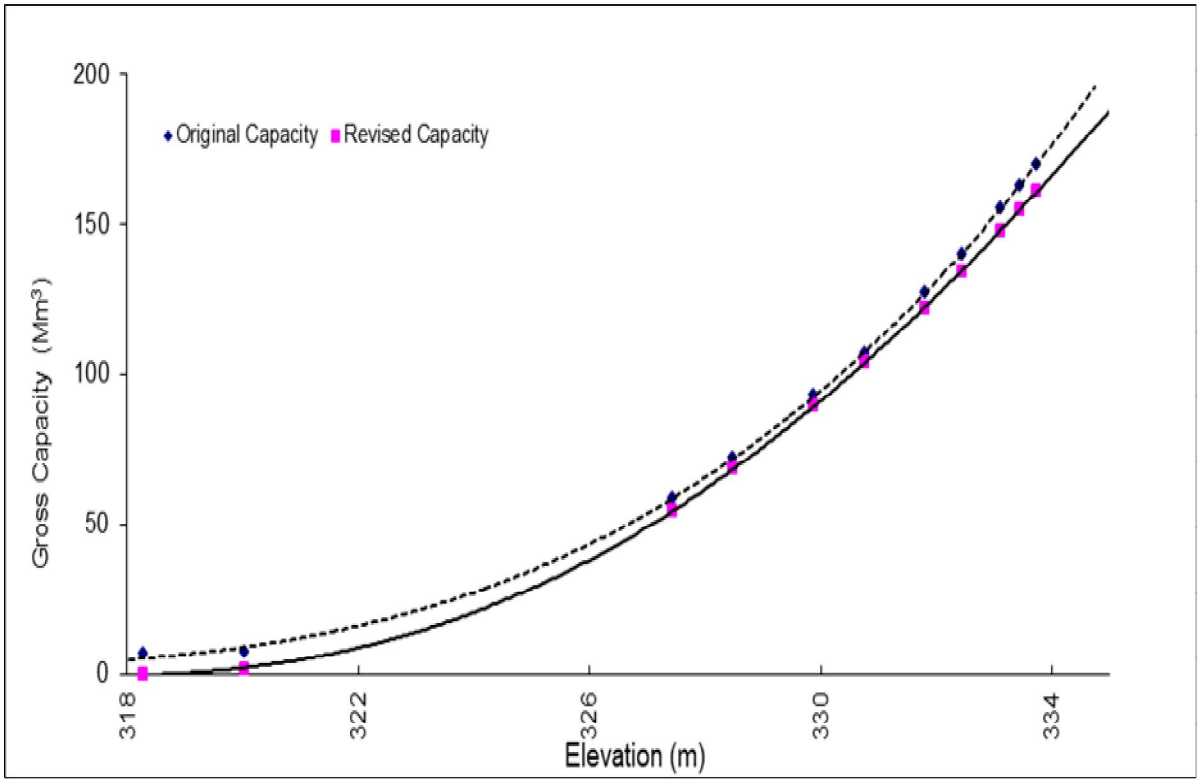
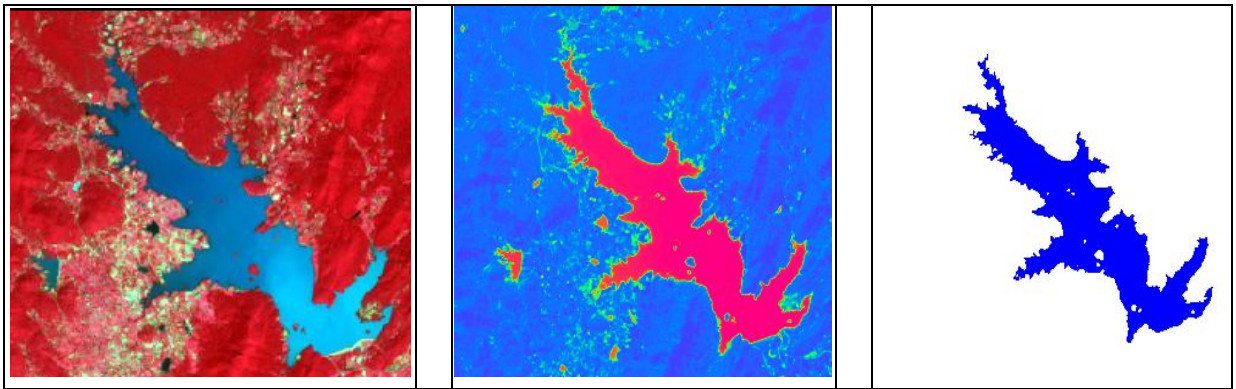


Fig-5: Original and revised cumulative capacity curves for Kharkhara reservoir

Table-3: Original, revised capacities and loss in storages of Kharkhara reservoir

Date of Pass	Reservoir Elevation (meter)	Original Capacity (Mm^3)		Revised Capacity (Mm^3)		Loss in Cum. Capacity (Mm^3)	% Loss in Cumulative Capacity
		Volume	Cumulative Capacity	Volume	Cumulative Capacity		
River bed	309.37		0.000		0.000		
Revised Bed*	318.27	6.54	6.54	0.000	0.000	6.54	100.00
DSL	320.02	0.89	7.43	1.41	1.41	6.02	80.99
03-Jun-17	327.44	51.21	58.64	52.88	54.29	4.35	7.42
21-May-15	328.48	13.45	72.09	14.37	68.66	3.43	4.76
16-Apr-17	329.88	20.64	92.73	20.92	89.58	3.15	3.40
23-Mar-17	330.76	14.39	107.12	14.17	103.74	3.38	3.15
27-Feb-17	331.80	19.79	126.92	18.12	121.87	5.05	3.98
03-Feb-17	332.44	13.25	140.17	12.13	133.99	6.17	4.40
09-Jan-15	333.11	15.18	155.35	13.69	147.68	7.66	4.93
18-Oct-16	333.44	7.65	162.99	7.02	154.71	8.28	5.08
FSL *	333.74	6.55	169.54	6.43	161.13	8.41	4.96



Date : 23 Oct 2016Reservoir Level: 348.69 m

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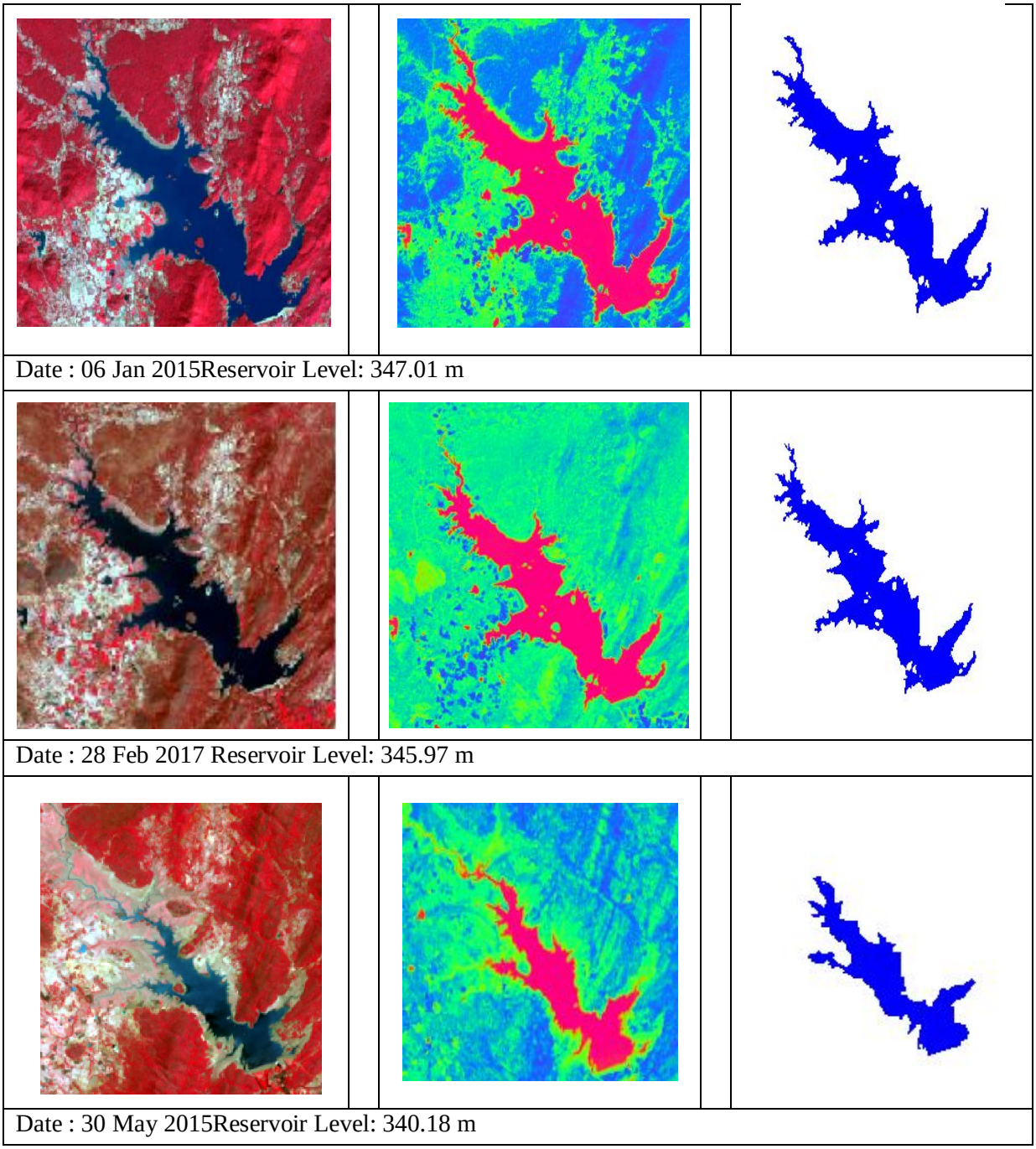

Fig-6: FCC, NDWI and extracted water spreads of few dates for Paralkot reservoir

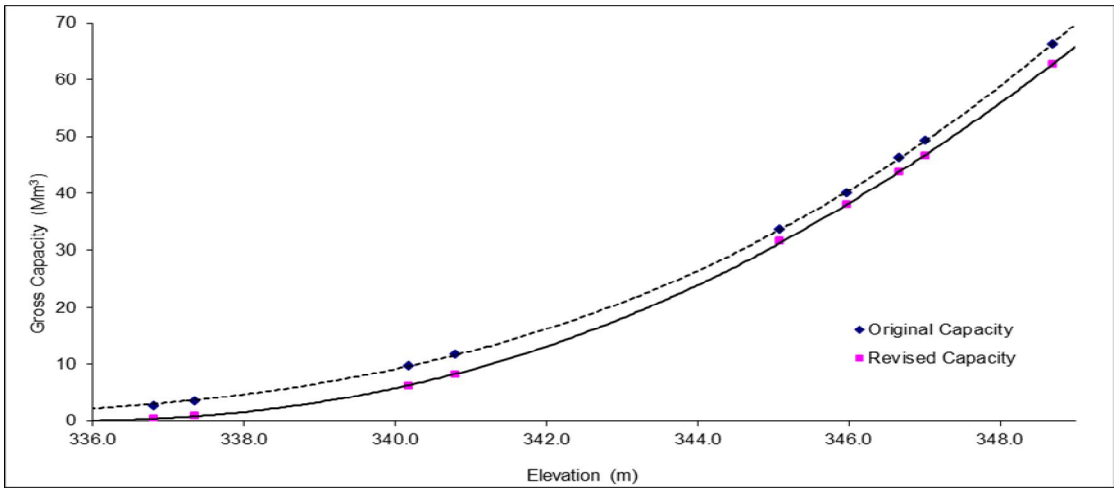

Fig-7: Original and revised cumulative capacity curves for Paralkot reservoir

ISSN 2394 - 7780

Table-4: Original, revised capacities and loss in storages of Paralkot reservoir

Date of Pass	Reservoir Elevation (meter)	Original Capacity (Mm^3)		Revised Capacity (Mm^3)		Loss in Cum. Capacity (Mm^3)	% Loss in Cumulative Capacity
		Volume	Cumulative Capacity	Volume	Cumulative Capacity		
River bed	327.29		0.00		0.00		
Revised Bed*	335.31	2.15	2.15	0.00	0.00	2.15	100.00
DSL	336.80	0.57	2.72	0.43	0.43	2.28	84.01
03-Jun-17	337.35	0.75	3.47	0.59	1.03	2.44	70.42
30-May-15	340.18	6.28	9.75	5.23	6.25	3.49	35.83
17-Apr-17	340.80	1.98	11.73	1.99	8.24	3.49	29.73
16-Mar-17	345.09	21.92	33.65	23.29	31.53	2.12	6.29
28-Feb-17	345.97	6.42	40.06	6.51	38.04	2.03	5.06
12-Feb-17	346.66	6.14	46.20	5.59	43.63	2.57	5.56
06-Jan-15	347.01	3.11	49.32	3.00	46.63	2.69	5.45
FSL 23-Oct 2016	348.69	16.935	66.250	16.09	62.716	3.534	5.33

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CONCLUSIONS
The systematic and scientific analysis of catchment and command areas may be helpful in planning to reduce distribution losses, equitable distribution of water and increase in crop yields which lead to overall livelihood in the region. In this reservoir sedimentation study, the reservoir sedimentation for Kharkhara reservoir in Mahanadi basin and Paralkot reservoir in Godavari basin of Chhattisgarh state have been determined by estimation of revised capacity using digital image analysis of remote sensing data. The revised capacities at different levels were estimated for Kharkhara and Paralkot reservoirs. The multi-temporal LISS 3 and OLI data were used in the analysis to cover whole live storage range in approximately equal intervals. The revised water spreads obtained from digital image processing were used to compute revised storage and cumulative capacities at different levels. The analysis suggested that the 8.41 Mm^3 from 169.54 Mm^3 of gross storage of Kharkhara reservoir has been lost due to deposition of sediment in 51 years (1967 to 2017). The rate sediment in this reservoir may be about 4.36 ha-m/100 km^2/year.Paralkot reservoir situated in Godavari basin started its operation in 1981 during this period (1981 to 2017), nearly 3.53 Mm^3 gross storage from 66.25 Mm^3 has been lost. The rate of sediment in Paralkot reservoir may be about 7.96 ha-m/100 km^2/yr.

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CLIMATE CHANGE DOWNSCALING ANALYSIS FOR SAMRAT ASHOK SAGAR DAM STUDY

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ABSTRACT

Climate change is altering local hydrology and availability of water resources. According to IPCC fifth assessment report, the global temperature has increased 0.85°C from 1880 to 2012. In this study, ten CORDEX South Asia model simulations of scenarios RCP 4.5 and RCP 8.5 from 1988 to 2050 are downloaded and applied to predict future rainfall near Samrat Ashok Sagar (SAS) Dam. The predicted rainfall near the dam are downscaled and imposed on a water balance model of catchment and command area of Samrat Ashok Sagar (SAS) Dam. The predicted rainfalls are downscaled based on measured rainfall at the four stations Basoda, Berasia, Raisen, and Vidisha near SAS Dam from 1988 to 2018. To determine the trend of climate change a non-parametric Mann-Kendall test has been carried out of the baseline period from 1988-2018 and of the downscaled future rainfall. The analysis of the measurement rainfalls show that at the three stations Berasia, Raisen, and Vidisha the rainfall is decreasing (Z values are -1.82, -0.36 and -2.46), at the station Vidisha a significant decrease, whereas at the station Basoda the test shows a non-significant increase (Z value is 0.11). The test of downscaled future rainfall shows a non-significant increase in rainfall at all four stations of SAS Dam.

Keywords: Climate change, CORDEX, Samrat Ashok Sagar Dam, RCP.

INTRODUCTION

Assessment of the effect of climate change in various socio-economic sectors is an activity important for planning at long term. The impacts and vulnerability are local scale issues that require more detailed climate information. Such information is used to assess the impacts of climate change on human and natural systems and to develop adaptation options and mitigation strategies at the state level. These assessments will be used by the decision-makers and policy-making communities to have solid purpose behind controlling response option. Global Climate Models (GCMs) are the major tool to provide information of climate change under different greenhouse gases emission scenarios. However, the grid sizes of these models are about 50 km. The regional climate models (RCMs) play the important role of downscaling the global climate simulations to smaller grid sizes in the area of interest (SAS Dam) where the impact studies can be carried out. The RCMs simulations with grid sizes of about a few ten kilometres are a compromise to point scale (i.e; downscaled at the location of rain gauge stations) (Chou et al., 2014).

According to IPCC Fifth Assessment Report (AR5), the global temperature has increased 0.85°C from 1880 to 2012(Krishnan R, 2017). Fifth Assessment Report (AR5) is based on the Representative Concentration Pathway scenarios, RCP 8.5, 6, 4.5, and 2.6 W/m^2 radiative forcing scenarios, which correspond to the range from pessimist to the optimistic emission scenarios (Giorgi Filippo, Jones Colin, 2009). Emissions scenarios describe future releases to the atmosphere of greenhouse gases, aerosols, and other pollutants and, along with information on land use and land cover, provide inputs to climate models. They are based on assumptions about driving forces such as patterns of economic, population growth, and technology development. In addition to their use as inputs to climate models, emissions scenarios are used in research on mitigation. They do not track "short-term" fluctuations such as business cycles or oil market price volatility but focus on long-term (e.g., decades) trends.

Climate scenarios are plausible representations of future climate conditions (temperature, precipitation, and other aspects of climate such as extreme events). They can be produced using a variety of approaches including analysis of observations, models, and other techniques such as extrapolation and expert judgment. Environmental scenarios focus on changes in environmental conditions other than climate that may occur regardless of climate change. Such factors include water availability and quality at basin levels (including human uses), sea level rise incorporating geological and climate factors, characteristics of land cover and use, and local atmospheric and other conditions affecting air quality. Scenarios of demographic, economic, policy, cultural, and institutional characteristics are needed for evaluating the potential to be impacted by changes in climate as well for examining how future patterns of economic growth and social change affect vulnerability and the capacity to adapt. Many of the same socioeconomic factors that affect emissions also affect vulnerability and adaptive capacity and thus the underlying socioeconomic modelling must be coordinated.

ISSN 2394 - 7780

The IPCC AR5 supported the climate projection framework within Coordinated Regional Downscaling Experiment (CORDEX) is based on the new set of global circulation models (GCMs). Ten CORDEX South Asian Model used to simulated future precipitation data under climate scenarios RCP 4.5 and 8.5 (Giorgi Filippo, Jones Colin, 2009).

The objective of this work is to assess the climate change in historic as well as future projection in Samrat Ashok Sagar dam based on ten GCMs model under two RCP 4.5 and 8.5 scenarios.

STUDY AREA

Samrat Ashoka Sagar (SAS) Dam or the Halali Project, commissioned in 1978, is located in the state of Madhya Pradesh between 77°33'00" Longitude and 23°30'00" Latitude. It lies in the Betwa Basin on the Halali River. The catchment and command area of halali reservoir falls under three district Bhopal, Vidisha and Raisen. the rain gauge station that comes under the study area shown in figure 2.1.

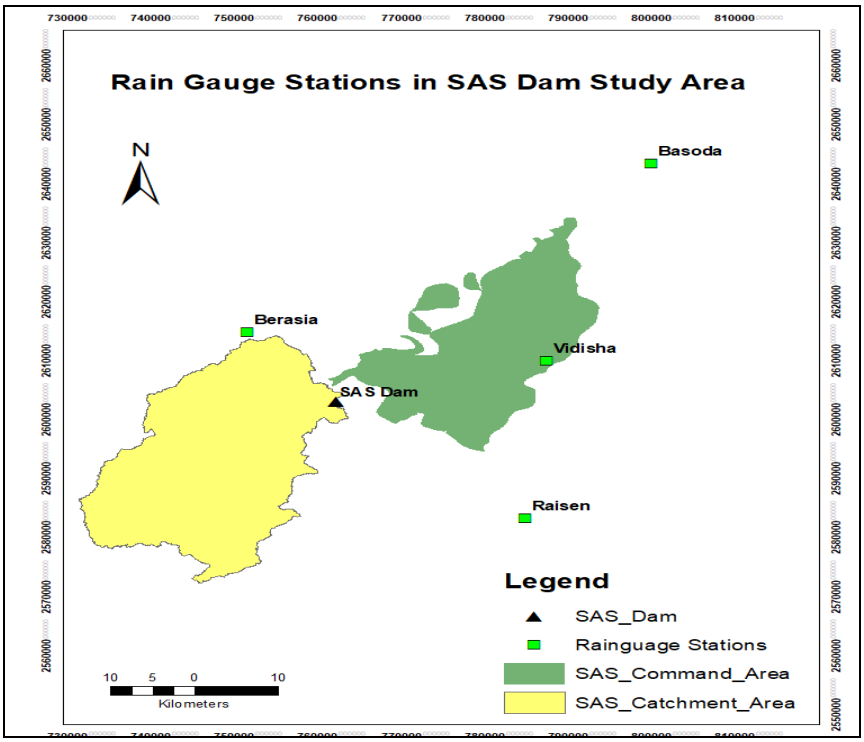


Figure-2-1: Rain Gauge stations in SAS Dam Catchment and Command Area

Halali is a rolled filled earthen dam with a maximum height of 29.57 meters above the foundation level and a length of 945 meters. The water spread area of the dam at Full Reservoir Level (FRL) is 57.46 km2 with a total capacity of live capacity of 252.13 Mcum. This dam is a multi-purpose dam including irrigation and water supply apart from Flood Protection and Fisheries. The main purpose of the dam was to provide irrigation to 12545 ha of land which is for Kharif Crop and 39292 ha of land for Rabi crop. The SAS Dam was also built to provide water to the town of Vidisha and Raisen. (MPWRD, 2014)

Temperature

The minimum temperature is in the months of December to February with an average temperature ranging from 9°C to 30°C. It begins to rise by middle of February and attains the maximum during May which is the hottest month of the year with ranges from 12°C to 44°C. However, there is no difference in the climate between catchment and command area (Gosain et al , 2017).

Topography and soil

The catchment and command area of halali reservoir falls under three district Bhopal, Vidisha and Raisen, which comes under black cotton soil. The black cotton soil in the SAS study area consist of Clay, Loam, Silt clay loam, and rest miscellaneous lands. General topography of command area is plain having gentle slopes and some part is terrain.(Nayak et al, 2016).

Data Collection

The observed daily precipitation collected from State Water Data Centre, Water Resources Department, Govt. of Madhya Pradesh, Bhopal. The daily rainfall data availability for Basoda, Berasia, Raisen and Vidisha stations for the time period 1988-2018.

ISSN 2394 - 7780

Global Climate Models

Ten CORDEX South Asian Model used to downscale daily precipitation data for all four stations of SAS Dam. Details of data availability, resolution and institution described in the Table 2-1.

Table-2-1: Overview of the ten CORDEX South Asia models applied to downscaled precipitation data.

GCM	RCM	Institute	Time Period	Resolution (time, space)
ECEARTH	RCA4	SMHI	1951-2100	(daily, 50km)
CERFARCS-CNRM	RCA4	SMHI	1951-2100	(daily, 50km)
MIROC5	RCA4	SMHI	1951-2100	(daily, 50km)
MPI-ESM	RCA4	SMHI	1951-2100	(daily, 50km)
GFDL-ESM2M	RCA4	SMHI	1951-2100	(daily, 50km)
IPSL-CM5A	RCA4	SMHI	1951-2100	(daily, 50km)
CanESM2	RCA4	SMHI	1951-2100	(daily, 50km)
NorESM	RCA4	SMHI	1951-2100	(daily, 50km)
HadGEM2	RCA4	SMHI	1951-2100	(daily, 50km)
Mk3-0-6	RCA4	SMHI	1951-2100	(daily, 50km)

METHODOLOGY

The methodology applied to the study includes climate change modelling, downscaling of future rainfall data under climate change scenarios RCP 4.5 and 8.5 by using observed data of SAS Dam. After downscaling future projection statistical analysis and trend analysis (Mann-Kendall Test) had done for both historical as well future data.

Climate change modelling

The CORDEX South Asian models including ten GCMs and downloaded for the South Asian grid which have been downscaled to point stations in the study area of SAS Dam. The gridded data have been directly downloaded from the website of Earth System Grid Federation (ESGF), (https://esg-dn1.nsc.liu.se/search/esgf-liu/) and there are two sets data available for the period 1951-2005 and 2006-2100 for both the climate scenarios RCP 4.5 and RCP 8.5 for all ten GCM models. First set of data used as historical data which ranges from 01/01/1951 to 31/12/2005 at an interval of 5 years each. The other type of data is the forecasted data which ranges from 01/01/2006 to 31/12/2100 at an interval of 5 years. This type of data is available for 10 different models which have been used for this study. This data set is valid for the entire south Asian Domain and needs to be reprojected to the area of interest. This reprojection have been done using a specific software which repreojects the entire dataset. After reprojection, using special MATLAB and Python script this data set have been downscaled to the point of area of interest for which observed data was available.

3.3 Mann-Kendall Method

The procedure started with the evaluation of trends in rainfall or precipitation for individual station using Mann-Kendall non-parametric trend test ((Kundu et al., 2014)(Morell and Fried, n.d.);(Jaiswal et al., 2016). The Mann-Kendall test is a rank-based method that has been applied in many previous studies for identifying trends in rainfall. This is one of the best methods to determine the trend in rainfall (Jaiswal et al., 2015; Arya et al., 2014). In this study the trend analysis was carried out on annual for the measured period i.e., observed data from 1988-2018 and future period i.e., (2019-2050) for Berasia, Basoda, Raisen and Vidisha stations.

The data values are evaluated as an ordered time series. Each data value is compared to all subsequent data values. The initial value of the Mann-Kendall statistic, *S*, is assumed to be 0 (*e.g.*, no trend). If a data value from a later time period is higher than a data value from an earlier time period, *S* is incremented by 1. On the other hand, if the data value from a later time period is lower than a data value sampled earlier, *S* is decremented by 1. The net result of all such increments and decrements yields the final value of *S*.

Let $X_1, X_2 \ldots\ldots X_n$ represents n data points where X_j represents the data point at time j. Then the Mann-Kendall statistic (S) is given by equation

$$s = \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} sgn(x_j - x_i) \quad (3.1)$$

Where,

$$sgn(\theta) = \begin{cases} +1 \text{ if } \theta > 0 \\ 0 \text{ if } \theta = 0 \\ -1 \text{ if } \theta < 0 \end{cases} \quad (3.2)$$

ISSN 2394 - 7780

when *n >10* the ***S*** statistic is approximately normally distributed with zero mean and variance as follows:

$$\sigma^2 = \frac{n(n-1)(2n+5)}{18} \tag{3.3}$$

The standard normal deviation *(Z Value)* is computed as

$$Z = \begin{cases} \frac{s-1}{\sigma} & \text{if } s > 0 \\ 0 & \text{if } s = 0 \\ \frac{s+1}{\sigma} & \text{if } s < 0 \end{cases} \tag{3.4}$$

A very high positive value of *S* is an indicator of an increasing trend, and a very low negative value indicates a decreasing trend. When *Z > +1.96 or Z<-1.96* then null hypothesis (*Ho*) is rejected at 95% level of significance level. Significance of positive and negative trend is found by the Z values at 95% level of significance. If *Z* value is greater than +1.96 it shows significant rising trend and if *Z* value is less than -1.96 it shows significant falling trend.

RESULTS AND DISCUSSION

Ten CORDEX South Asia model used to simulate future rainfall data (2019-2050) by using gridded data under RCP 4.5 and RCP 8.5 future scenarios. After downscaling of daily rainfall data, it has converted into annual rainfall data, statistical analysis and Mann-Kendall test are calculated which is described in this section.

4.1 Observed rainfall data analysis.

Statistical analysis and Mann-Kendall test was analyzed for historical rainfall data (1988-2018) and future predicted annual rainfall data FP (2019-2050) under RCP 4.5 and RCP 8.5 future scenarios for all four station located in catchment and command area of SAS dam.

Table-4-1: Statistical and Mann-Kendal test analysis of all four rainfall stations for period 1988-2018.

S. No	Station	Max	Min	Avg	Std	Z Value
1	Basoda	2081.60	728.00	1094.86	297.26	0.11
2	Berasia	1741.20	432.12	891.78	290.11	-1.82
3	Raisen	1882.20	612.10	1150.45	326.86	-0.36
4	Vidisha	2587.00	792.00	1370.56	414.53	-2.46

Table-4-1 shows the results of statistical analysis and Mann-Kendall test analysis of annual rainfall data for all four stations of SAS Dam. It is found from the Mann-Kendall test that four stations Berasia, Raisen, and Vidisha showing falling trend (Z values are -1.82, -0.36, and -2.46), at the station Vidisha a significant decrease, whereas at the station Basoda the test shows a non-significant increase (Z value is 0.11). Which is shown graphically in Figure 4-1.

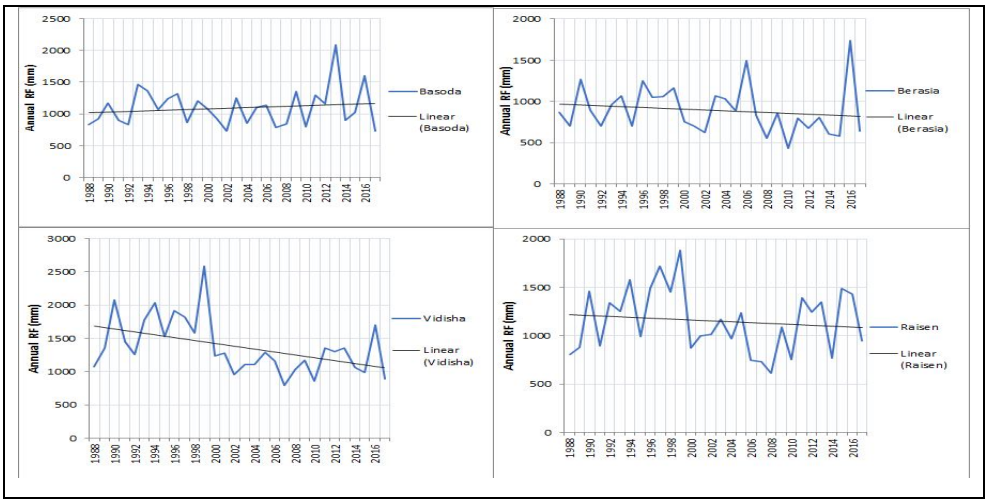
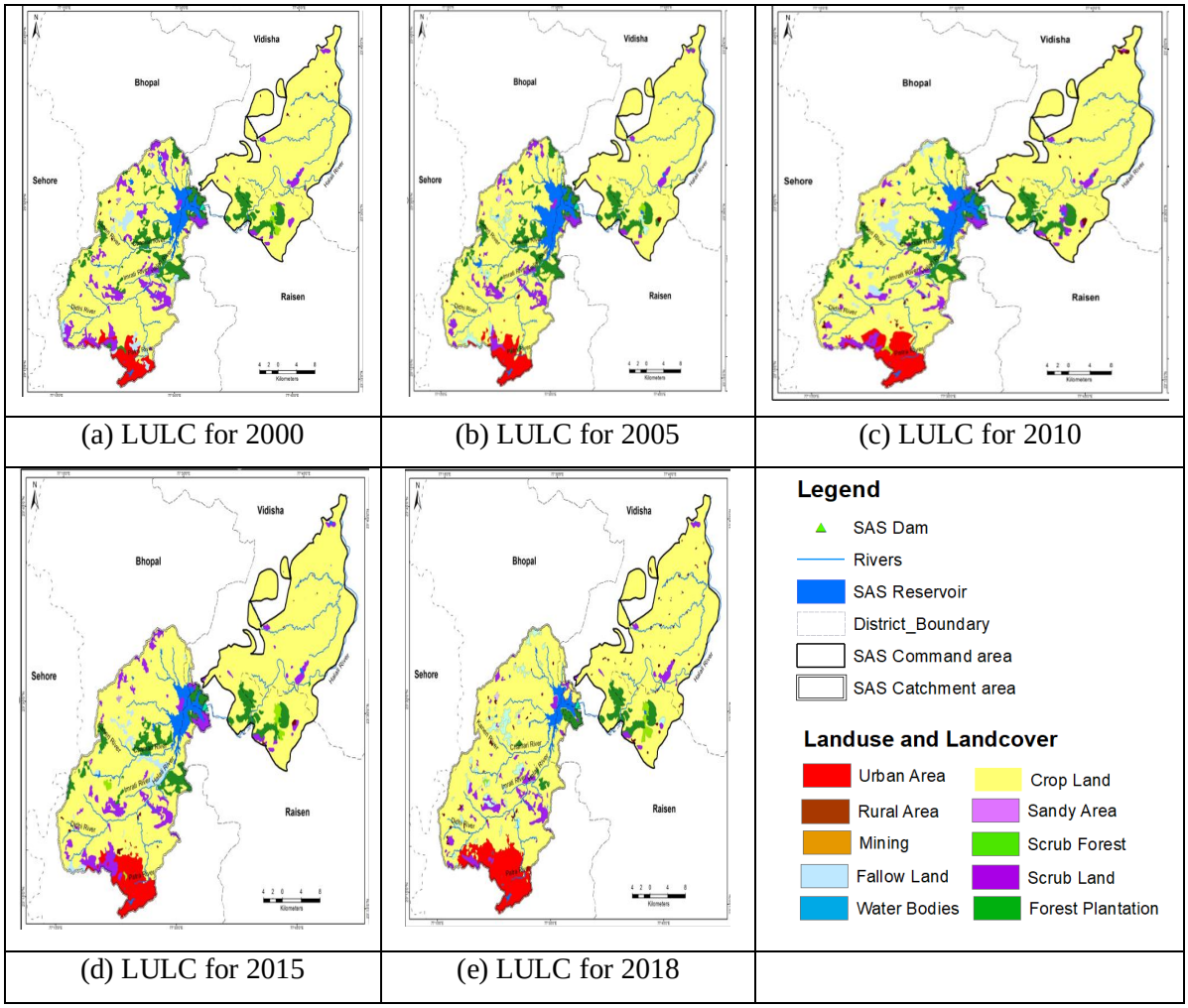


Figure-4-1: Graphical analysis of trend for observed annual rainfall of all four station.

4.2 Lan Use Land Cover of study area

The impact of LULC change varies with the climate condition, the climate of a region plays a crucial role in LULC changes as studied by Lahmer et al., 2001, legesse et al., 2003,Kim et al., 2013. In this study baseline situation of the catchment and command area has been analyzed and LULC prepared with the help of satellite imagery in 30m spatial resolution at every five-year interval as shown in figure 4-2.

ISSN 2394 - 7780



(a) LULC for 2000 (b) LULC for 2005 (c) LULC for 2010

(d) LULC for 2015 (e) LULC for 2018

Figure-4-2: Land Use and Land Cover for Catchment and Command Area (a) LULC for 2000, (b) LULC for 2005, (c) LULC for 2010, (d) LULC for 2015, and (e) LULC for 2018. (Source- Landsat OLI/TIRS C1 Level-1 satellite imagery with 30m spatial resolution).

Figure 4-2 Land Use and Land Cover for Catchment and Command Area (a) LULC for 2000, the area covered by crop land, fallow land and scrub land is 86% and the area covered by forest area is 7.9%, (b) LULC for 2005, The area covered by crop land, fallow land and scrub land is 86% and the area covered by forest area is 7.6%, (c) LULC for 2010, The area covered by water bodies is around 2.5% of the total area and the forest area around 7.5%, (d) LULC for 2015, The forest area has reduced over the period. The area covered by agricultural land which includes crop land, fallow land and scrub land is 85% of the total area and (e) LULC for 2018, The urban area has increased from 2.9% in 2000 to 5.8% in 2018.

In the five above maps, the majority of the area is the crop land but slight changes can be observed in the other features. For example - Increase in urban and rural area, reduction in forest plantation.The scattered changes can be observed for fallow land over the years as the fallow land is the agricultural land which is left with no crops for a season to recover its fertility. So more or less, fallow land varies accordingly.The analysis for the forest cover in the study area has been done as mentioned below in the table. The decrement in the forest area can be observed shown in Table 4-2.

Table-4-2: Forest area from 2000 to 2018

Year	Forest Area (% of total area)
2000	7.93
2005	7.68
2010	7.52
2015	7.24
2018	6.94

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4.3 Population forecast

Population growth obviously has an impact in climate change, higher growth involves more emission and means more individuals will be vulnerable against climate related effects. It was found from the study that one child can create 20 times more greenhouse gas than an individual will spare by driving a high-mileage vehicle, reusing, utilizing vitality proficient machines and lights, etc (scovronick .N, 2016). The population projection for three districts, Bhopal, Raisen and Vidisha is first estimated for year 2050. Figure- 3 shows the population forecast calculated by decadal growth rate method using base year 2009 (See Table-4-3).

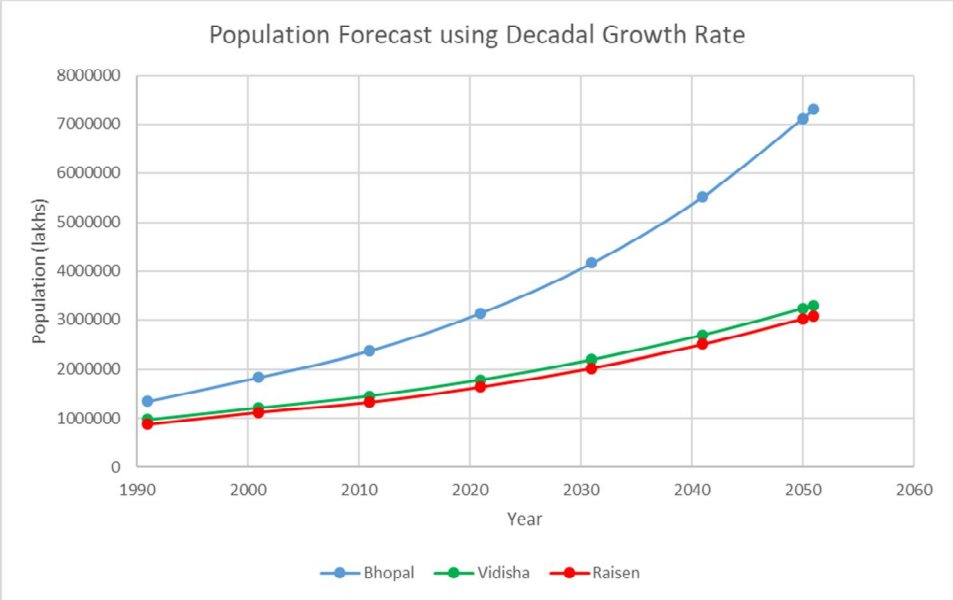


Figure- 4-3: Population projection till year 2050 using decadal growth rate method (Census Government MP, 2011)

Table-4-3: Population of Bhopal, Raisen and Vidisha (Census Government MP, 2011).

Year	Bhopal	Vidisha	Raisen
1991	1351479	970388	876461
2001	1843510	1214857	1125154
2011	2371061	1458875	1331597

It is found from the population forecast that population of Bhopal will increase more than 3 times population at present 2018 and population of Rasien and vidisha increases 50 percent population at present 2018.

4.4 Downscaled rainfall data analysis.

Statistical analysis and Mann-Kendall test was analyzed for future predicted annual rainfall data FP (2019-2050) under RCP 4.5 and RCP 8.5 future scenarios for all four station located in catchment and command area of SAS dam.

Table-4-2: Statistical analysis of future predicted annual rainfall data FP (2019-2050) at Basoda station under RCP 4.5 Scenario.

Models)	Max	Min	Avg	Std	Z Values
CanESM	3691.05	139.70	1124.67	756.93	0.45
CNRM_CM5	1392.09	297.76	971.98	243.04	-0.91
ECEARTH	1431.32	224.87	881.09	305.00	-1.07
GFDL_ENM2M	1637.37	445.33	1049.20	355.72	1.94
HadGEM2	3024.98	819.76	1600.81	520.63	-0.26
IPSL_CM5A	3006.55	391.42	1390.46	626.06	2.59
MIROC5	1913.36	199.48	1052.05	406.41	0.02
MK306	3074.71	229.91	1211.55	768.58	-0.64
MPIESM	1648.14	200.46	938.55	350.94	-0.42
NorESM	1969.76	379.59	1057.93	421.17	0.54

In this Table 4-2 statistical analysis and MK test results are mentioned, Z value shows the trend of future predicted rainfall data. In this case, fifty percent models show a non-significant rising trend and rest of the models show non-significant falling trend whereas IPSL_CM5A model shows significant rising annual rainfall trend under the RCP 4.5 scenario.

ISSN 2394 - 7780

Table-4-3: Statistical analysis of future predicted annual rainfall data FP (2019-2050) at Basoda station under RCP 8.5 Scenario.

Models	Max	Min	Avg	Std	Z Values
CanESM	3162.33	101.04	1437.22	840.85	1.05
CNRM_CM5	1880.77	522.82	1123.02	337.29	0.79
ECEARTH	1718.36	320.38	952.53	283.41	0.83
GFDL_ENM2M	1500.99	437.36	1013.88	287.66	-0.18
HadGEM2	3969.41	639.27	1775.01	724.97	-0.54
IPSL_CM5A	3920.80	134.14	1521.49	869.24	1.09
MIROC5	2065.41	158.30	1196.10	433.01	0.37
MK306	4409.16	448.10	1792.03	905.27	1.77
MPIESM	2700.13	325.73	966.88	496.64	-0.24
NorESM	2224.57	595.08	1270.46	412.23	1.09

The statistical analysis and MK test results are mentioned, Z value shows the trend of future predicted rainfall data. In this case, seven models (CanESM, CNRM_CM5, ECEARTH, IPSL_CM5A, MIROC5, MK306 and NorESM) show non-significant rising trend and three models (GFDL_ENM2M, HadGEM2 and MPIESM) show non-significant falling trend under RCP 8.5 scenario.

Table-4-4: Statistical analysis of future predicted annual rainfall data FP (2019-2050) at Berasia station under RCP 4.5 Scenario.

Models	Max	Min	Avg	Std	Z Values
CanESM	2883.93	22.32	747.12	565.58	1.50
CNRM_CM5	1631.05	222.97	792.09	316.45	-0.14
ECEARTH	1483.98	321.32	718.93	266.42	-0.29
GFDL_ENM2M	1410.49	218.78	729.46	331.65	1.60
HadGEM2	2217.01	300.42	1067.13	494.57	-0.20
IPSL_CM5A	3064.13	180.37	773.58	521.90	2.68
MIROC5	1393.54	322.40	790.77	258.82	0.88
MK306	2048.02	151.82	792.03	537.44	0.05
MPIESM	1977.20	298.17	827.16	360.90	-1.69
NorESM	1496.70	248.33	669.41	303.42	0.45

In the statistical analysis it is found that future average annual rainfall will decrease in the range of 600 to 1000 mm as compared to baseline period. It is observed from MK test that six models show non-significant rising trend and rest of the model shows non-significant falling trend in future under RCP 4.5 scenario.

Table-4-5: Statistical analysis of future predicted annual rainfall data FP (2019-2050) at Berasia station under RCP 8.5 Scenario.

Models	Max	Min	Avg	Std	Z Values
CanESM	2670.90	94.50	1009.18	650.24	0.54
CNRM_CM5	1686.79	128.24	815.73	347.43	2.35
ECEARTH	1346.11	396.22	844.35	240.86	0.66
GFDL_ENM2M	1270.91	325.04	728.67	226.12	0.99
HadGEM2	2540.19	287.02	1095.19	543.75	0.08
IPSL_CM5A	2472.38	24.39	841.95	567.36	1.99
MIROC5	1990.91	366.52	963.44	366.87	1.09
MK306	2994.25	342.70	1233.79	623.99	1.41
MPIESM	1737.76	221.61	838.04	398.20	1.44
NorESM	1444.62	230.35	759.09	338.79	0.21

In the statistical analysis most of the model shows that future average annual rainfall will decrease in the range of 700 to 1000 mm as compared to baseline period. It is observed from MK test that all ten models show non-significant rising trend and except CNRM_CM5 model shows significant rising trend in the future under RCP 8.5 scenario.

ISSN 2394 - 7780

Table-4-6: Statistical analysis of future predicted annual rainfall data FP (2019-2050) at Raisen station under RCP 4.5 Scenario.

Models	Max	Min	Avg	Std	Z Values
CanESM	3685.26	102.88	1183.69	772.52	0.54
CNRM_CM5	1804.47	315.57	1092.90	284.25	-0.29
ECEARTH	1521.07	219.40	987.01	330.29	-0.29
GFDL_ENM2M	1696.46	586.78	1122.88	345.66	1.75
HadGEM2	3241.94	786.63	1685.16	573.41	-0.36
IPSL_CM5A	3329.07	311.69	1437.43	665.86	2.53
MIROC5	2177.02	239.83	1150.74	424.65	-0.23
MK306	3049.56	180.05	1300.82	820.73	-0.39
MPIESM	2537.65	310.39	1149.72	473.05	0.00
NorESM	2708.26	485.63	1113.63	478.81	0.88

In the statistical analysis annual average rainfall will increase in future (more than 1100 mm) as compared to baseline period. MK test shows that fifty percent of models show non-significant rising trend except IPSL_CM5A model shows significant rising trend (z value is 2.53) and rest of the models show non-significant falling trend in future under RCP 4.5 scenario.

Table-4-7: Statistical analysis of future predicted annual rainfall data FP (2019-2050) at Raisen station under RCP 8.5 Scenario.

Models	Max	Min	Avg	Std	Z Values
CanESM	3520.16	98.25	1530.09	955.76	0.96
CNRM_CM5	2702.03	431.77	1280.49	500.41	1.09
ECEARTH	2240.35	410.03	1097.27	406.33	1.05
GFDL_ENM2M	1749.20	364.64	1106.06	310.63	-0.02
HadGEM2	3390.14	497.60	1809.05	637.67	-0.18
IPSL_CM5A	4082.37	149.98	1581.96	879.95	1.09
MIROC5	2253.41	206.57	1346.30	491.18	0.86
MK306	5104.50	430.34	1959.86	1036.99	1.64
MPIESM	2791.87	329.51	1100.91	508.42	-0.21
NorESM	2085.28	653.58	1257.46	390.50	0.47

In the statistical analysis annual average rainfall will increase in future (more than 1100 mm) as compared to baseline period. MK test shows that seven models shows non-significant rising trend and rest of the models show non-significant falling trend in future under RCP 8.5 scenario.

Table-4-8: Statistical analysis of future predicted annual rainfall data FP (2019-2050) at Vidisha station under RCP 4.5 Scenario.

Models	Max	Min	Avg	Std	Z Values
CanESM	4171.29	116.92	1369.65	872.98	0.79
CNRM_CM5	2457.88	386.50	1294.86	395.00	-0.51
ECEARTH	2013.77	287.06	1178.98	404.19	-0.45
GFDL_ENM2M	2000.16	683.10	1315.11	410.06	1.60
HadGEM2	3799.75	890.02	1972.19	678.63	-0.29
IPSL_CM5A	4023.50	372.84	1648.39	798.99	2.56
MIROC5	2581.51	285.47	1336.17	487.23	-0.05
MK306	3713.89	250.45	1532.97	995.15	-0.26
MPIESM	2175.01	376.75	1274.54	476.72	0.08
NorESM	2893.50	550.53	1274.79	520.39	1.04

In the statistical analysis most of the model shows that annual average rainfall will increase in future (more than 1000 mm) as compared to baseline period. MK test shows that fifty percent of models shows non-significant rising trend except IPSL_CM5A model show significant rising trend (z value is 2.56) and rest of the models show non-significant falling trend in future under RCP 4.5 scenario.

ISSN 2394 - 7780

Table 4-9 Statistical analysis of future predicted annual rainfall data FP (2019-2050) at Vidisha station under RCP 8.5 Scenario.

Models	Max	Min	Avg	Std	Z Values
CanESM	3983.71	110.18	1752.07	1092.27	0.89
CNRM_CM5	2952.13	535.26	1431.32	506.43	1.05
ECEARTH	2327.53	496.19	1253.79	398.08	1.35
GFDL_ENM2M	2018.96	398.78	1297.04	352.34	0.02
HadGEM2	4049.44	633.50	2098.89	752.39	-0.24
IPSL_CM5A	4536.49	207.53	1818.18	1001.35	1.15
MIROC5	2540.45	244.15	1539.50	568.16	0.83
MK306	5871.12	528.75	2268.16	1247.78	1.80
MPIESM	3656.02	348.64	1252.99	623.32	0.00
NorESM	2085.28	653.58	1257.46	390.50	0.47

In the statistical analysis most of the model shows that annual average rainfall will increase in future (more than 1200 mm) as compared to baseline period. MK test shows that all ten models show non-significant rising trend except HadGEM2 model shows non-significant falling trend and MPIESM model shows no trend in future under RCP 8.5 scenario.

4.5 Comparison of historical annual rainfall data and future data under RCP 4.5.

The ensemble time series data was generated for future periods FP-1(2021-2030), FP-2 (2031-2040), FP-3 (2041-2050) and FP-4 (2021-2050) using gridded data obtained from COREX South Asian Models under climate scenario RCP 4.5. The statistics including annual average rainfall, maximum annual rainfall, minimum annual rainfall and trend analysis were computed. The average annual rainfall of base period (1988-2018) and all four periods FP-1, FP-2, FP-3 and FP-4 shown in figure 4-4. It has been observed from the analysis that annul average and maximum rainfall may increase 0.27% to 14% and 24% to 38%. Minimum annual rainfall may decrease during 4% to 48%.

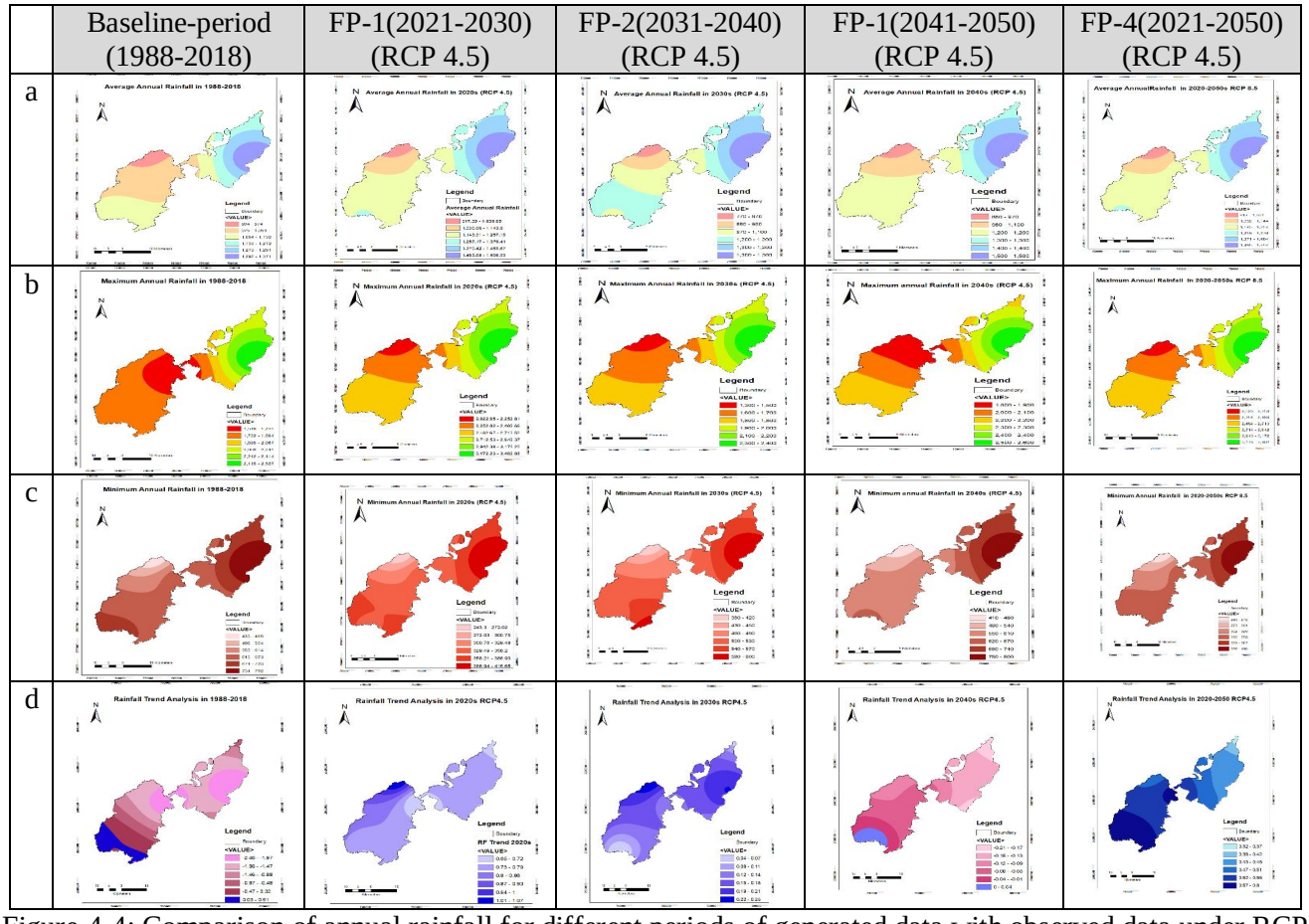


Figure-4-4: Comparison of annual rainfall for different periods of generated data with observed data under RCP 4.5 climate scenario. (a. Annual average rainfall, b. Maximum annual rainfall, c. Minimum annual rainfall, c. Rainfall trend analysis-(i) Blue colour shows positive trend; (ii) Purple colour shows negative trend)

ISSN 2394 - 7780

4.6 Comparison of historical annual rainfall data and future data under RCP 8.5.

The ensemble time series data was generated for future periods FP-1(2021-2030), FP-2 (2031-2040), FP-3 (2041-2050) and FP-4 (2021-2050) using gridded data obtained from COREX South Asian Models under climate scenario RCP 8.5. The statistics including annual average rainfall, maximum annual rainfall, minimum annual rainfall and trend analysis were computed. The average annual rainfall of base period (1988-2018) and all four periods FP-1, FP-2, FP-3 and FP-4 shown in figure 4-5. It has been observed from the analysis that annul average and maximum rainfall may increase 6% to 27% and 14% to 38%. Minimum annual rainfall may decrease during 16% to 45%.

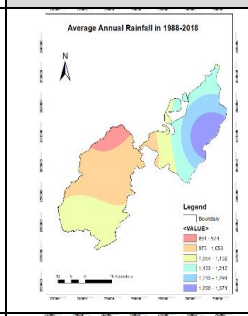
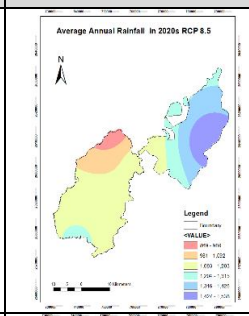
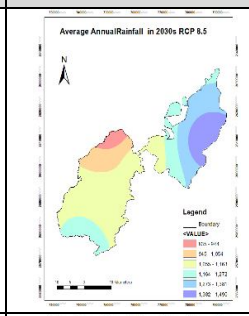
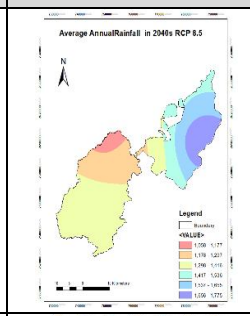
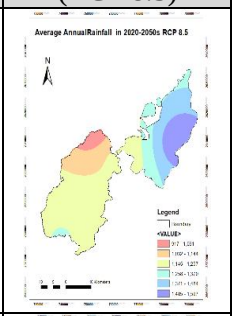
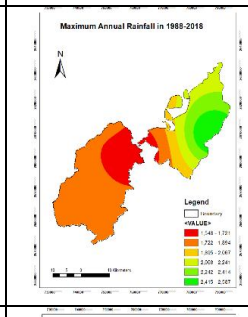
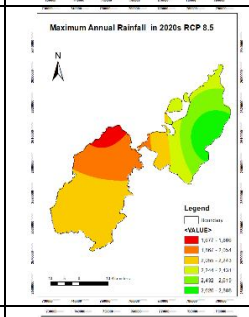
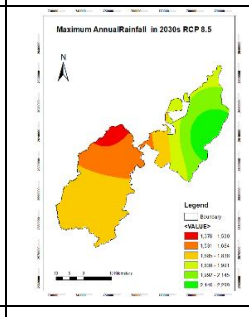
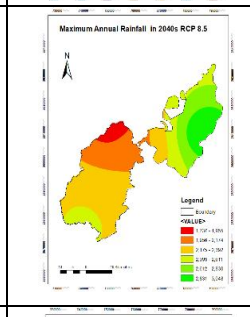
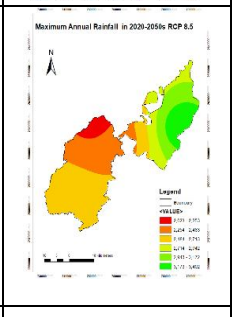
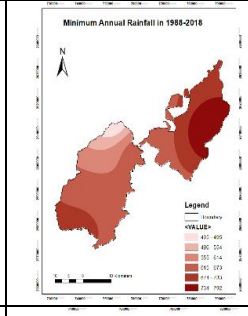
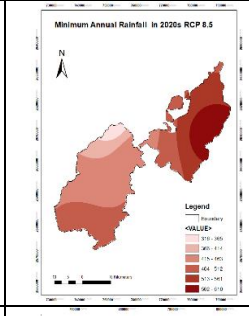
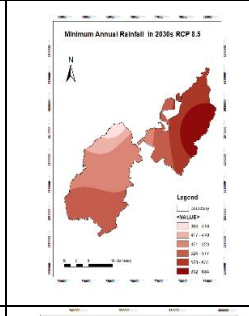
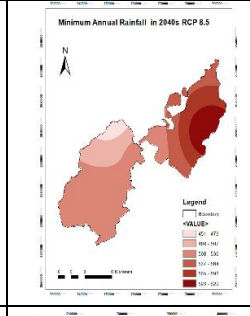
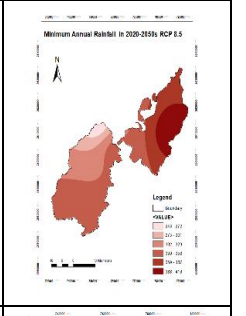
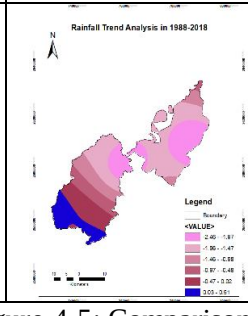
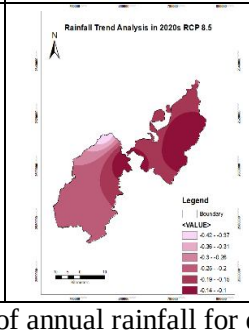
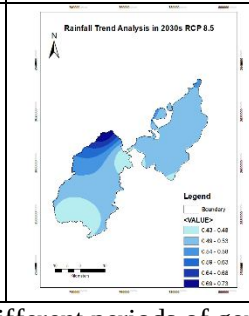
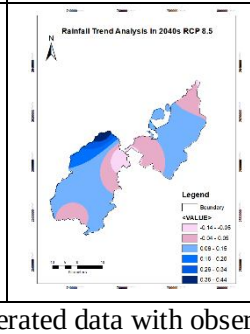
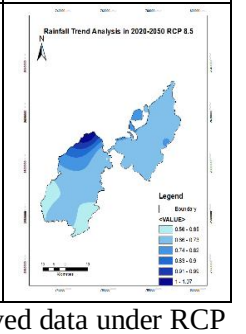
	Baseline-period (1988-2018)	FP-1(2021-2030) (RCP 8.5)	FP-2(2021-2030) (RCP 8.5)	FP-2(2021-2030) (RCP 8.5)	FP-4 (2021-2050) (RCP 8.5)
a					
b					
c					
d					

Figure-4-5: Comparison of annual rainfall for different periods of generated data with observed data under RCP 8.5 climate scenario. (a. Annual average rainfall, b. Maximum annual rainfall, c. Minimum annual rainfall, c. Rainfall trend analysis-(i) Blue colour shows positive trend; (ii) Purple colour shows negative trend).

SUMMARY AND CONCLUSION

The CORDEX South Asian Models contain a set of ten GCMs and which has been used to downscale future projection rainfall data FP (2019-2050) by using historical data for baseline period 1988-2018 under climate change scenario RCP 4.5 and 8.5 in Samrat Ashok Sagar Dam. To understand the present climate of study area Land Use and Land Cover change is studied at present 2018 and collected information of population growth at present and forecast till 2050. Land use and land cover show that forest cover has decreased 12.48% from 2000

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to 2018, and population growth increased fifty percent from 2011 to 2018 and it will increase three times more population at present.

From the MK test analysis, it is found that all four stations show falling trend during historical period (Z values are -1.82, -0.36, and -2.46), at the station Vidisha a significant decrease, whereas at the station Basoda the test shows a non-significant increase (Z value is 0.11). The ten models simulated annual rainfall under RCP 4.5 and 8.5 it is found that annual and average rainfall will extremely increase in future as the concentration of greenhouse gases increases in these scenarios.

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REDUCTION OF CONCENTRATION OF RO REJECTS ON SOIL AND AQUIFER USING RHAFM

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ABSTRACT
In many countries like India, polluted water is major cause of mortality where clean water is not easily accessible. Therefore many efforts are being made to provide access to clean drinking water. Fortunately, efficient and low cost water purification systems are now developed and are used worldwide to provide access to clean water. Some of purification methods like boiling, sand filtration, ceramic filtration, Reverse Osmosis method, UV method, ozonization, deionization etc., are commonly used. Among these processes, Reverse Osmosis (RO) is one of the widely used technique to treat water and also now-a-days commercial RO water system plays a key role in Indian society. In Kakinada, most of the people consume water from the commercial RO systems for drinking purpose. So all attempts have been made to collect raw water, treated and rejected water separately from ten locations in Kakinada smart city and analysed with hydro chemical parameters. In the present study, it was observed that in some commercial RO plants, the treated water had very low TDS (Total Dissolved Solids) levels which are similar to distilled water and is not recommended for drinking purpose regularly. However, in rejected water, the TDS levels were found to be almost 3000 ppm. Without any proper disposal technique, the rejected water was poured into the shallow pits. However, in some of the commercial treatment process, for every one litre of raw water, only 25% is obtained as treated water and 75% is considered as rejects and is poured into the pits. This results in soil and shallow ground water contamination.

Therefore, column adsorption test was used to prepare soil filter stratum at disposal site for safe disposal. In this test, RO rejected water was passed through biochar filter which was prepared by different agricultural waste, followed by quartz sand. This, results in adsorption of more than 50% of TDS in rejected water. The results suggest technique to decrease impact on soil and aquifer and protect them from polluted water.

Keywords: purification system, RO (reverse osmosis), rejected water, biochar.

INTROUCTION
Purified water is essential to live a healthy life. Therefore, everyone should have access to it. It has a great impact on everyday life, especially in the rural and remote areas where access to safe drinking water is very crucial. As only surface water and ground water are available as the sources, water contamination is difficult to avoid due to rigorous and reckless use of water.

To fulfil the requirement of drinking water standards, the municipal water is used in developing countries. Various cost efficient water filtration techniques are being developed to improve taste and to eliminate any undesired matter.

Some of the purification methods like boiling, sand filtration, ceramic filtration, RO method, UV method, ozonization, deionization etc., are used frequently. Among these processes, reverse osmosis (RO) is one of the best techniques to treat water but now-a-days commercial RO water systems play a key role in Indian society.

From these RO plants, huge amount of rejected water with high hardness, alkalinity, chlorides etc. flows out continuously. This gets disposed on the soil and indirectly affects the soil and ground water. This deteriorates ground water quality day by day. To overcome this problem, an engineering technique was developed to decrease the contamination in water.

OBJECTIVES OF STUDY
- To study on various water treatment methods for drinking water.
- To assess of hydro chemical parameter in raw, treated, rejects of RO system within KMC (Kakinada Municipal Corporation).
- To make a comparative study by taking both surface water and ground water as raw water and analyses of the changes after treating.
- To identify suitable measures for safe disposal of RO rejects.

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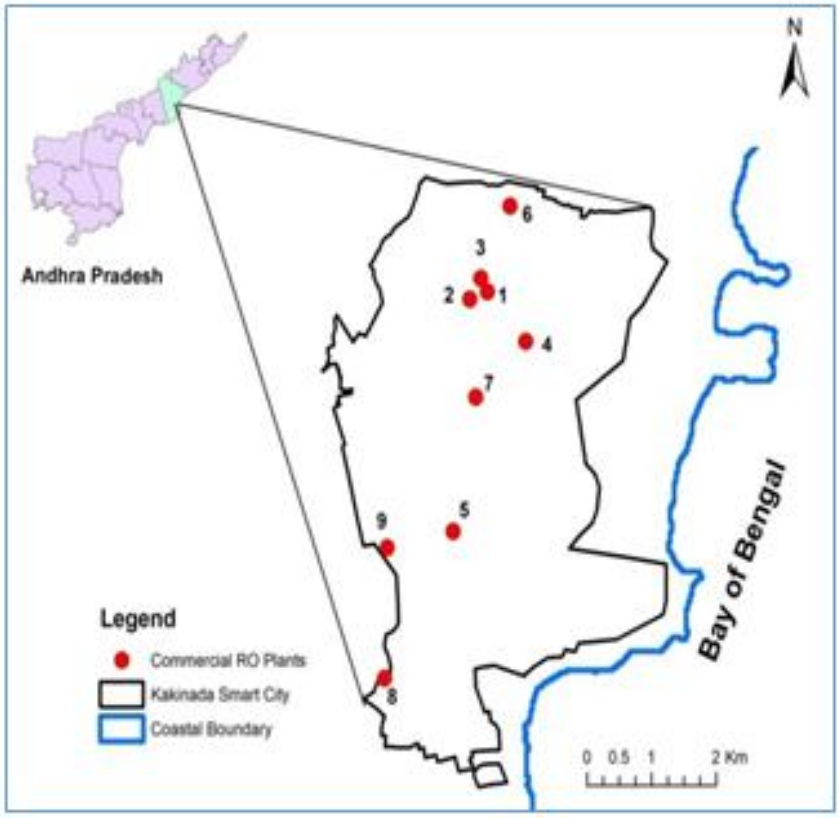

Figure-1: Sample sites in Kakinada smart city

- To study the impact of RO rejects on soil and ground water by using column adsorption test.

STUDY AREA

Study area of project is Kakinada smart city which is situated in East Godavari district of Andhra Pradesh. Study area outline is prepared in ARC GIS. Red spotted points are the RO plants which are chosen for the project and nearly 9 plants are selected and all attempts were taken to collect the samples.

1. JNTUK-1
2. JNTUK-2
3. JNTUK-3
4. DMART PLANT
5. PORT STATION PLANT
6. RAMANAYYAPETA RO PLANT
7. BHANUGUDI RO PLANT
8. ANNAMAGHATI RO PLANT
9. AMG RO PLANT

METHODOLOGY

Various drinking water sources in Kakinada were identified along with the treatment methods. R.O water is widely used in Kakinada. Samples were collected from commercial R.O plants such as raw and mineral. Collected samples were then examined with hydro chemical parameters like pH, TDS, sodium, magnesium, calcium levels etc. Soil was checked for soil contamination by using soil salinity test. Filter media was prepared to investigate on different waste and cheap materials having adsorption capacity. Also, soil stratum was prepared for safe disposal by using column adsorption test. From this test analysis and results, some engineering methods were used to decrease the impact on soil and aquifer and protect them from contaminated water.

Hydrological Analysis

In Kakinada, most of people utilize commercial RO treatment plants for drinking purpose Due to this, rapid growth of RO plants installation had taken place in Kakinada. In our observation, 72 RO plants were identified and most of plants were disposing RO rejects

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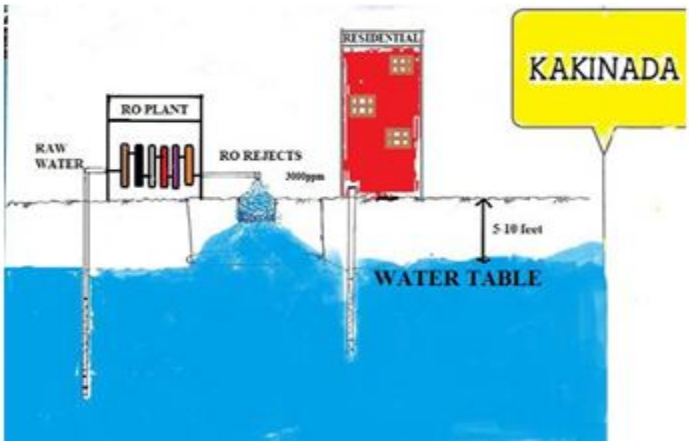

Figure-2: Hydrological analysis of Kakinada smart city directly on ground as shown. 10 feet below ground level so directly disposal of reject on ground may easily pollute ground water.

RO Plants Reject Analysis (Kakinada) Total RO plants = 72 (as per the observation) For one RO plant,

Per one hour average rejected water = 2500lts/hr. Plant run per day = 8 hours

Total reject per day from one plant =2500*8

=20,000lts/day

If we assume plant running throughout 365 days

Total volume of rejects from one plant per annum = 20000*365

=73, 00,000lts/yr.

Now total 72 plants approx. in Kakinada for one year

=73, 00,000*72

=52, 56, 00,000 lts/yr.

It was assumed that RO plants have very less waste water discharge but in our observation RO plants at Kakinada have levelling tubes in which, how much waste water generated for an hour, some have 1500lts/hr., 2000lts/hr., 3000lts/hr., and some discharge 4500lts/hr.an average of

2500lts/hr. was considered while counted the working hours of plant in daily basis and estimated above calculation for an year. It was huge that nearly 525.6MLD of waste water discharging just from RO plants in Kakinada.

LOCATION OF RO / FEATURES

- Most of RO plants were located in the residential areas.
- All plants had same internal mechanism but with different treating capacities like .2000 Lph, 3500 Lph Kakinada, 4500 Lph.
- Due to lack of maintenance like back wash, changing filters and membranes, each plant produces treated and rejected water in different ratios of 1:3; 1:4; 1:1.
- But majority of the plants produce 4 litres of raw water with 1 litre treated and 3 litre rejects.

ANALYSIS & RESULTS

Raw/Treated/Rejects

Most of RO plants utilize ground water as raw water but only one plant in Kakinada (Annamaghati plant) uses municipal water as raw water. Although there is no need of using municipal water as raw water and disposing huge amount of water as reject water.

All the plants are following BIS standards as allowable limit for total dissolved solids which is 500 ppm. They don't follow WHO regulations where the minimum limit is 100 ppm. This is done to remove essential minerals and to maintain plants TDS as 50 ppm and 30 ppm which is similar to distilled water. Long term consumption of low TDS water may lead to chronic effects like

- Intake of low-mineral water is responsible for an increased elimination of existing minerals from the body.

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- Gradual changes in homeostasis mechanisms.
- It can lead to lower volume of red blood cells and blood becomes thin.
- Increase in diuresis (almost by 20%, on average).
- Bones become week.
- Increases the elimination of sodium, potassium, chloride, calcium and magnesium ions from the body
- Low-mineral water acts on the gastrointestinal

To overcome this, AUTOMATIC TDS CONTROLLER SYSTEM is to be installed which will fulfill the requirement of all the essential minerals. If it doesn't fulfill the requirement of the essential minerals, then the water is called as DEMINERALIZED WATER.

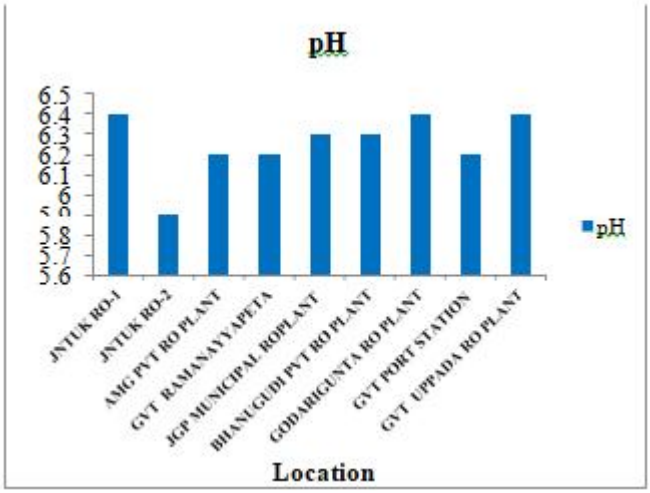

Figure-3: pH of the water

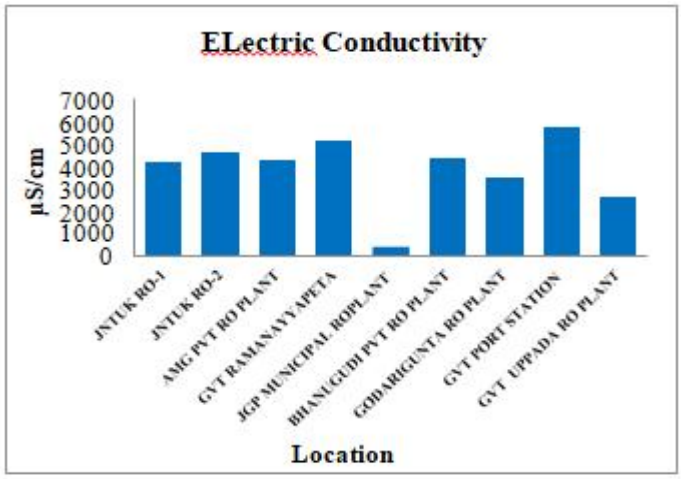

Figure-4: Electrical conductivity of water at different locations

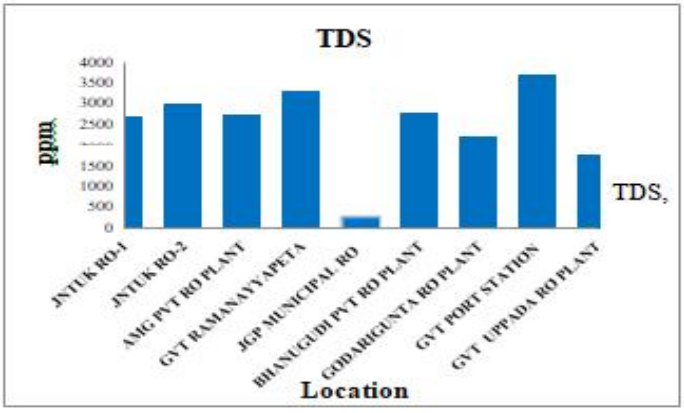

Figure-5: TDS in water of different locations

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Due to the disposal of RO rejects on the surface soil by infiltration it enter into subsurface soil and all the chemical parameters are gradually increasing in subsurface and also polluting ground water.

- To check whether soil contamination happening or not we collected soil samples at three different RO plants.
- Each plant two sample one at disposal site another at surroundings of plant.

On these samples, different soil chemistry test such as Electrical conductivity, Calcium, Magnesium, sodium and potassium tests was conducted.

Chemical tests on soil sample

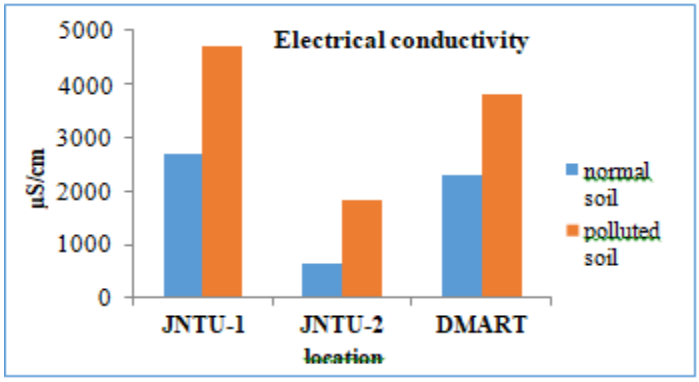

Figure-6: Electrical conductivity of water

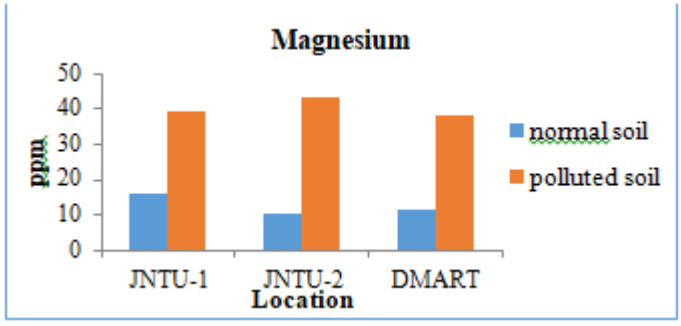

Figure-7: Magnesium concentration in water

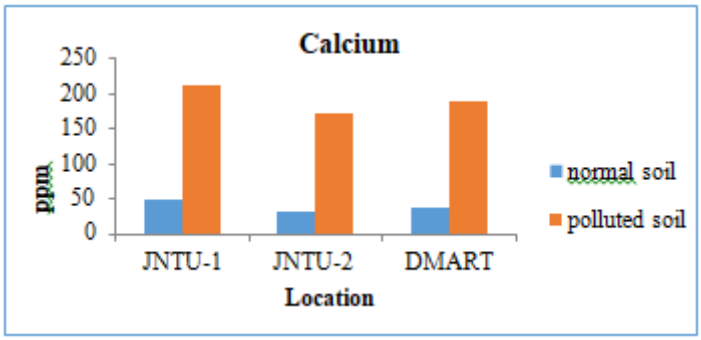

Figure-8: Calcium concentration in water

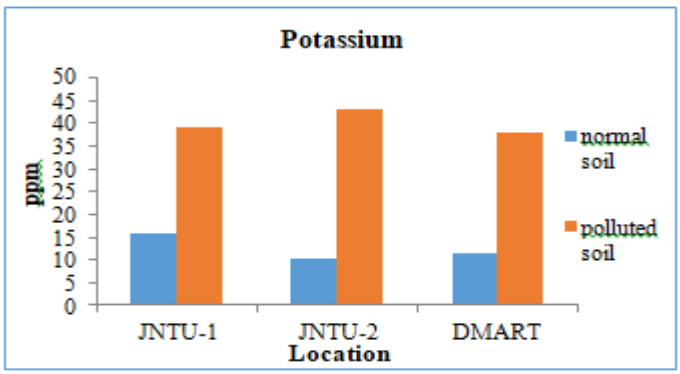

Figure-9: Potassium concentration in water

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Soil tests discussion

Various chemical parameters identification was done in two types of soil, normal soil and polluted soil by the test analysis. Normal soil is the soil sample which was collected beside disposal site. However, polluted soil is the soil sample which was collected from the disposal site. Major parameters like Sodium, Potassium, Calcium, Magnesium, Electrical conductivity (salinity) were conducted for the soil sample. All the parameters were found to be high in polluted soil as compared to normal soil. For RO plants similar tests were conducted. Three RO plants were examined at the disposal sites. Results showed that due to the direct disposal of RO reject, soil gets contaminated and polluted. This might be due to the continuous disposal of RO rejects and waste water which enters into unconfined aquifers and deteriorates the ground water quality.

Various Materials Used For Adsorption & columns used for adsorption

Coconut Shell (Charcoal)


Neem And Tulasi

Ground Nut Shells Charcoal


Corn Waste

Tea Waste

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Banana Bark

Rice Husk Ash columns

In the above material we observed that some material have adsorption capacity by using COLUMN ADSORPTION TEST (CAT).

This CAT was conducted with some RO reject samples with different adsorption material. Each sample was allowed to flow through a adsorption material. Initial and final TDS values of samples were noted. It was repeated for

5 times for 100 mL of the sample. Similarly, five units of samples were checked with different materials and adsorption capacity was observed.

Similarly, adsorption capacity was determined for different types of materials. Among all the materials, rice husk ash is most effective material and also available in huge quantity so it is used as adsorption material for filter media.

By using this material and prepared filter media with different layers And RO rejected sample had passed through that composition of layers.

Table-1: Adsorption capacity of each material

Material	Initial TDS of sample	No. of repetitions	Final TDS of sample	Percentage of adsorption
Herbal Powder	3328	1	4416	NIL
Coconut Shells Charcoal	3328	5	2063	38%
Ground Nut Shells Charcoal	2865	5	2178	24%
Tea Waste	2865	5	2377	17%
Tea-Charcoal	3412	5	2490	28%
Corn Charcoal	3412	5	2661	22%
Banana Barks	3056	5	2597	15%
Rice Husk Ash	3056	5	1200	59%

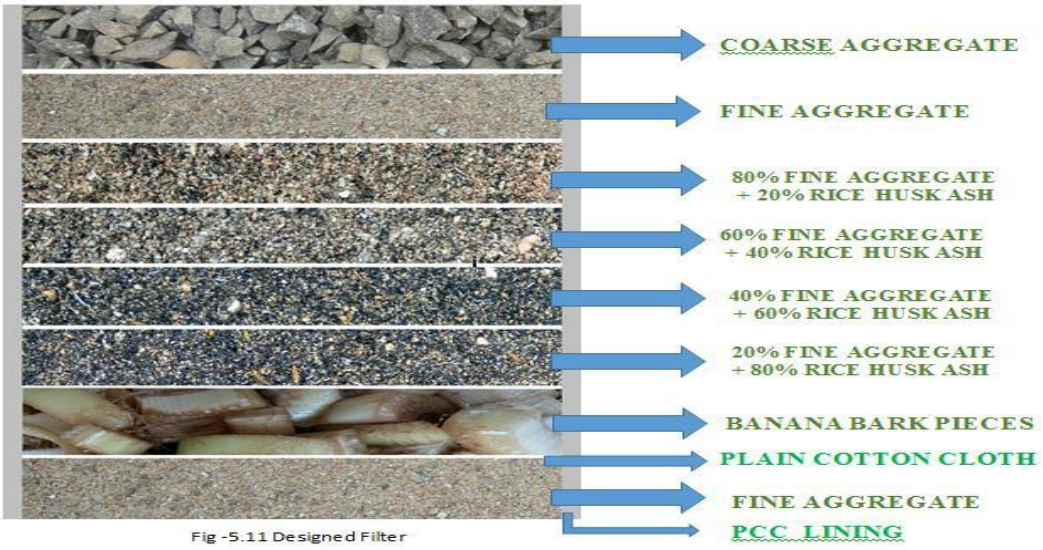

Figure-5: Final proposed filtered media at disposal site (Rice Husk Ash Filter Media)

ISSN 2394 - 7780

S.no	Location	Initial TDS (ppm)	Final TDS (ppm)	% Adsorption
1.	JNTUK-1	2689	1130	58
2.	JNTUK-2	2987	1135	62
3.	JNTUK-3	3056	1100	64
4.	DMART PLANT	3328	1364	59
5.	PORT STATION PLANT	3688	1438	61
6.	RAMANAYYAPETA RO PLANT	2865	916	68
7.	BHANUGUDI RO PLANT	2240	739	67
8.	ANNAMAGHATI RO PLANT	294	103	65
9.	AMG RO PLANT	2856	1028	64

Table-2: Rejects passed through RHAFM

CONCLUSIONS AND DISCUSSIONS

- The installation of RO plants have to be encouraged to supply safe drinking water but proper measures should be implemented to decrease the drawback of that technique.
- In Kakinada, pH of RO treated water is ranging between 6.5-8.5 which was prescribed by BIS.
- Most of treated water samples of RO plants in Kakinada have very less TDS value nearly (30-100) ppm which does not fulfil the BIS standards this shows ultimately RO treatment gives demineralized water.
- The demineralized water is biggest task resulted to chronic effects it is better to take RO water for drinking purpose but if it has automatic TDS controller system will fulfil all essential mineral.
- The test results from the samples had been found that correlation between total dissolved solids and electrical conductivity is ranging from 0.6-0.7, nearly 0.64 is observed.
- In raw water samples which was taken from bore wells have high chloride content in various forms such as sodium chloride, potassium chloride, calcium chloride and while treated with RO technique maximum chlorides are removed and flows in rejected water dispose on surface which infiltrate and again enter in ground water and can removed by this RHAFM .

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REMOTE SENSING AS A TOOL FOR RECONNAISSANCE IN GROUNDWATER EXPLORATION

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ABSTRACT
Food shortage and diseases are largely associated with water shortage or low/non supply of portable clean water. Desert encroachment also which is as a result of global climate change, has become difficult to control through afforestation due to low or non-availability of sources of water. Most communities especially in the rural areas rely on local sources of water which are mostly potential sources of diseases due to impurities. Clean water sources are becoming scarce and since the majority of the society are engaged in agricultural activities, then there is need to identify and explore the potential sources of water for drinking, agriculture and other industrial applications especially irrigation and other uses. Remote sensing stands as a tool due t its numerous advantages of covering a large area within a short time, reaching inaccessible areas as well as exposing the direction, size and changes associated with physical features. Infrared remote sensing has a special attention due to the high response of soil particles, rocks and minerals. This paper reviews the role been played by remote sensing in providing a working data for groundwater exploration. We realized that infrared remote sensing is highly effective if it can be used for reconnaissance especially due to its large coverage, low cost and updated information gathering ability.

INTRODUCTION
The use of remote sensing and geographic information system for hydrogeological purposes has become widely acceptable in most of the developed countries. Although it is a recent technology or it is only appreciated recently, most of its foundation has been used for quite a very long time. The age of computer and information technology has made acquisition of data through remote sensing, interpretation and display of the result (obtained) through GIS a very reliable, simple and standard source of important information. In some countries such as Canada and India, research centers have been established for the study and applications of remote sensing and GIS to various fields and the result been achieved so far has been commendable. Remote sensing provides a flat form for much environmental data while GIS remain the most outstanding means of interpreting, manipulating and storage of this data. Ground water resources are dynamic in nature as they grow with the expansion of irrigation activities, industrialization, urbanization etc. (Das, 2008), thus remote sensing with its advantages of spatial, spectral and temporal availability of data covering large and inaccessible areas within short time become a very handy tool in accessing, monitoring and conserving ground water resources. Also, considering the fact that for major towns supplies, the rivers serves as the sources and most of these rivers however are subjected to very high seasonal fluctuations which makes them unreliable for any major water supply project, predicts that any study that is not easily dynamic or up to date on one hand and which could not cover a large area within short time on the other hand cannot be feasible for such an environment.

According to Becker et al (2004), in any hydrogeological investigation, various factors are considered depending on the location and the prevailing surface features in the area, these features are mostly manifestations of underlying structures below the surface of the earth. Since remote sensing is associated with surface observation of features and the prediction of subsurface features, then an integration of remote sensing data with ground truth data will give a better understanding of the subsurface structures. Some of the features usually considered are geology, soil type, lineaments, drainage pattern, annual rainfall, temperature, topography or relief, lithology etc. All these when used altogether, partly or separately gives useful information on the hydrogeological formation of an area.

REMOTE SENSING
Remote sensing is the science of acquiring information about a surface without actually being in contact with it. This is done by sensing and recording reflected or emitted energy and processing, analysing and applying that information (CCRS, 2004).

In much of remote sensing, the process involves an interaction between incident radiation and the target of interest. This is exemplified by the use of imaging systems where the following seven elements were involved. Note however that remote sensing also involves the sensing of emitted energy and the use of non-imaging sensors.

ISSN 2394 - 7780

(1). Energy source or illumination (**A**);The first requirement for remote sensing is to have an energy source which illuminates or provides electromagnetic energy to the target of interest.

(2.) Radiation and the atmosphere (**B**); As the energy travels from its source to the target,it will come in contact and interact with the atmosphere it passes through. This interaction may take place a second time as the energy travels from the target to the sensor.

(3).Interaction with the target, (**C**);-Once the energy make its way to the target through the atmosphere, it interacts with target depending on the properties of both the target and the radiation.

(4).Recording of energy by the sensor (**D**): After energy has been scattered by or emitted from the target, we require a sensor (remote- not in contact with the target) to collect and record the electromagnetic radiation.

(5.) Transmission, reception and processing (**E**): The energy recorded by the sensor has to be transmitted, often in electronic form to a receiving and processing station where the data are processed into an image (hard copy and/or digital).

(6.) Interpretation and analysis (**F**): The processed image is interpreted visually and/or digitally or electronically to extract information about the target which was illuminated.

(7.) Application (**G**) ;- The final element of the remote sensing process is achieved when we apply the information we have been able to extract from the imagery about the target in order to better understand it, reveal some new information or assists in solving a particular problem.

These seven elements comprise the remote sensing process from the beginning to the end.

INTERACTION WITH THE ATMOSPHERE

Before radiation which is used for remote sensing reaches the earth's surface, it has to travel through some distance of the earth's atmosphere. As stated earlier, EMR manifests itself only when it interacts with matter which can be in form of gas, liquid or solid. This can be detected when a shining light beam of visible light falls on a white wall in a darkened room. If a person stands at right angle to the long axis of the beam the light is visible only at its source and where it strikes the wall and is reflected to the person's eye. The beam itself cannot be seen from the side and can be made visible only when its optical path contains particles large enough to scatter some of the light beam sideways. This can be accomplished by adding chalk dust or smoke to the invisible beam. The large particles will scatter a portion of the EMR to the person's eyes, enabling the beam to be seen from the sides. The side scattering of visible light along a beam path is known as the ***Tyndall effect.***

EMR that impinges upon matter is called incident radiation. For the earth, the strongest source of incident radiation is the sun, such radiation is called **INSOLATION**, a shortening of Incoming Solar Radiation. The full moon is the second strongest source, but its radiant energy measures only about one millionth of that from the sun.

The two fundamental energy interactions with the atmosphere can be explained as follows:

1. SCATTERING

Scattering occurs when particles or large gas molecules present in the atmosphere interact with and cause the electromagnetic radiation to be redirected from its original path. How much scattering took place depends on several factors including the wavelength of the radiation, the abundance of the particles or gases and the distance the radiation travels through the atmosphere. There are three (3) types of scattering take place:

i. RAYLEIGH SCATTERING: This occurs when particles are very small compared to the wavelength of the radiation. Rayleigh scattering causes shorter wavelengths for energy to be scattered much more than longer wavelength. Rayleigh scattering is the dominant scattering mechanism in the upper atmosphere. The fact that the sky appeared 'blue' during the day is because of this phenomenon. As sunlight passes through the atmosphere, the shorter wavelength (i.e. Bleed) of the visible spectrum are scattered more than another (longer) visible wavelength. At sunrise and sunset the light has to travel further through the atmosphere than at midday and the scattering of the shorter wavelength is more complete, this leave a greater proportion of the longer wavelength to penetrate the atmosphere.

ii. MIE SCATTERING: This occurs when particles are just about the same size with the wavelength of the radiation. Dust, smoke and water vapour are common causes of Mie scattering which tends to affect longer wavelengths than those affected by Rayleigh scattering. Mie scattering occurs mostly in the lower portions of the atmosphere where longer particles are more abundant, and dominates when cloud conditions last over.

ISSN 2394 - 7780

iii. NON SELECTIVE SCATTERING: This occurs when particles are much longer than the wavelength of the radiation. Water droplets and large dust particles can cause this type of scattering. Non selective scattering gets its name from the fact that all wavelengths are scattered about equally. This type of scattering causes fog and clouds to appear white to our eyes because blue, green and red light are all scattered in approximately equal quantities **(Blue + Green + Red light = White light)**.

2. ABSORPTION

This is one of the main mechanisms at work when electromagnetic radiation interacts with the atmosphere. It refers to the process by which incident radiation is taken up by medium. In contrast to scattering, this phenomenon causes molecules in the atmosphere to absorb energy at various wavelengths. Among the numerous gases of the atmosphere the most significant absorbers of EMR are oxygen (O_2), nitrogen (N_2), ozone(O_3), carbon dioxide (CO_2) and water vapour (H_2O).

Although all the above absorbers are responsible, but ozone, carbon dioxide and water vapours are the three main constituents which absorb most of the radiation.

Ozone serves to absorb the harmful (to most living things) ultraviolet radiation from the sun. Without this protective layer in the atmosphere, our skin would burn when exposed to sunlight. Carbon dioxide also referred to as greenhouse gas, this is because it tends to absorb radiation strongly in the far infrared portion of the spectrum that are associated with thermal heating which serve to trap this heat inside the atmosphere. Water vapour in the atmosphere absorbs much of the incoming long wave infrared and shortwave microwave radiation. The presence of water vapour in the lower atmosphere varies greatly from location to location and at different times of the year. For example, the air mass above a desert would have very little water vapour to absorb energy, while the tropics would have high concentrations of water vapour (i.e. High humidity).Ozone effectively absorbs ultraviolet radiation with wavelength between 0.2 and 0.3μm in the ozone layer of the stratosphere.

Water vapour and carbon dioxide are responsible primarily for several narrow absorption bands in the reflected and infrared spectral regions between 0.9 -2.7μm. In the thermal infrared region, strong water vapour absorption occurs 5- 8μm and from about 20μmto the beginning of the microwave region. Carbon dioxide also effectively absorbs between 14 and 20μm and ozone in the 9 to 10μm wavelength span. This absorbed radiation heats the lower atmosphere, especially in humid areas where there is abundant water vapour.

Because these gases absorb electromagnetic energy in specific regions of the spectrum they influence where (in the spectrum) we can look for remote sensing purposes. Those areas of the spectrum which are not severely influenced by atmospheric absorption and thus are useful for remote sensors are called ***ATMOSPHERIC WINDOWS.*** By comparing the characteristics of the two most common energy/radiation sources (the sun and the earth) with the atmospheric windows available to us, we can define those wavelengths that we can use most effectively for remote sensing. The visible portion of the spectrum, to which our eyes are most sensitive, corresponds to both an atmospheric windows and the peak energy level of the sun. Also note that heat energy emitted by the earth corresponds to a window around 10μm in the thermal IR portion of the spectrum, while the large window at wavelengths beyond 1mm is associated with the microwave region.

So far we have discussed how electromagnetic energy makes its journey from its source to the surface of the earth. Now we will look at the radiation and examine what happened to it when it arrives at the surface.

2.1.5 RADIATION-MATTER INTERACTIONS

Radiation that is not absorbed or scattered in the atmosphere can reach and interact with the earth's surface, there are three forms of interaction that can takes place when energy strikes or is incident (I) upon the surface, these are;

1. Absorption (**A**)

2. Transmission (**T**) and

3. Reflection(**R**)

The total incident energy will interact with the surface in one or more of these three ways.

(i) The composition and the physical properties of the medium

(ii) The wavelength or frequency of the incident radiation and

(iii) The angle at which the incident radiation strikes a surface.

ISSN 2394 - 7780

Absorption occurs when radiation (energy) is absorbed into the target while transmission occurs when radiation passes through target. Reflection occurs when radiation ‘’bounces’’ off the target and is redirected. **In remote sensing, we are most interested in measuring the radiation reflected from targets**. We refer to two types of reflection, which represents the two extreme ends of the way in which energy is reflected from a target, i.e. specular reflection and diffuse reflection.

When a surface is smooth, we get specular or mirror-like reflection where all (or almost) of the energy is directed away from the surface in a single direction. Diffuse reflection occurs when the surface is rough and the energy is reflected uniformly in all directions. Most earth surface features lies somewhere between perfectly specular or perfectly diffuse reflectors. Whether a particular target reflects specularly or diffusely, or somewhere in between, depends on the surface roughness of the feature in comparison to the wavelength of the incoming radiation. If wavelengths are much smaller than the surface variations or the particle sizes that make up the surface, diffuse reflection will dominate. By measuring the energy that is reflected (or emitted) by targets on the earth surface over a variety of different wavelengths, we can build up a spectral response patterns of different features we may be able to distinguish them.

2.1.6 TYPES OF SENSING

The sun provides a very convenient source of energy for remote sensing. The sun’s energy is either reflected, as it is for visible wavelengths, or absorbed and then re-emitted as it is for thermal infrared wavelengths.

PASSIVE SENSORS;- Remote sensing systems which measure energy that is naturally available are called passive sensors. Passive sensors can only be used to detect energy when the naturally occurring energy is available for all reflected energy. This can only take place during the time when the sun is illuminating the earth. There is no reflected energy available from the sun at night. Energy that is naturally emitted (such as thermal infrared) can be detected in the day or night, as long as the amount of energy is large enough to be detected.

ACTIVE SENSORS: - These sensors on the other hand provide their own energy source for illumination. The sensor emits radiation which is directed towards the target to be investigated. The radiation reflected from that target is detected and measured by the sensor. Advantages for active sensors include the ability to obtain measurement any time, regardless of the time of day or season active sensors can be used for examining wavelengths that are not sufficiently provided by the sun, such as microwaves, or better control the way a target is illuminated, some example of active sensors are a laser flourosensor and, Synthetic Aperture Radar (SAR). (Thomas et al, 2007).

Electromagnetic energy may be detected either photographically or electronically, the photographic process uses chemical reactions on the surface of light sensitive films to detect and record energy variations.

IMPORTANT VARIABLES

1. SATELLITE IMAGE

Satellite image which is acquired through remote sensing reveals much information about the various features on the surface of the earth (Thapa *et al.*, 2008). Imaging of the earth in various wavelengths within the electromagnetic spectrum from the ultraviolet to the infrared regions yields a wide range of detail about earth surface structure and physical properties; vegetation and cultural development. Most of the imaging is done by passive techniques using radiations emitted by objects being viewed, but much useful work can be done with active components like RADAR. Long wave radar can sometimes detect groundwater levels at depths of a few meters and other subsurface features, such as buried channels (McCauley *et al* 1982), but only if all conditions are suitable, i.e. coarse-grained deposits, dry vadose zone without vegetation and some prior knowledge of the geology. Radar imagery has its general use in hydrogeology for the interpretation of geological structures (Drury, 1990). Satellite photos with the help of ground check are used to produce thematic maps; land and water use map and plant cover map, the surface features contained in the imagery of the reflected shorter wavelengths relate to the surface expressions of geological and geomorphological features and land cover, hence indirect hydrogeological information is obtained. In the broad perspective of images covering thousands or tens of thousands of square miles features stands out that were not recognized on foot or from aircraft. Numerous faults and fracture systems of the kind associated with mineral ore, groundwater and oil deposits can be identified. Therefore, selection of exploration sites for groundwater shall be based on spectral reflectance from multispectral high resolution satellite data for identification of interconnected fractures exposed and hidden within the soil and vegetation cover (Mukherjee, 2008). Therefore, despite the fact that remote sensing is more applicable to surface features, it provides a clue on how subsurface features are related to the surface features and laid a foundation for the study of such features beneath the earth surface.

ISSN 2394 - 7780

The ground water information most useful to water resource managers includes; the presence or absence of groundwater in designated areas, the depth to groundwater, the quantity and quality of water available for development, recharge rates to aquifer, the possible impact of pumping on land subsidence, a real extent of the aquifer, location of recharge and discharge areas and the interaction between withdrawals and recharge at wells and natural discharge into rivers. Ground water is the last component of the hydrologic cycle to realize the benefits of remote sensing. Ground water scientists have been late to embrace satellite data for an obvious reason; ground water lies in the subsurface and current air and satellite based radar and radiometers can normally penetrate only a few centimeters into the ground. In spite of this apparent road-block, remote sensing efforts that are applicable to shallow ground water can be easily studied. It should be remembered that ground water accounts for 26% of global renewable fresh water resources (FAO, 2003). At a basin scale, therefore, remotely sensed positioning of stream head water can provide a dynamic monitoring of the water table. Study of aerial photographs, satellite images,, topographic maps supported by ground truth surveys gives clue on a network of interlinked subsurface structures. Thus, whereas this information is generally sought by hydrogeologist using conventional methods (e.g. borehole logging and geophysical methods), remote sensing helps in the planning of conventional measurements and can be used to estimate some hydrogeological variables quantitatively and others qualitatively (Marwan, 2004).

Satellite data provide quick, up-to date and useful baseline information on the parameters controlling the occurrence and movement of ground water like geology, soil, lineament, lithology, geomorphology, land use/cover, etc., therefore, a system study of the factors mentioned above leads to a better delineation of prospective zones in an area which is then followed up on the ground through detailed hydrogeological and geophysical investigation. The advantage of the use of satellite images is that these images cover large and inaccessible areas under uniform conditions.

2. DRAINAGE MAP

Drainage map represents the arrangement and repetition of stream channels that have been formed in response to natural forces acting upon the earths' land surface. Drainage network system prevailing on a given terrain surface is largely controlled by the soil types or surficial deposits, slope, parent material and underlying structure. Most surfaces develop diagnostic drainage patterns that are easily recognizable on images because of their geometric attributes. This is because drainage pattern provides quantitative description of basin geometry, which helps us in understanding slope and inequality in rock hardness. These patterns provide great deal of information about the surface and subsurface characteristics of the landscape. Drainage patterns which are normally visible on drainage maps reflect to varying degrees the lithology and structure of the region. The study of slope, aspect, drainage networks represent the hydrogeology and helps in categorization of the land forms into different hydro-geomorphologic classes representing the relationship of the geological structures viz-a-viz the ground water occurrence. Drainage is studied according to its pattern type and its texture. Drainage pattern is associated with the nature and structure of the lithology (i.e. rock type) obtainable in an area while texture or density is a function of rock/soil permeability. When the drainage density of an area is high, it is suggestive of high runoff and consequently low infiltration rate whereas low drainage density of an area is indicative of low runoff and high infiltration (Prasad, 2008). Less developed/absence of drainage in an area is an indication that underground water circulation is much more developed than surface runoff. The defined drainage network over a large area subject to good rainfall may indicate good water occurrence. Information on soil also forms an important input in mapping ground water potential zones. For example coarse textured soils indicate less permeability. Highly permeable soil permit relatively rapid rate of infiltration. Thus, to evaluate ground water potential zones, various parameters such as drainage, slope, lineaments, lithology, and topography have to be considered and carefully selected for different geographic units.

3. LINEAMENTS

Lineaments are surface manifestations of structurally controlled features such as joints, straight course of streams and vegetation alignment. Lineaments are linear or curvilinear features and are identifiable on landsat imagery by their long, narrow and approximately straight alignments visible as tonal differences with respect to other terrain surfaces. Lineaments being weak zones, usually serve as conduits for movement or accumulation of groundwater in the subsurface; therefore, lineaments analysis of an area when extracted from the remotely sensed data give important information on subsurface features that may control the movement and /or storage of groundwater. For geologic interpretation, particularly since the 1930s with the advent of photogeology (Campbell, 1996), lineament analysis has been used extensively. Furthermore, lineaments like joints, fractures etc, developing generally due to tectonic stress and strain, provide important clue on surface features and are responsible for infiltration of surface run off into subsurface and also for movement and storage of groundwater. The feature of neo-tectonic activities in the forms of fault and lineaments has a definite control on the alignment

ISSN 2394 - 7780

of many rivers and their tributaries (Amin, 2008). Therefore it implies that the zones with high number of lineaments represent the terrain surface which has a good property to allow surface water percolating downward through rocks and soil. Hence, there is general agreement that the most promising water bearing directions originates from brittle deformation caused by tensional stress related to faulting and strike-slip faulting (Du Wenchai *et al*. 1993). That is why, apart from being conduits for groundwater flow, lineaments are considered to be features with secondary permeability consequent upon which potential sites for productive water wells are located (Marwan, 2004). Bedrock lineaments are associated with linear lake shores and perennial wet land complexes. They were identified using a robust multi-image method and characterized by remote sensing fracture mapping, integrated dataset and models of lineament partiality that are geologically realistic which results in better understanding of fractured bedrock aquifers and patterns of fluid flows in the brittle upper most crust. Different rocks respond to the same overall stress field with different fracture densities. The mapping of linear features on various types of maps or remotely sensed data is one of the keys to understanding ground water occurrence in the hard rock area. The identification of lineaments has immense importance on hard rock hydrogeology as they can identify rock fractures that localize groundwater (Das, 2010). According to Soulakellis (2000), lineament information extractions in satellite images can be broadly divided into three categories;

1. Lineament enhancement and extractions for the characterization of the geologic structure.
2. Image classification to perform the geologic mapping or locate spectrally anomalous zones attributable to mineralization.
3. Superposition of satellite images and multiple data such as geological, geochemical and geophysical data in a geographical information system.

From the above, it will be seen that application number (i) and (iii) are of much significance in this study as the GIS software to be used (ILWIS and ArcView) have the capability for extraction of hydrogeological features as required in (i) above and the GIS itself contains all the capabilities needed to handle geographical, geochemical as well as geophysical data. Also frequently, stratigraphy and structural traps can be observed on satellite images as indicative through the linear features. Satellite imageries with high resolution play an essential role in identifying a miscellany of terrain characteristics.

4. DIGITAL ELEVATION MODELS (DEM)

Digital elevation models (DEM)/ shuttle radar topographic mission (SRTM). DEM refers to a digital representation of a surface topography or terrain. It is also widely known as digital terrain model (DTM) and is either represented as a raster (a grid of squares) or as an irregular triangular grids. They are used in producing very high quality digital relief maps. DEMs are also used nowadays for generating new digital products (Krupnik, 2000), among these products are digital orthoimages, perspective views and ‘‘fly through’’ sequences, these products, especially digital orthoimages, are accepted today as standard mapping tools. SRTM is a DEM covering all land areas between 600N and 560 latitude at a 90m pixel resolution and a vertical accuracy of at least 5m. The shuttle radar topographic mission (SRTM) delivered a digital terrain model of better spatial resolution and accuracy than traditional free global DEM datasets at near global coverage and made a wide range of detailed hydrologic applications feasible (Ling *et al.*, 2002). Digital elevation models has been profound sources of information in ground water exploration since on one hand they can provide many hydrological relevant parameters such as drainage networks and catchment boundaries and on the other hand there exist a relation between surface water body and underground water, in this case, digital elevation model which represent the depth and undulation of the barrier/impermeable base layer plays an important role in determining the ground water flow (Bhakar, 2007). Topographically driven ground water flow implies that ground water is recharged over broad upland areas and discharged at relatively focused lowland areas as surface water, in other words, the direction of shallow ground-water flow can be considered as a gradient of topographic slope. Deeper ground water flow likely is a function of fracture width, continuity, and interconnectivity and likely is partly controlled by the heterogeneous and anisotropic orientation of fractures. In more arid climates, evapotranspiration may cause broad areas of net ground water discharge. The contrast in spatial resolution of the ground water/surface water interface and ground water/ land surface interface require different remote sensing methods. Thus DEM provides useful information on groundwater interest on the drainage pattern and slope of an area. It also helps in providing information on hydrogeologic importance of the drainage system of an area.

ISSN 2394 - 7780

5. GEOLOGY MAP

A geologic map represents the lithology and so far as possible the geologic age of every important geologic unit in a given area. Geology describes the regional geological structures of a given area. Each distinctive unit that can be shown effectively to the scale of the map is a geologic formation. A good topographic base map is essential for representing relations of bedrock to land surface forms. A complete geologic map would indicate important structural details such as inclinations of strata, locations of faults and axial traces of folds. Usually the map is supplemented by vertical sections on which structural features seen at the surface are projected to limited depths. Multi-sensor remote sensing provides different geological information on the surface cover and mapping of boundaries between geological units. This information can be used to map bedrock lithology, mineral alteration and regolith materials in highly weathered and vegetated areas. Optical remote sensing on the other hand can be used for lithological mapping in areas with little vegetation and weathering cover (Scott *et al*., 1997 and Finn *et al*., 2002), thus this can be used to project groundwater occurrence/absence and also project the extent of such aquifers. Because of the importance of underground water, sometimes artificial recharge is employed to ensure the effectiveness of the aquifer and for economic considerations. The type of artificial recharge system that can be developed at any site is controlled to a large degree by the geologic and hydrologic conditions. In addition to economic considerations, Das (2010) observed site selection criteria to include the following;

1. Source of recharge water
2. Chemical, physical and biological characteristics of recharge water.
3. Availability of geologic formation suitable for artificial recharge.
4. Thickness and permeability of material underlying the geological formation considered suitable for recharge.
5. Proximity of the potential recharge site to the cone of depression of an appropriate well.
6. Water level differences between the aquifer and the recharge site.

When we consider the above stated criteria, we will see that criteria numbers (1-2) can be observed through remote sensing of surface water, criteria number (3) can be observed using satellite image, criteria numbers (4-6) can be studied using geophysical techniques, digital terrain models and well inventory processes.

From the above, it is obvious that a linkage has been shown between surface inundation and ground water drainage; greater effort should be made toward coupling soil water and ground water studies.

DATA RECEPTION, TRANSMISSION AND PROCESSING

Data obtained during airborne remote sensing mission can be retrieved once the aircraft lands, it can then be processed and delivered to the end user. However, data acquired from satellite platforms need to be electronically transmitted to Earth, since the satellite continues to stay in orbit during its operational life time.

There are three main options for transmitting data required by satellites to the surface.

1. The data can be directly transmitted to Earth if a Ground Receiving Stating (GRS) is in the line of sight of the satellite (A).
2. The data can be recorded on board the satellite (B) for transmission to a GRS at a later time.
3. Data can also be relayed to the GRS through the Tracking and Data Relayed Satellite System (TDRSS) (C) which consist of a series of communication satellites in geosynchronous orbit. The data are transmitted from one satellite to another until they reach the appropriate GRS.

After the data is received in a GRS station in a raw digital format, they may then if required be processed using appropriate software to correct systematic, geometric and atmospheric distortion to the imagery and be translated in a standardized format.

GEOGRAPHIC INFORMATION SYSTEM (GIS)

GIS (Geographic Information Systems) refers specifically to Computer based technologies for the storage, manipulation and analysis of geographically referenced information (Mark *et al*, 2007). Many of the early computer-based Geographical Information Systems have been relatively technical and only really accessible to people with a high level of computer literacy. Over the past decade or so the rapid advances in computer hardware have dramatically increased the potential for producing IT systems to effectively manage and process spatial information, which is invariably more complex than non-spatial information.

ISSN 2394 - 7780

METHODOLOGY

The methodology employed in such study involved various Digital Image Processing (DIP) techniques which includes Image Stacking, Image enhancement, false color composite and principal component analysis; extraction of lineaments from the satellite image; generation of slope from the SRTM image and finally, integration of the results to produce the groundwater potential map for the area. The software used include ILWIS 3.1 and Arc View 3.2versions. This involves the study and identification of the ideal geo-hydrological conditions prevailing in the area within the regional geological set up with respect to the major and minor geological structures based on the temporal satellite data, lineament analyusis, survey of Nigerian maps at 1:50,000 scale followed by ground truth (well inventory) surveys. The DIP technique with its different satellite data enhancement techniques facilitated in generating accurate hydrogeological maps.

CONCLUSION

The results of the study can assist in proper understanding of the hydrogeological condition of an area. This review has go a long way in depicting the efficiency and effectiveness of remote sensing in groundwater exploration, thus creating awareness to the fact that a simple and easy way of detecting the hydrogeological condition of an area exists. This study is qualitative and hence has served as reconnaissance investigation technique that will enhance the success of quantitative subsurface geophysical investigations that will subsequently be carried out in future.

RECOMMENDATION

It must however be added that the results of this study is qualitative hence, it is recommended that more quantitative investigations involving geophysical technique(s), such as borehole drilling and pump test must be carried out to fully understand the quantitative prospect of the groundwater resources of the area and consequently designing a model for the effective groundwater use and management for irrigation and other purposes.

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WATER AND SANITATION HYGIENE (WASH)

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ABSTRACT
This research paper gives the information about the water, sanitation and hygiene 'WASH'. The main objective of this paper is to spread basic need of cleanliness and personal hygiene among the school children of both private and government sector. Through this survey we also want to improve sanitation and water services in different schools because conditions are not satisfactory even in urban area. It helps the students to aware of the diseases like dengue, malaria etc. caused due to unhygienic condition in regular basis. We surveyed twelve different schools and tried to persuade students

The study recommends substantial and synchronize contributor and strong partnership which includes financial support too. Government and teachers should also helps in increasing funds to improve the environment and to establish a gadget for substantial school water, sanitation and hygiene. This paper also consists of the pictures in which the students pick up the garbage under his/her desk and throws the garbage in the dustbin. This shows that we are almost successful in our mission to improve sanitation and personal hygiene.

This survey enhanced pathways in the field of sanitation and water hygiene. By this survey 700-750 students of 12 different schools got this message and the implemented themselves and always concentrate on their personal hygiene and water sanitation.

INTRODUCTION
Sanitation includes safe drainage of excrement, garbage disposal, personal hygiene and cleanliness. Inadequate sanitation is a major cause of different types of transferable diseases such as malaria, diarrhoea, cholera, typhoid and dysentery. Most of the developing countries lack ample water and sanitation services impact on health of students. Hygiene is defined as the practice of desirable personal behaviours, e.g., hand washing with soap before eating and after using toilet, taking bath and maintaining body cleanliness that will improve health and prevent from sickness. A healthy nation is positively contributed to overall development of the country. The role of sanitation & hygiene in routine life in order to live a healthy life is unlimited.

The School Sanitation and Hygiene Education (SSHE) program started in India in 1999. Included under a flagship program "Total Sanitation Campaign" (TSC), the priority areas of SSHE is to provide water, sanitation and hand washing facilities in the schools and promote behavioural change through hygiene education, and linking the same to home and community. The honourable Prime Minister Shri Narendra Modi started a campaign called "Clean India Campaign" which is very important in the field of sanitation and hygiene.

In India, rapid urbanisation and the increasing population has placed a major strain on the existing infrastructure. Better water, sanitation and hygiene in schools provide healthy and secure school life that can protect children from diseases. If school sanitation and hygiene facilities are absent or are not maintained properly then school become risky place where diseases can be transmitted. It should be a part of daily routine life of all school children. Separate sessions on cleanliness can be conducted along with regular classes so that in earlier age of school time a student's aware the drawback of unhygienic conditions. Though the government has tried to overcome this problem through urban development programmes like "Clean India Campaign", the total costs required for successful operations continue to mar their efforts. Hence, the contributions of corporations, and other organisations is a welcome change.

STUDY AREA
Why we have selected schools over public areas for our survey on water, sanitation and hygiene (WASH)?

Schools are the ideal places of learning for children and they have an important role for the growth of nation. In schools, the students have a right to basic facilities such as school toilets, safe drinking water, clean surroundings and basic information on hygiene. Because of fewer numbers of children in particular public area as compared to schools we selected government as well as private schools for study. Students were examined under two categories like habit and attitude. We wanted to spread basic awareness among the school children regarding daily cleanliness habit and its necessity in life. Some general questions were the part of survey like 'Do you have a bath every day? , how often do students wash their hands after touching a pet/ using the toilet/after coming back home?

In this survey we asked questions in these three categories:-

ISSN 2394 - 7780

1. Distribution of knowledge among students
2. Attitude of students
3. Assessing the practices of students

The study was carried out in rural as well as in urban area of District Jaipur. The students were asked appropriate questions related to sanitation & hygiene that was an effective way to raise awareness in short time period. We surveyed in 12 different private & government schools. The facilities of water and sanitation are better in private school as compared to government school under our study. In government schools the teacher do not focuses on student's hygiene but that was not seen in private schools. In schools, we observed that the drinking water is not too good and pure, lack of cleanliness and hygiene. So it is necessary for the students to be aware and the staff and teachers of the respective schools must improve the daily habits. Students should make themselves clean and full of hygiene so that they only concentrate on their studies and will successful in future.

OBSERVATION

Table-1: Differences between the facilities in government and private schools

Government Schools	Private Schools
➢ Drinking water quality is not tested at regular intervals of time. ➢ Water sludge like covering of percolate pits, connection to sewer lines, etc is not properly managed. ➢ All students wash their hands before eating food and after contact with waste. ➢ There is activity based on education in which students manages the garbage disposal in school. ➢ The facility of menstrual hygiene like napkins, pads are not generally provided for primary girls. ➢ Teachers do not focus on a student's personal health and hygiene.	➢ Drinking water quality is tested in every two weeks. ➢ Faecal sludge safely managed doors and adequate lighting to ensure privacy and safety for girls. ➢ All students wash their hands with soap before having lunch. ➢ There is no activity related to cleanliness of schools done by students. ➢ Menstrual hygiene for girls, access to sanitary napkins and disposal facilities are available. ➢ Teaches mainly focussed on student's personal hygiene as well as education.

Table-1.3: Data collected by the survey of twelve different schools

S.No.	Name of School	Region	Total Students	Number	% Knowledge	No.	% Level of Interest	No.	% Hygiene
1	Ryan International School	Mansarovar	83	55	66.27	70	84.34	70	84.34
2	Rajshree Sr. Secondary School	Shyam Nagar	40	15	37.50	25	62.50	20	50.00
3	Super Kids Public School	Ramnagar	45	21	46.67	28	62.22	30	66.67
4	Gayatri Public School	Nandpuri	60	25	41.67	40	66.67	35	58.33
5	American International School	Patrakar colony	65	35	53.85	46	70.77	55	84.62
6	Prerna Public School	Goner	88	21	23.86	53	60.23	40	45.45
7	Kendriya Vidyalaya No. 03	Jhalana Dungri	60	40	66.67	45	75.00	47	78.33
8	Government Girls School	Goner	45	20	44.44	40	88.89	30	66.67
9	Kendriya Vidyalaya No.05	Mansarovar	67	47	70.15	55	82.09	65	97.01
10	Government Sr. Secondary School	Jagatpura	50	25	50.00	35	70.00	40	80.00
11	Government Sr. Secondary School	Sanganer	60	25	41.67	50	83.33	45	75.00
12	Government Girls Sr. Secondary School	Sanganer	70	50	71.43	56	80.00	45	64.29
			733.00	379.00	51.18	543.00	73.84	522.00	70.89

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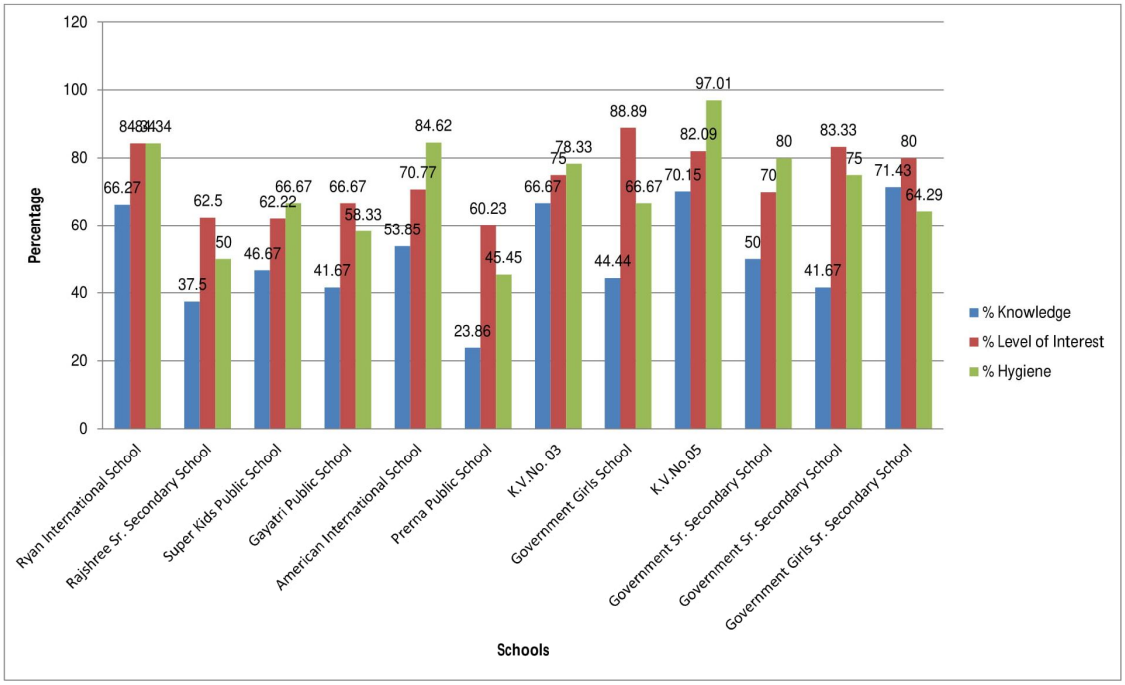

Fig-1: Analysis shows the hygiene, level of interest, knowledge of twelve different schools

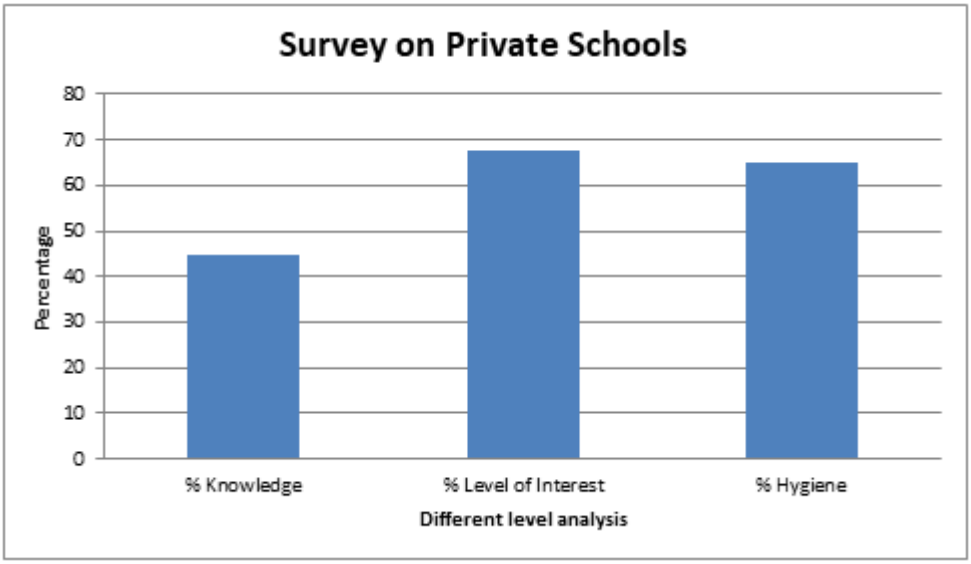

Fig-2: Percentage analysis on the basis of knowledge, interest & hygiene (Private schools)

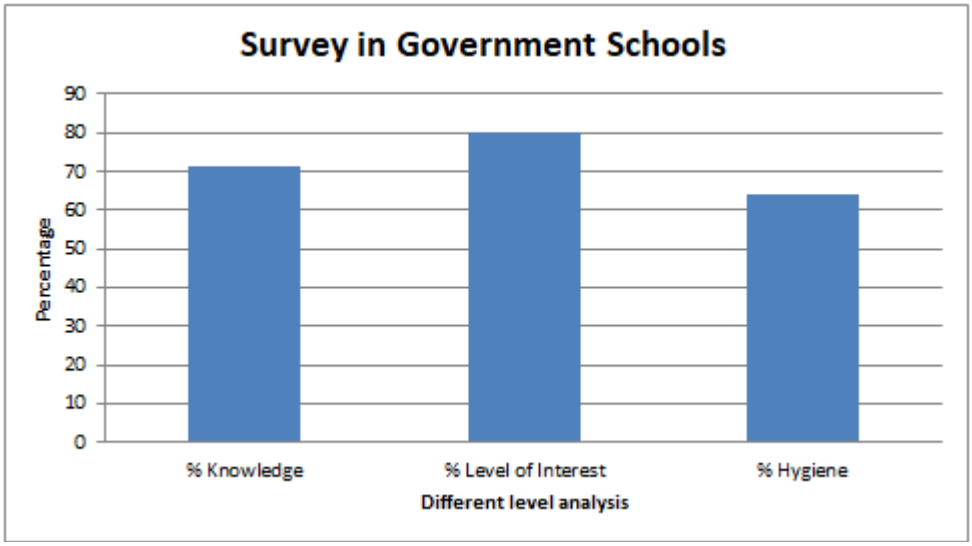

Fig-3: Percentage analysis on the basis of knowledge, interest & hygiene (Government schools)

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RESULT

More than 733 students were involved in the study. The data was collected by asking questions on the basis of personal hygiene, socio-demographic characteristics of students and the knowledge among students. We started our survey by told them about personal hygiene, different practices to care for their body health. We observed student's attitude towards hand washing after using the toilet. We aware the students that hand wash is very important improvement of health then we assessing the practises done by the students like taking bath/shower every day, brushing their teeth two times in a day, which toothpaste and soap they used. By the above steps of the survey we collected the data of twelve different schools and then we classified and compared the data.

Cleanliness of school area was observed to be adequate in 75% of the schools. However, there were no separate rooms to serve the midday meals/ to take lunch in any of the schools under study. Most of the schools were having drinking water points which were adequate while drainage of waste water was appropriate in only 70% of the schools. Hand washing facilities were pitiable in most of the schools only two (10%) of the schools were having adequate hand washing points with soap.

CONCLUSION

The children also clean the places around them like garbage under the benches, in playground, etc. There are proper numbers of sweepers for the cleanliness of schools. There should be facility of R-O water coolers for the purification of water. The schools should provided medicated soaps for the hand wash before eating food or after using toilets. The school should conduct various activities in which all students should participate in cleanliness of school. The schools should provide sanitary pads for primary girls and constructed no. of latrines. By our survey we aware the students and motivate them that throw the garbage always in the dustbin.

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STREAM DELINEATION ANALYSIS OF PAWANA RIVER BASIN USING GEOSPATIAL TECHNOLOGY

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ABSTRACT
Stream delineation is fundamental to get imperative information about river drainage basin and various river features. The satellite technology can serve efficiently to derive delineation parameters of existing river basin and to make future predictions. Satellite data along with topographic maps are used to delineate stream networks and validate. Digital Elevation Model (DEM) Image of the Shuttle Radar Topography Mission (SRTM) which has spatial resolution of 3-arc second is used for the delineation of the Pawana River watershed. The study area is of Pawana river basin in Mawal Taluka in Pune (Maharashtra, India). Various Parameters like Stream Order, Stream Length, Elongation Ratio, Bifurcation Ratio etc. is derived with the help of GIS software i.e. ArcGIS 10.2. Thematic maps of the aforementioned parameters are created which will further be useful for analysis of site suitability for water diversion structures such as weirs, barrage etc, for watershed management and for important river joining projects. Toposheets which covered the Pawana River are acquired from Survey of India (SOI), Pune, are used to affirm the results drawn from SRTM data. The quantitative study of various components suggest that the highest stream order of Pawana river is 6th and the pattern being dendritic drainage system with total stream length being 1290.78 Km and length of main channel/river is 52.53 Km. This research study can systematically aid in future projects such as river joining and also in identifying potential ground water zones using remote sensing and GIS.

Keywords: Stream Delineation, River drainage basin, SRTM, toposheets, Thematic maps, ArcGIS, Arc Hydro

INTRODUCTION
Stream delineation analysis is the quantitative approach for deriving data about the drainage basins and to know the paramount facets of the basin. National Institute of Hydrology (1993) has done work for various basins on morphometric analysis, which was grounded on aspects such as linear, aerial and relief using different arithmetical equations (Dubey *et al.,* 2015). Analysis of Morphometry for the basin convey's data about the hydrological nature of the earth's surface lying inside the basin. Many researchers, scholars and scientists carried out assessment of various basin with the help of Remote Sensing and GIS which inferred that the tool was very useful and systematic, and also provided fairly accurate and detailed characteristics of the drainage basin (Grohmann *et al.,* 2004; Javed *et al.,* 2009; Pankaj and Kumar, 2009; Singh *et al.,* 2014). Utilization of space borne satellites has proved to be an important development for drainage system mapping and their recurrent monitoring using geospatial technology and was inferred from recent development in assessment of morphometric parameters of the drainage (Singh *et al.,* 2013, 2014; Saha and Singh, 2017). Using conventional methods, researchers such as R. E. Horton (1945), A. N. Strahler (1957) and Krishnamurthy (1966) found out characteristics of drainage for various river basins and sub basins on different locations on the earth's surface. Assessment using GIS and with the help of DEM 30m Image Data captured by Shuttle Radar Topographic Mission (SRTM) has proved a lot faster and detailed analysis and also a low cost option for analysis of hydrological structures (Smith and Sandwell, 2003; Grohmann *et al.,* 2004). Stream Delineation parameters such as length of stream, mean stream length, length of basin, area of the basin, stream number, stream order, perimeter of the basin area etc. was produced with the help of freely available DEM data and GIS software. For hydrological research such as groundwater potential zoning, erosional surface etc. the geomorphological characteristics of the basin and the geographic features are necessary (Rai *et al.,* 2014). The main purpose was to study the Delineated Streams of Pawana River basin located in Mawal taluka of Pune district in Maharashtra. This study can be useful for future hydrological works such as river joining projects, river water training works, water management etc.

STUDY AREA
The study is conducted for the area which lies in the Pune district of Maharashtra. The study area consists of Pawana River flowing through the Pune district. The origination of the river is in Western Ghats. The river crosses through Dehu, Pimpri-Chinchwad, Pune and Dapodi. It later on confluences with the Mula River near Sangvi. Pune is the second largest city of Maharashtra district having area of approximately 15,642 Km^2 . The population of the district according to census of 2011 is 94,26,259. The area of interest lies in Mawal taluka of Pune district. The population of Mawal taluka according to census 2011 is 3,77,559. There are approximately 181 villages lying under Mawal Taluka.

ISSN 2394 - 7780

The soil type is deep, moderately well drained, strongly calcareous, fine clayey soil on planes having gentle slopes and valley having erosion. The river gets water from south west monsoons. There are two tributaries which join Pawana River known as Kasarsai odha and Chandkhed Nadi. The region receives average rainfall of 1688 mm annually mainly from June to september. The catchment has boundary extents of top 18° 44' 13.56", Rights of 73° 51' 40.68", left of 73° 23' 28.68", and bottom of 18° 34' 15.56". The area of watershed under the study is approximately 500 km^2. The SOI Toposheet, which is used for the study is having scale of 1:50,000 and the area of interest falls within toposheets No. E43H6 (47 F/6), E4310 (47F/10), E4314 (47F/14).

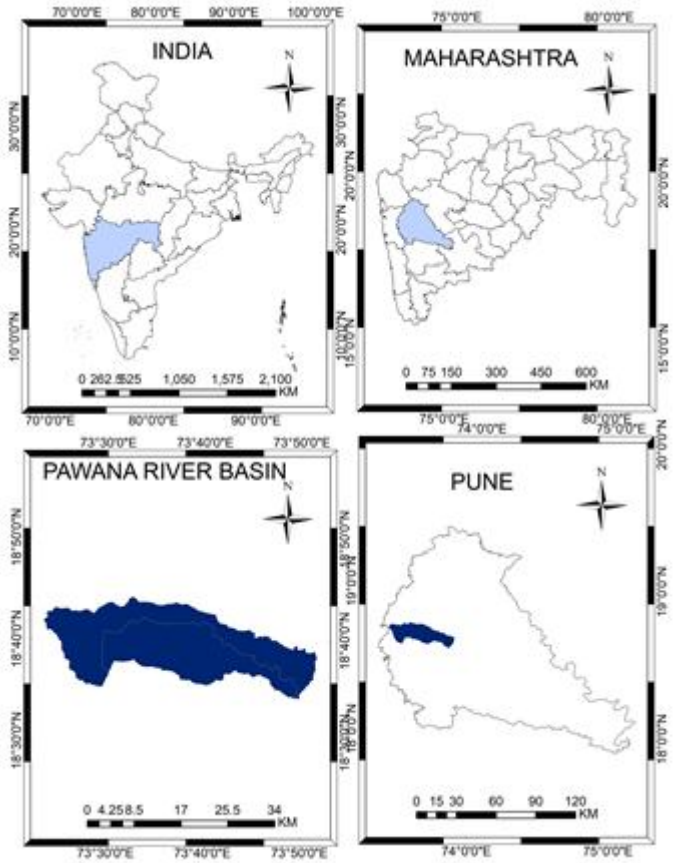

Fig-1: Location of Study Area (Pawana River Basin)

MATERIALS AND METHODS USED

The Drainage basin is delineated and the required drainage network is derived with making the use of SRTM DEM 3-arc second i.e. 90m spatial resolution and with ARC GIS 10.2 software. SRTM DEM Data was published on 1st October 2012. Arc Hydro tools were used for extraction of drainage streams, drainage catchment, stream definition, flow direction, fill sink, stream segmentation, flow accumulation, and Spatial Analyst tools were used, like hydrology tool which help in extracting stream order, flow length, also tools such as aspect, slope. These tools were used for finding Stream parameters for entire Pawana River Basin.

Table-2: Data/Software specification

Type of Data/Software used	Details of Data	Source of Data
SRTM DEM	3-Arc Second Global (90m resolution)	https://earthexplorer.usgs.gov/ http://srtm.usgs.gov
Arc GIS software	Arc Map 10.2	http://desktop.arcgis.com/
SOI Toposheets	(1:50000) 47F/6, 47F/10, 47F/14)	Survey of India, Pune

SOI Toposheet is used to extract the drainage network and thus assigning the stream order. Automatic Extraction method is used for extracting the required parameters such as extraction of stream network, area of basin, stream order, flow direction, flow accumulation, drainage density map from the Pawana River Basin SRTM DEM using GIS software. The stream number and stream lengths of various orders, drainage area, perimeter of the basin, drainage frequency, total length of the basin, drainage density, were obtained from these parameters.

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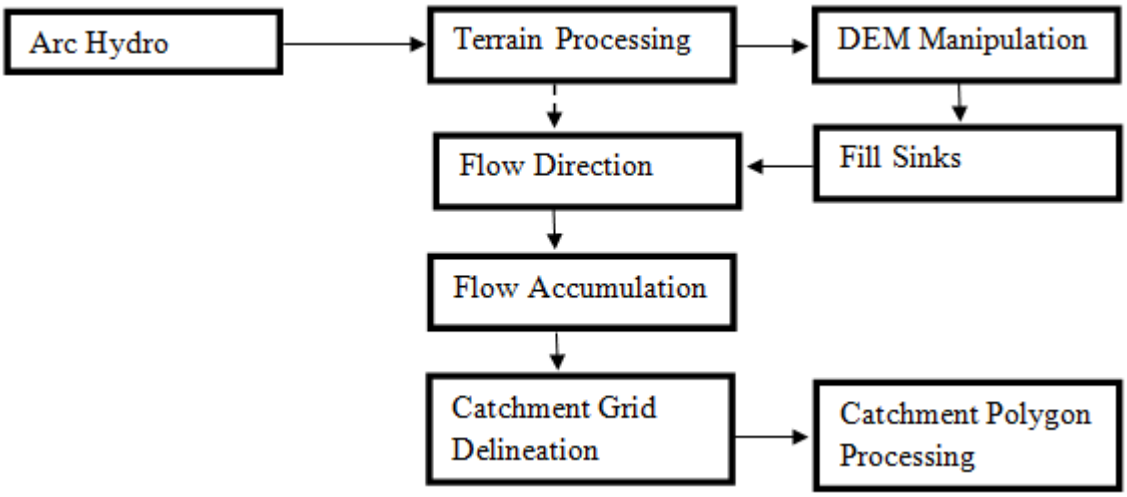

Fig-2: Flow chart for Process of Stream Delineation using Arc GIS

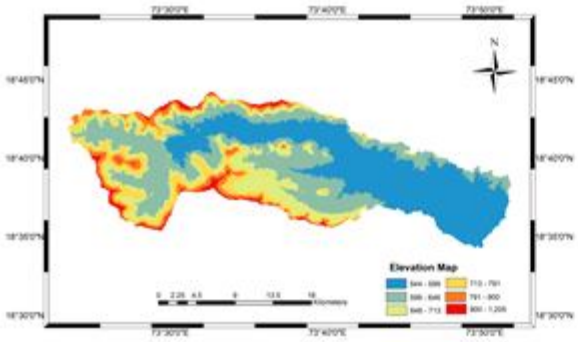

Fig-3: Digital Elevation Model (DEM) Map

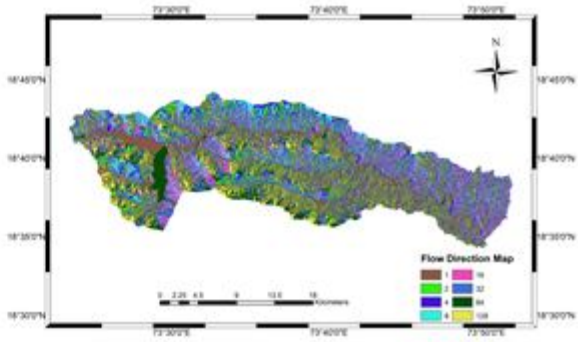

Fig-4: Flow Direction Map

RESULTS AND DISCUSSION

The SRTM DEM data 90m resolution was obtained from USGS Earth Explorer website, which was used to develop maps such as elevation map, flow direction map, flow accumulation map, and also drainage density map of the watershed. Stream Delineation of the Pawana watershed basin was found out with the help of these thematic maps and also with the help of GIS Software and Arc Hydro. These Parameters are shown in the Table no. 2. Basin discharge is also dependent on the Parameters like Basin Shape, Length of the river, Drainage Pattern, Basin Relief and these parameters have variable effect on the river over the period of time.

Table-2: Stream delineation Parameters

Sr. No.	Parameter	Formulae	Reference
	A. Drainage network		
1	Stream Order	Hierarchical Rank	Strahler (1964)
2	Stream Number (N_U)	Based on Stream Order	Strahler (1964)
3	Stream Length (L_U)	Length of the Stream	Horton (1945)
4	Mean Stream Length (L_{UM})	$L_{UM}=L_U/N_U$	Strahler (1964)
5	Stream Length Ratio (R_L)	$L_{UM}/(L_{UM-1})$	Horton (1945)
6	Bifurcation Ratio (R_b)	$R_b =N_U/N_{U+1}$	Schumm (1956)
7	Mean Bifurcation Ratio (R_{bm})	R_{bm} = Average of all R_b	Strahler (1957)
8	Length of Main Channel/River (C_l)	GIS software	-
	B. Basin Geometry		
9	Area of basin	Area	-
10	Length of Basin (L_b)	GIS software	-
11	Basin Perimeter(P)	GIS software	-
12	Circulatory Ratio (R_{CN})	R_{CN} =A/P	Strahler (1957)
13	Elongation Ratio (R_e)	$R_e = 2\sqrt{(A/\pi)}/L$	Schumm (1956)
	C. Drainage Texture Analysis		
14	Stream Frequency (F_S)	$F_S = N_U/A$	Horton (1945)
15	Drainage Density (D_d)	$D_d = L_U/A$	Horton (1945)

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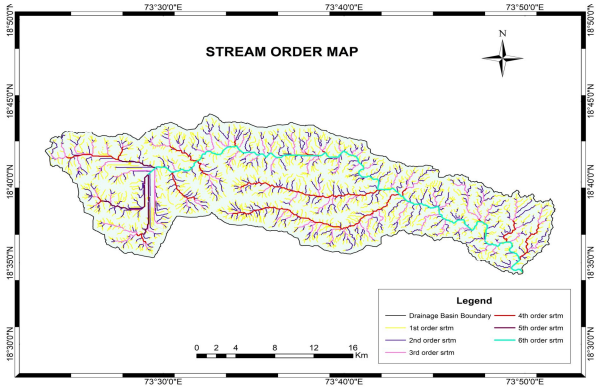

Fig-5: Stream Order Map

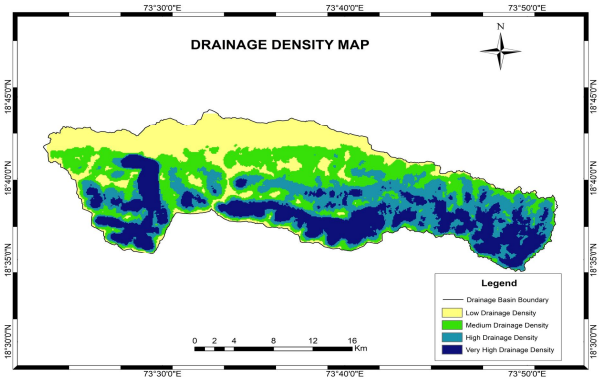

Fig-6: Drainage Density Map

Table-3: Stream Delineation Results

Sr. No.	Parameter	Dimensions	Result					
A. Drainage network								
1	Order of Main Stream	Dimensionless	6^{th}					
	Stream Orders		1^{st}	2^{nd}	3^{rd}	4^{th}	5^{th}	6^{th}
2	Stream Number(N_U)	Dimensionless	2712	547	332	31	3	1
3	Stream Length(L_u)	Km	657.99	329.04	166.89	66.09	18.25	52.53
4	Mean Stream Length (L_{UM})	Km	0.24	0.6	0.5	2.13	6.08	52.53
5	Stream Length Ratio (R_L)	Dimensionless	-	2.48	0.84	4.24	2.85	8.63
6	Bifurcation Ratio (R_b)	Dimensionless	4.96	1.65	10.71	10.33	3	-
7	Mean Bifurcation Ratio (R_{bm})	Dimensionless	5.11					
8	Length of Main Channel/River (C_l)	Km	52.53					
B. Basin Geometry								
9	Area of basin	Km^2	502.68					
10	Length of Basin(L_b)	Km	50.21					
11	Basin Perimeter(P)	Km	142.97					
12	Circulatory Ratio(R_{CN})	Km	3.46					
13	Elongation Ratio (R_E)	Dimensionless	0.5					
C. Drainage Texture Analysis								
14	Stream Frequency (F_S)	$/km^2$	5.48	1.1	0.67	0.06	0.01	0
15	Drainage Density(D_d)	Km/Km^2	2.61					

Stream ordering technique was originally proposed by Strahler (1952). It was a conventional method for stream ordering. Stream order will increase when similar order streams meet or intersect. So if second order stream intersects with the first order then the order will remain as the second order only and so on. Pawana River has the stream order of 6 and the summation of all 6 order stream length is 1290.78 Km. Total watershed Basin area was 502.68 km^2.

Bifurcation Ratio: Bifurcation ratio is inversely proportional to chances of flooding i.e if the value is low then high flooding possibility is present, as the water will accumulate in particular streams instead of spreading out (Lodhi *et al.,* 2017). Lower values implies there is less structural changes occurred in the watershed (Strahler 1964) and there is no damage or distortion to drainage pattern (Nag 1998). The value of Pawana Basin bifurcation was 5.11 which tells us there are low chances of flooding.

Elongation Ratio: The watershed is classified based on the values i.e. if values lies in 0.9-1.0 then its circular, 0.8-0.9 is oval, 0.7-0.8 is less elongated, 0.5-0.7 is elongated and if less than 0.5 it is more elongated. The value of Pawana River Basin is 0.5 which tells us that the watershed Basin is elongated.

Circulatory Ratio: Miller (1953) suggested that if the range lies between 0.4 to 0.5 then the watershed is circular and has highly permeable homogenous soil, but our Pawana watershed basin has value of 3.46 which tells us that the catchment is not at all circular in shape and has lower permeability soil and high discharge.

ISSN 2394 - 7780

It has found that drainage density 2.61 in Pawana river basin which is relatively higher and indicates that permeability of sub soil is low in 5th and 6th stream order and thick cover of vegetation is present in the watershed area.

CONCLUSION

Assessment of watershed area using Geospatial technology is an effective method. It is time efficient and simpler method. With the help of freely available DEM data it can be used to analyse parameters of the Pawana River Watershed. Stream delineation was done with the help of GIS software and validated with the streams delineated from the SOI Toposheets. Pawana River watershed has elongated shape. It has 6th order stream network which has drainage pattern as dendritic pattern which helps in analysing various topographic parameters such as runoff of the surface water and infiltration capacity. This watershed has a drainage density of 2.6 which indicated that it has low permeability of subsoil and has dense vegetation cover The results obtained from the analysis will be helpful in identifying suitable location for water conservation structures and rain water harvesting structures for that basin, also along with this results if combined with hydrological data such as discharge of the river will be helpful for researchers in future water management projects and also for big projects like river joining projects.

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DESIGN, DEVELOPMENT AND TESTING OF SOLAR PARABOLIC TROUGH CONCENTRATOR PROTOTYPE

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ABSTRACT

In the era of global warning and greenhouse effect due to consumption of conventional source of energy, there is implausible need of green and clean energy. Solar energy is one of the most promising, non- depletion and universally available source of renewable energy. Only drawback of this energy it that solar energy is disperse in nature. Solar parabolic trough concentrator is one of the device to overcome this limitation by concentrating solar energy on absorber tube which is on focal line which further utilized to produce steam for industrial process heat or to run power plant. The present paper consists of study of present research work for design and construction of parabolic trough concentrator considering the effect of the various parameters like the mass flow rate, concentration ratio, rim angle, absorber tube materials, reflecting surface materials, various heat transfer fluids and tracking of the trough on the performance of the system. The performance of the prototype of PTC is evaluated in terms of overall loss coefficient, Heat gained, Efficiency and final outlet temperature of the working fluild.

Keywords: Solar Energy, Parabolic Trough Collector, efficiency of PTC, Heat transfer enhancement, Prototype Design. Parabolic Concentrator.

1. INTRODUCTION

The solar technology offers abundant potential in terms of providing the world's energy requirements. However, its current involvement in the world energy supply is still limited, due to the reason that the solar energy is scattered in nature and a high initial cost of building the solar concentrator system in spite of low operating cost and green energy. The solar parabolic concentrator is widely used in industry and power plant due to higher concentrator ratio and capabilities to yield high temperature or high mass flow rate of working fluid. Its efficiency depends on various input parameters like inlet temperature, the mass flow rate of the fluid, solar insolation available, wind speed and design parameters like concentration ratio, type of reflecting material, open or evacuated absorber, size and type of the absorber, tracking or non-tracking of the parabolic trough, rim angle etc. It has been studied an up-to-date review of the solar concentrators and their benefits to make the solar technology affordable by means of optimizing parameters. The indigenous design and development of low-cost solar parabolic trough concentrator with tThe solar PV assisted tracking mechanism is explained, designed, fabricated and installed at terrace of the Institute building, Surat (21.22° N, 72.87° E), Gujarat to evaluate the experimental performance of developed parabolic trough concentrator

2. SOLAR PARABOLIC TROUGH

The parabolic collector is made by the two Dimensional design of a parabola. As per parabola, the sunrays are concentrated at single focus point after reflected by reflecting materials. It is formed by truncated part of the parabola. The two types of parabolic concentrator design are available, the first type is formed by rotating the two-dimensional design alongside the x-axis to form a parabolic dish having a single focal point with high concentrator ratio and the second type is with a parabolic trough with the single focal line to focus concentrated rays. Both concentrators are widely used in large solar power plant. To provide continues high concentration, it requires to track the sun by tracking system for maximum solar energy collection, which is quite expensive. The distinguishing feature of the parabolic structure is that it reflects all the parallel rays to the focal length.

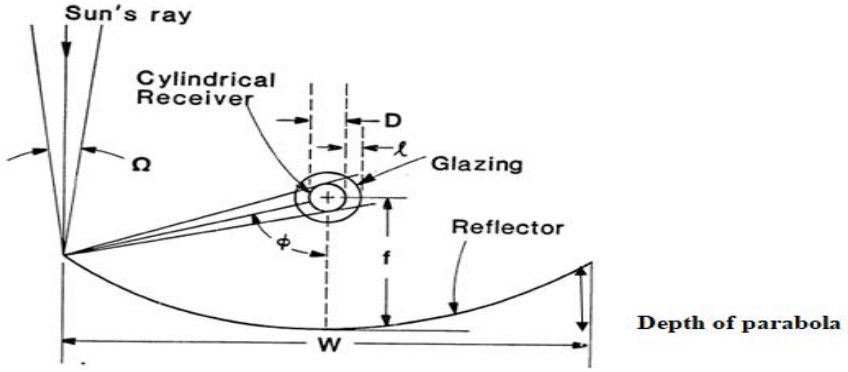

Fig-1: Schematic of parabolic trough solar concentrator (Sukhatme and Nayak, 2010)

ISSN 2394 - 7780

3. LITERATURE REVIEW

The performance of the solar parabolic trough depends on various designed and operating parameters. An extensive literature review is done to optimize the favorable parameters to design and construct prototype.

Kennedy and Price (2005) successfully prepared a solar-selective coating comprised of materials stable at high temperature along with both high solar absorptance and low thermal emittance, using computer-aided design software and verify its accuracy by a round-robin experiment. Receiver tube with improved properties of selecting coating will increase the efficiency of parabolic trough collectors and reducing cost.

Diver and Moss (2007) have developed and commercialized the parabolic trough collector with the small focal lengths and lower operating temperature with comparatively erroneous configuration by the use of fixtures.

Sukki et al. (2010) concluded that solar concentrators could reduce the entire cost of the solar cell, thus generating the solar energy reasonable and inexpensive, without compromising the overall performance of the solar technology. Although the state of art designs made, there is still further enhancements scope is remaining for the design of the concentrator.

R. M. Muthusivagami (2011) mentioned that the incident solar rays after reflected by reflecting the surface focus on absorber tube in the form of concentrating energy and transferred to heat transfer fluid. In order to intercept that reflected rays, the absorber tube required to sufficient long. Accordingly, the study reveals at least 10% extra length of the absorber tube is required to intercept 95% of reflected solar insolation.

Kawira *et al*. (2011) evaluated performance for deferent reflecting material and found that the efficiencies for Aluminium sheet reflector of 54.65 %, Car solar reflector of 53.16 % and Aluminium foil reflector is 49.26 % for the same size of parabolic trough concentrator. Fontani et al. (2011) developed a simple, trustworthy, and adjustable to all weather conditions working the sun-tracking system for tracking the sun for sunlight concentration. A simple, valuable and unusual technique based on a double regulatory system using two harmonizing techniques. The suggested tracking system is working well and relocation the collector within few seconds in presence of cloud or other obstruction if the sun temporary invisible.

Romero et al (2011) have built a PSC prototype with easily and cheaply available materials from the market to make the qualitative evaluation of the operation of the parabolic solar concentrator.

Gharbi et al. (2011) suggested that with more the concentration ratio, more the temperature achieved. However, in contrary, the cost of the system increases due to the construction of the parabolic shape used in the parabolic trough solar concentrator.

Silverio et al. (2012) advised that the Axis of the solar parabolic trough concentrator should keep facing N-S direction and solar tracking systems used to track the system towards the sun during a different time of day.

Yassen (2012) has conducted the experimental and theoretical study to determine the thermal efficiency of a PTSC, it is found that the efficiency starts with the mass flow from zero, at zero mass flow rate there will be zero heat removal factor. The increasing the mass flow rate will reduce the absorber tube temperature so that heat losses from absorber tube will decrease and heat removal factor will improve. The efficiency reaches a maximum at the mass flow rate of 40 kg/hr, above which no more efficiency increase observed.

Reddy et al. (2012) presented the optimization of process parameters level of a solar parabolic collector based on Taguchi method's response table as a way of studying the maximum temperature, enthalpy, optical efficiency, and thermal efficiency to be the quality targets.

Gaitan (2012) has prepared Design, Construction, and Test of a Miniature type parabolic trough solar concentrator, the results achieved using solar concentrator did not quite match with the initial mathematical modeling. The mathematical model initially proposed perfect conditions along with a perfect PTC.

Filho et al. (2013) observed that the system performance severely changes on slightly change in the working environments and misalignment of the parabolic trough axis.

Tayade et al. (2014) had locally fabricated and designed the solar parabolic trough with unusual features like minimum maintenance cost, running cost and labor cost for low-temperature application use in the village area.

Mwesigye et al. in 2014 presented the influence of different concentration ratios, Reynolds numbers and rim angles on the heat flux and temperature distribution in the receiver for thermodynamic, entropy generation and thermal performance of a PTC.

ISSN 2394 - 7780

Valenciaa (2014) presented a demonstrative a prototype of PTC for the design, construction and evaluation purpose. The efficiency gained was inferior to the reported findings. This is due to the absorber pipe's coating; having absorptivity 0.90.

Keou et al. (2017) assessed solar perspective for the four different tracking means and revealed that the one axis polar movement E-W and horizontal E-W tracking provide 96% and 94% of full annually tracking mode, respectively.

4. DEVELOPMENT OF THE PROTOTYPE FOR THE EXPERIMENTAL SETUP

There are various designs of the solar concentrators. Each design has its own advantages and disadvantages based on available constrain of their resources and various parameters that affect the performance of parabolic trough. There would be a possibility of combining various favorable parameters based on the desired requirement to enhance heat transfer, hence increase the overall performance of the system.

4.1 Finalizing parameters for designing and development of the prototype

To enhance the heat transfer possibility of PTC various parameters that may affect as mentioned above need to finalize. As per literature review as mention above Aluminium sheet as a reflective surface provide better (Kawira et al., 2011) and consistent performance compared to other reflective material. Copper as an absorber material (Shuai et al., 2010) having less thermal stress compared to other material like Stainless steel and Aluminium, the sound diameter of the absorber (Kumar and Kumar, 2016) is nearly 3.1 cm for cost-effective performance, extra length provided to absorber leads to better reception (Muthusivagami, 2011) of reflected radiation on absorber. Trough axis at N-S and rotation of trough from East to West to follow (Keou et al., 2017) the sun provide 94% of two-axis tracking which is reasonable for the present setup compared to complicated and costly two-axis tracking system, efficiency of the system increase (Singh and Sulaimanet, 2003) up to concentrations ratio 10 than after no effect of it, use of water as a working fluid because Nanofluid or other thermic fluids are comparatively costly and difficult to separate it from the water for the desired application, as well no appreciable change in thermal outcome for more than 40 LPH mass flow rate. Based on the above mentioned preferred parameters the design and development of the solar parabolic trough done with specification as mentioned in Table 1.

Parameter	Specifications
Aperture Width	1.1 m
Length of Reflector	1.85 m
Aperture Area	2.035 m^2
Area of Reflecting Surface	2.6455 m^2
Focal Length	0.4 m
Depth of Parabola	0.189 m
Rim angle	69^0
Reflecting Surface Material	Anodized Aluminium Sheet Reflectivity(ρ)=0.88
Concentration Ratio(CR)	21.75
Type of linear absorber	Evacuated glass covered copper tube
Glass cover D_{co} and D_{ci}	58 mm and 54.4 mm
Glass Cover transmisivity (τ), Emissivity (ε)	0.95, 0.9
Annular Space of evacuation	Up to 5 mm radially on both sides
Evacuation in tube	Up to 500 Pa
The material used for absorber pipe	Copper tube, with black paint
Size of the absorber tube	O.D.=15.875 mm, I.D.=14.1 mm Extended Length approx. 10%
The mass flow rate of the fluid	40 kg/hr,
Working Fluids	Water
Tracking	Fixed value tracking with Resolution of 1^0 /4 minute, with solar PV assisted mechanism.
Tracking Mode	Axis facing N-S Direction and rotation of Axis about N-S axis and from East to West Direction.

Table-1: Final set up parameters for development of the prototype

ISSN 2394 - 7780

4.2 Construction of Experimental set-up
The parabolic trough solar concentrator consists of the following basic components:

1. Parabolic Shaped Structure (Frame)
2. Reflective Surface
3. Receiver tube (absorber tube)
4. The support Structure (Stand)

4.2.1 Parabolic shaped structure (frame)
The frame is the structure that supports the reflecting surface and the receiver or the absorber tube. It can be made of wood, cast iron, stainless steel or aluminum material. The design of frame structure made up of M.S. The frame structure mounted on the stand through a central shaft, which then supported by the support structure or the stand.

4.2.2 Reflective surface
The reflective surface is the part that faces the sun to collect the incident solar radiation. It may be a parabolic mirror, an Aluminium film, black silvered mirror, etc. The working of the reflective surface based on the reflectivity of the material. The aluminum sheet is selected for the present setup.



Fig 2 and 3 Fabrication of parabolic trough concentrator: Frame and Surface

4.2.3 Receiver tube (absorber tube)
The heat transfer fluid flows in the central receiver tube. The solar radiations reflected by the reflecting surface and focused on the receiver tube. These reflected solar radiations are concentrated on the receiver tube, which ultimately increases the temperature of the receiver tube and hence increases the temperature of the working fluid. In this setup the single receiver tube is used which is made of copper is used.

4.2.4 The support structure (stand)
The support structure as the name suggest is used to support the parabolic shaped structure (Frame), reflective surface, receiver tube (Absorber tube) and other accessories that are mounted on parabolic trough solar concentrator. It may be made of cast iron, wood or stainless steel. It transfers the load of the structure to the floor. It consists of a central shaft on which the parabolically shaped structure is mounted. The legs then support the central shaft.

4.2.5 Assembly of the solar parabolic trough concentrators
The assembly of the parabolic trough solar concentrator is made as given below. Initially, the parabolic support structure mounted on the central shaft of the stand. Then the reflective surface attached to the parabolic support structure. After that, the receiver tube or the absorber tube placed at the focusing line. Then the reflective surface faced toward the sun to absorb the solar energy.

4.2.6 Fabrication of setup for parabolic trough solar concentrator
The Indigenous design of the prototype fabricated in a workshop of the institute as per dimension mentioned earlier.

4.3 Design and development of tracking mechanism to trace the sun
In case of flat plate collector concentration ratio is unity so the fixed position of the collector is preferred but for parabolic trough collector, the concentration ratio is high when incident rays fall on reflecting surface are normal to the surface.

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Fig-4: Assembly parabolic trough concentrator

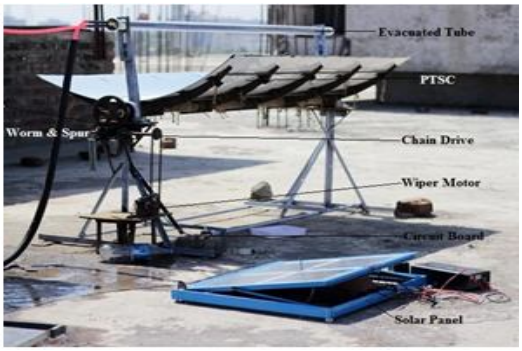

Fig-5: Final setup of PTC

As the daily apparent motion of the sun is from east to west, a mechanism requires to trace the sun. The developed solar PV assisted tracking mechanism used to rotate the trough from east to west. Electricity produces by PV module transfer to the battery to have uninterrupted continuous 12 Volt supply to an electric motor that runs the chain drive to move the trough at the desired angle per unit time. In the present set up there is 1^0 rotation of N-S facing axis of the trough at every 4 minutes of the time interval. Tracking mechanisms for Mode III of Tracking are prepared. The setup rotated about its axis from East to West direction and tracks the sun's movement. Various parts assembled in this structure like parabolic trough, drive system, evacuated tube, inlet supply system, stand etc.

5 THE EXPERIMENTAL PROCEDURE

Fig 5 show overview of single evacuate tube absorber mounted experimental set up of PTC. It was installed at the terrace of Institute building, Surat, India. Table 1 shows detail specifications of setup , for experimentation at one end water is supply through water tank maintain at an elevated height to provide constant pressure water inlet, while at another end 1 liter of hot water is collected in measuring jar and time noted by stopwatch to find the mass flow rate of water. Thermocouples are used to measure the inlet and outlet temperature of water along with ambient air temperature. The digital anemometer is used to measure the velocity of wind while solar power meter is used to measure solar insolation available at the same time, all data recorded in a specific format at every five minutes of a time interval. All reading were taken from 10:00 am to 3:30 pm every day for 05 number of different days**.** Through is rotated 1^o at every 4 minute of time interval with the help of tracking mechanism**.** The solar intensity, wind velocity, ambient temperature, inlet water temperature and the mass flow rate values were taken from daily observation. With the help of programme made, the calculation is done for minimum 40 set of data that were taken at 5 minute time interval for the evacuated tube absorber to calculate average value U_l, thermal efficiency and fluid outlet temperature T_{fo} for the whole day.

6. CONCLUSION

The present work includes the study of parabolic trough concentrator for the various designed and operating parameters and development of the prototype based on optimized parameters for enhancement of heat transfer. Design and development of the solar energy operated tracking mechanism to rotated evacuated absorber mounted PTC to trace the sun that runs on the solar PV module. Outcomes of parabolic trough concentrator for heat gains, overall heat transfer coefficient, heat loss coefficient and efficiency are evaluated. The average value of the experimental heat gains Q_u of 839 W against total solar insolation available are 1750 W. The average value of overall heat transfer coefficient U_o is of 10.5 W/m^2-K, the average value of overall loss coefficient U_l is of 11 W/m^2-K. The average difference between the experimental fluid outlet temperature T_{fo} and theoretical fluid outlet temperature T_{fo} is 10.2. The average value of the experimental efficiency η_i is of 53.37 % against its theoretical efficiency η_i of 61.6 %. The overall outcomes of the parabolic prototype is found better than earlier research work.

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AGE AND GENDER: DO THEY INFLUENCE PSYCHOLOGICAL EMPOWERMENT OF BANK EMPLOYEES?

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ABSTRACT
This study is aimed at examining the role of gender difference and age in perception of empowerment of employees in banking sector in India. The study is empirical in nature. Spreitzer's Psychological Empowerment Scale was used to measure employees' perceptions of empowerment. Data were collected from employees of various private sector, public sector and new generation banks in India. One way ANOVA was conducted to find out the influence of gender and age on psychological empowerment. The findings from the study indicated that the age of bank employees has a significant relationship with psychological empowerment whereas psychological empowerment of bank employees is not influenced on the basis of gender. Employees working in an organisation will be of different age groups. When empowerment is implemented in banks, age factor should be given due importance as the study reveals that the psychological empowerment is dependent on age group of employees. But men and women working in banking sector they do not perceive empowerment differently.

Keywords: Psychological Empowerment, Gender, Age, Employees, Service Sector

INTRODUCTION
In this era of global competition and change, employees are the only resource which will not get obsolete and this highlight the importance of human resource in an organisation. Employees are from different cultural, social and ethnic background. They also differ in their demographic variables and face different problems. It is vital for an organisation to identify the problems faced by its employees. In a service sector the problems are more complex as the employees symbolize the organisation when they handle the customers. Employee empowerment is an effective tool to support the employees, especially those employees who are working in the service sector. The benefits of empowerment can be attained only if the employees perceive empowerment properly.

Due to increased competition and introduction of new technology the banking sector of the country has changed significantly. The banks have become customer focused and have undergone rapid changes including policy changes. As a result of these changes, the employees working in the banking sector are experiencing various social and psychological problems. The studies in banking sector have shown that employee empowerment can reduce the problems faced by bank employees and even improve their performance while handling customers.

THEORETICAL PERSPECTIVES OF EMPLOYEE EMPOWERMENT
The term 'empowerment' was used in business organizations by management practitioners from 1970s (Klose, 1993). Before 1990, empowerment could only be accessed through concepts such as participative management, total quality control, individual development, quality circles, and strategic planning (Sullivan, 1994). Research on the team dimension of empowerment (Beckhard, 1969); leadership approach that empowers subordinate (Bennis and Bert, 1985) and employee participation (Lawler, 1992) also led towards the evolution of the new concept called employee empowerment.

The empowerment literature is viewed by different researchers from different perspective. One is macro and the other micro in orientation. The macro orientation is referred to as the relational approach or social structural approach to empowerment and the micro orientation is referred to as the motivational or psychological approach to empowerment (Conger and Kanungo, 1988). Some researchers like Laschinger et al. (2001) and Seibert et al. (2004) have viewed empowerment from a multidimensional perspective also. The relational approach emphasis the idea of sharing power between managers and subordinates with the aim of pouring relevant decision-making power to lower levels of the organizational hierarchy (Liden and Arad, 1996) It also emphasizes the importance of changing organizational policies, practices and structures (Bowen et al., 1995). Psychological approach focuses on how the individual perceives about their role in the organization. The multi-dimensional perspective suggests that to empower successfully the role of management and leaders should be studied as it influence the individual perception.

ISSN 2394 - 7780

PSYCHOLOGICAL PERSPECTIVE OF EMPOWERMENT

The psychological perspective emphasizes on employees' perceptions and experiences of empowerment. It focuses on perceptual or psychological dimensions of empowerment (Liden et al, 2000). The structural view of empowerment fails to explain the biases which are inherent in perception (Jones, 1990) and cannot assure the empowerment felt by the employees. The work of Conger and Kanungo (1988) is considered as the beginning of the concept psychological empowerment. Later, Thomas, and Velthouse (1990), Spreitzer (1995), Menon (1999) etc. have contributed towards clarification of the psychological approach to empowerment.

Thomas and Velthouse's (1990) defined empowerment as intrinsic task motivation developed a cognitive model of empowerment. They identified four cognitions (task assessments) - impact, competence, meaningfulness and choice, as the basis for empowerment. The combination of the four cognitions reflects an active orientation to a work role. Spreitzer (1995) made modifications in the model developed by Thomas and Velthouse (1990) and operationalized the model. Spreitzer (1995) changed 'meaningfulness' cognition to "meaning" and the 'choice' cognition to "self-determination". Spreitzer explained that the four cognitions are interrelated and in combination will measure the psychological empowerment constructs. If any of these cognitions are not measured the experience of empowerment of employees may not be accurate. Menon (1999) states psychological empowerment as a cognitive state of perceived control, perceived competence and goal internalisation.

In any model of the empowerment process, the employees' attitudes and perceptions of the work environment are essential variables (Robbins *et al.* (2002). But empirical research shows that more focus is on management practises of empowerment rather than the employees' perception (Chen, 1998; Barbee and Bott, 1991; Lashley, 1995; Lin, 2002 and Sarmiento, Laschinger and Iwasiw, 2004). Spreitzer (1996) states that worker's interpretation and the perceptual reality is what matters and not the efforts taken by the management. According to Mishra and Sprietzer (1998), people get involved in activities and behave confidently when they judge themselves capable of handling situations which would otherwise be threatening. Further, research shows that when empowerment are implemented in organisations, different employees perceive the concept of empowerment differently which may affect their productivity. Hence it is essential to find out why employees perceive empowerment differently.

EMPOWERMENT IN BANKING SECTOR

Holden (1999) claimed that while there is a desire by senior management of banks to restrict forms of empowerment to workplace levels, employees and managers at lower levels, continued to perceive empowerment initiative measures as much more power enhancing. A study on sales person of Swedish bank by Barrutia , Charterina and Gilsanz (2009) revealed that salespeople's feeling of empowerment depended on two types of drivers: process-driven empowerment (PDE) and decision-making-driven empowerment (DDE). Zakaria (2011) explained that there is a link between empowerment and intrinsic motivation of bank employees. Higher level of empowerment induced a higher level of intrinsic motivation in the employees.

Naeem and Saif (2010) stated that customers were more satisfied with foreign bank where employee empowerment level was high than the local bank where there was no empowerment. Sharma and Kaur (2011) analyzed the relationship between the perceived levels of psychological empowerment and the organizational effectiveness and found that there is a high correlation between the perceived levels of psychological empowerment and organizational effectiveness. Hashmi and Naqvi (2012) concluded from their study that employees having high level of all four dimensions of psychological empowerment are emotionally attached to the organization and feel obligated to remain with the organization.

Though there are few studies on empowerment in banking sector, the studies have not considered the demographic aspects of employees while implementing empowerment in organisations. This study attempts to find out whether demographic factors like age and gender influence the perception of empowerment of employees in banking sector.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Age and Empowerment

Several studies have compared the influence of different demographic variables with psychological empowerment. Wang and Zhang (2012) assessed the level of psychological empowerment among teachers from six provinces in China, to determine if differences exist in the level of psychological empowerment based on demographic variables. The study indicated that there were significant differences between different age groups on factors of psychological empowerment. The results revealed statistically significant differences between different age groups in scores of self-efficacy, status, communication skills, decision-making participation

ISSN 2394 - 7780

behaviour, and influence teaching behaviour. Lin (2002) conducted a study on three insurance companies that operated in Taiwan to have an understanding of empowerment. The study checked the effect of age on perceived empowerment and found that age did not show a significant influence on perceived empowerment.

There are studies which show significant relation between age and psychological empowerment. Sparks (2012) studied the differences in nurses' generational psychological empowerment and job satisfaction with the assumption that generations differ in work styles, leadership views, and on what constitutes innovation, quality, and service. The result revealed that the Baby Boomer nurses reported higher mean total psychological empowerment scores than Generation X nurses which means that there were significant differences among the generations' psychological empowerment scores. But the result did not show any differences in total job satisfaction scores between the generations. Gkorezis and Petridou (2011) examined the impact of a bundle of rewards, namely skill variety, information, recognition and job security, on the psychological empowerment of public nurses. Further, they investigated the influence of demographics on this construct. With respect to demographics, age, work experience and tenure had an impact on psychological empowerment. Wallach and Mueller (2006) explored whether and to what extent job characteristics, predicted empowerment among paraprofessionals from private human service organizations and state social welfare agency. This study indicated that work stressors, participation, supervisory relationship and peer support were associated with paraprofessionals' perceptions of empowerment. When socio-demographic predictors, such as participant's age and gender, organizational unit size, and time in position were entered into the regression equation, theoretically defined variables predicted significant additional amounts of variance in empowerment.

When the employees grow older their needs and preferences may change and people may be bored with their present jobs and they require challenges (Mondy, Noe and Premeaux, 2002). So aging may influence perceived empowerment and hence to see whether there is any link between the age of the employee and psychological empowerment the following hypothesis was formulated.

H1: There exists a relationship between Age and Psychological Empowerment.

Gender and Empowerment

Review shows that there are several studies which examined the relation between gender and psychological empowerment. Koberg, Boss, Senjem, & Goodman (1999) have reported that men and women show no significant differences in their attitude toward empowerment. Spreitzer (1996) in a survey of a sample of 393 middle managers of different work units from a Fortune 50 company could not find any relationship between gender and psychological empowerment. In a study by Ergeneli et al. (2007) on bank managers in Ankara, Turkey they examined the effect of demographic variables on psychological empowerment and found that gender did not have any effect on psychological empowerment. The studies of Patah et al. (2009) and Joo and Shim (2010) found out that there were no significant differences in the scores of both genders-males and females when compared, with the employee psychological empowerment. Lockwood et al. (2012) also indicated that gender do not have any relationship with psychological empowerment.

Hechanova, Alampay and Franco (2006) surveyed 954 employees and their supervisors to determine the relationship of empowerment with job satisfaction and performance in five different service sectors: hotels, food service, banking, call centers, and airlines. In their study men reported greater empowerment than women even when job level and performance were controlled. A study by Speer , Peterson, Armstead and Allen (2013) explored the influence of gender and on both the intrapersonal and interactional components of psychological empowerment . Participants were residents involved in community organizing efforts in five U.S. communities. Gender was only associated with intrapersonal empowerment, and only for low-income individuals. Bhatnagar and Sandhu (2005) attempted to identity the strength of relationship among organisational citizenship behavior (OCB) and psychological empowerment among the managers of IT Sector in India. It was found that male managers had a significant and positive level of psychological empowerment than the female managers.

Wang and Zhang (2012) in their study among teachers found a statistically significant difference in the level of psychological empowerment based on gender. Further it was revealed that, except on the dimension of impact, there were significant gender differences on seven factors. Female teachers reported higher scores on self-efficacy, self-determination, status, communication skills, and influencing teaching behaviour, while male teachers reported higher scores on decision-making skills and decision-making participation behaviour. Lin (2002) conducted a study on insurance companies to have a comprehensive understanding of the essence of empowerment. He proposed a 4-dimensional empowerment model namely, empowering leaders, empowering culture, empowering practices, and empowered employees in an organizational setting. Female employees rated empowering culture and empowering practices more favourably than the male employees.

ISSN 2394 - 7780

Johnson (1994) suggested that men and women may conceptualize empowerment in different ways. Men and women may be differently affected by empowerment that is even though men and women will be affected positively by empowerment and negatively affected by lack of empowerment the magnitude of these affects will be different in different gender. Thus to see whether gender affects psychological empowerment of bank employees the following hypothesis was formulated.

H2: There exists a relationship between Gender and Psychological Empowerment.

Method

Sample: Multistage sampling was adopted to collect the data from branch level employees working in clerical and managerial cadre of various banks in India. A total of 337 employees of private sector banks, public sector banks and new generation banks, participated in this study. Two banks from each sector were selected and from each banks few branches were selected. The data were collected from the employees of these selected branches. Since the banks have their own restrictions and rules which prevent the researcher to collect information from all the employees of the branch, the sample was restricted to available and permitted employees Of the total respondents, 29.4 per cent of the respondents were in the age group 20-30, 31.2 per cent, were in the age group 30-40, 11.9 per cent in the age group of 40-50 and 27.6 per cent in the age group of 50-60. 66 per cent (n=223) of the sample were males and 33.8 per cent (n =114) were females.

Measures: *Spreitzer's Psychological Empowerment Scale* - The psychological empowerment perceptions of bank employees were assessed using Spreitzer's Psychological Empowerment Scale (1995). The scale is composed of four subscales: meaning, competence, self determination, and impact. Each of the sub scales has three items each. Respondents were asked to indicate their level of agreement or disagreement on each item on a five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). Cronbach alpha of the entire scale was 0.78. Cronbach alpha for the subscales were 0.72 for meaning, 0.75 for competence, 0.75 for self-determination, and 0.85 for impact. Spreitzer's (1995) explains that the four sub facets additively create the psychological empowerment. The higher scores indicate that the employees are more psychologically empowered.

ANALYSIS

Age and Psychological Empowerment

The entire sample is categorized into four age groups for the purpose of analysis. The majority of the respondents were in the 30-40 age group and very few employees were in the age-group of 40-50. One way ANOVA was computed to explore the impact of age on psychological empowerment.

Table-1: Showing Mean, Mean Percentage Score and Standard Deviation of Psychological Empowerment of employees of different age group

Age group		Psychological Empowerment
20-30	Mean	46.58
	Mean per cent Score	77.63
	Std. Deviation	5.58
30-40	Mean	46.07
	Mean per cent Score	76.78
	Std. Deviation	5.34
40-50	Mean	45.50
	Mean per cent Score	75.83
	Std. Deviation	4.18
50-60	Mean	48.83
	Mean per cent Score	81.38
	Std. Deviation	6.34
Total	Mean	46.91
	Mean per cent Score	78.19
	Std. Deviation	5.70

Table 1 shows that the mean percentage score of the psychological empowerment is seemed to be highest for the age group 50-60 and it is 81.38 per cent followed by 20-30 age group with 77.63. 30-40 age groups showed a mean score of 76.78 per cent and 75.83 per cent for 40-50 age group. Thus, it can be concluded that there is

ISSN 2394 - 7780

variation in mean score of psychological empowerment between different age groups. To verify the difference observed in mean percentage score is significant or not one way ANOVA (F-test) was conducted.

Table-2: Showing One Way ANOVA showing the relationship between Age and Psychological Empowerment

		Sum of Squares	df	Mean Square	F	Sig.
Psychological Empowerment	Between Groups	507.367	3	169.122	5.417	.001
	Within Groups	10395.962	333	31.219		
	Total	10903.329	336			

Table-3: Showing Post-Hoc analysis of Age and Psychological empowerment of bank employees

Dependent Variable	(I) Age group	(J) Age group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Psychological Empowerment	20-30	30-40	.50909	.78273	.915	-1.5120	2.5301
		40-50	1.07576	1.04682	.733	-1.6272	3.7787
		50-60	-2.25220*	.80687	.028	-4.3356	-.1688
	30-40	20-30	-.50909	.78273	.915	-2.5301	1.5120
		40-50	.56667	1.03817	.948	-2.1139	3.2473
		50-60	-2.76129*	.79562	.003	-4.8156	-.7070
	40-50	20-30	-1.07576	1.04682	.733	-3.7787	1.6272
		30-40	-.56667	1.03817	.948	-3.2473	2.1139
		50-60	-3.32796*	1.05649	.010	-6.0559	-.6001
	50-60	20-30	2.25220*	.80687	.028	.1688	4.3356
		30-40	2.76129*	.79562	.003	.7070	4.8156
		40-50	3.32796*	1.05649	.010	.6001	6.0559

* The mean difference is significant at the 0.05 level.

The result of one way ANOVA is shown in Table 2. It clearly indicates that there exist significant differences among different age group as far as psychological empowerment is concerned (F=5.417, p value = 0.001) implying that the psychological empowerment is dependent on age group of employees.

Now to verify which ever groups have significant difference, Post Hoc multiple comparison tests were conducted. The result of the test shows that only 50-60 age groups have significant difference among all other age groups. All the other age groups do not have any significant difference.

Gender and Psychological Empowerment

Out of the total respondents only 114 respondents were female whereas 223 of them were male respondents. The relationship between psychological empowerment and gender was determined by Z-test.

Table-4: Showing Z-Test showing the relationship between Gender and Psychological Empowerment

	Gender	Mean	Std. Deviation	Mean % Score	Z	Sig. (2-tailed)
Psychological Empowerment	Male	46.61	5.76	77.68	-1.359	0.175
	Female	47.50	5.55	79.17		

From the Table 4 summarizes the value of mean and standard deviation and mean percentage score. The mean value experienced by male and female are 46.61 and 47.50 respectively. The mean score is more or less identical which is further established by the Z test. The Z value obtained is -1.359. This shows that there is no gender difference as far as psychological empowerment is concerned among the bank employees.

FINDINGS AND DISCUSSIONS

Age and Psychological Empowerment

The result revealed that there exist significant differences in psychological empowerment among different age group. This shows that the age of bank employees have a significant relationship with psychological empowerment. Current findings support the results reported by Dimitriades and Kufidu (2004); Hartmann

ISSN 2394 - 7780

(2004); and Wang and Zhang (2012) who found a correlation between age and psychological empowerment. Spreitzer(1996) in her study also identified a positive relationship between age and perceived competence. The result of this study further revealed that only 50-60 age groups have significant difference among all other age groups. All the other age groups do not have significant difference.

The study contradicts the findings of Koberg et al. (1999). It stated that age has no significant influence on psychological empowerment. One possible explanation for this discrepancy may lie in the nature of the samples studied. In another study also it was found that there is no relationship between age and psychological empowerment (Lockwood et al., 2012).

In a study by Sparks(2012) on the differences in nurses' generational psychological empowerment and job satisfaction with the assumption that generations differ in work styles, leadership views, innovation, quality of performance and service, it was revealed that revealed that the Baby Boomer nurses reported higher mean total psychological empowerment scores than Generation X nurses. This means that there were significant differences in psychological empowerment scores among people of different generations.

Taking into consideration the findings of the study and above finding it can be concluded that the age of the bank employees are related to psychological empowerment which means that bank employees of different age group have difference in the level of psychological empowerment. One of the major implications of the study is its finding about the high psychological empowerment among the 50-60 age groups of employees. Training can be given to bank employees in lower hierarchy to augment the level of psychological empowerment.

Gender and Psychological Empowerment

Spreitzer (1996) in their study could not find any relationship between gender and psychological empowerment. The findings of Koberg et al. (1999) on technically skilled, professional and managerial hospital employees also revealed that men and women reported no significant differences in the feeling of empowerment. These results are consistent with the present study which indicated that there is no gender difference as far as psychological empowerment is concerned among the bank employees. Lockwood et al. (2012) also indicated that gender do not have any relationship with psychological empowerment. In contrast, some studies showed that women tend to feel less empowered than men because they are given less powerful positions in organizations. In Lim and Hechanova's study (2005), they found that women managers reported that they are being excluded from informal networks. Male managers also reported that they were given more responsibilities than women in the same position. Wang and Zhang (2012) in their study among teachers found a statistically significant difference in the level of psychological empowerment based on gender. Zani and Pietrantoni (2001) revealed that women scored higher empowerment with regard to meaning and perceived competence than the score of men.But the studies of Patah et al. (2009) and Joo and Shim (2010) found out that there were no significant differences in the scores of both genders-males and females when compared, with the employee psychological empowerment. Dimitriades and Kufidu (2004) in her study on mature working students in the Greek context also found that gender was not related to empowerment.

From these above discussions it may be concluded that if we compare men and women working in banking sector they do not perceive empowerment differently. This may be because banking sector being a service sector authorities and responsibilities are shared equally among the employees of similar designation irrespective of the gender .

CONCLUSION

Psychological Empowerment focuses on the belief an employee has, about their role in relation to the organization. This study shows that age of a bank employee is closely associated with psychological empowerment where as gender do not have a statistically significant relationship with psychological empowerment. So banking organizations who wish to empower their employees should keep in mind that psychological empowerment can be affected due to human capital variables like age and be sensitive towards the age group of the employees, when they implement empowerment in banks. It is also quite evident that the banks can enhance the psychological empowerment of their employees by designing training programmes for the bank employees who are in the lower age group. If banking sector is considered as a true representative of the service sector, the results of the study have wider implications in the service industry.

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EVALUATION OF WORKING WOMEN'S HOSTELS IN MUMBAI

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ABSTRACT

The process of industrialization and urbanization has been widely researched topic. The issues of migration, gentrification and urban housing have been the areas of concern for many scholars. It has led to the development of number of social institutions in many urban centres. Among diverse things affecting the urban centres; in-migration of population is one of the main issues. Modern metropolises necessarily develop institution/s for accommodating certain sections of transitory population. It may provide lodging and boarding for learners and people engaged in gainful activity among others. Such transitory population is at odds at times to avail these facilities available in the city. However, those who manage to get in may face difficulties in adjusting to the prescribed living conditions due to structural constraints and objectives of the facilitators.

The researcher has been interested in having a closer perusal at such institutions in modern metropolis like Mumbai which provide lodging-boarding to the fleeting population in general and working women in particular. In this regard the establishment of working women hostels in the city of Mumbai has been probed in keeping with the nature of such institutions. Also the living and working conditions provided by such institutions for the inmates have been examined in the study. Overall perspective in locating the issues of women empowerment and gender equality has been also the focus of this study.

Keywords: working women's hostel, urbanization, women's empowerment

INTRODUCTION

Modern society is affected by urbanization, industrialization and modernization that lead to better production and thereby facilitating material development of society. It has been observed that these processes have encouraged lot of influx of population to these urban centres. People come to these centres not only for seeking gainful activity but also for development of career prospects including academic achievements. Not everybody has an advantage of having proper shelter and accommodation in these centres. Number of studies have pointed out that the urban centres provide for various kinds of accommodations and shelters for catering to different categories of migrating population.

Thus the present study focuses on working women's hostels in Mumbai city which cater for exclusive women migrants to the city.It centers on the issues concerning the development of hostel/s as an institution in urban areas; and the need of hostel to empower working women in ascertaining their independence and self-identity.

OBJECTIVES

1. To examine the advantages and disadvantages of working women' hostel.
2. To study the socio-economic background of the inmates.
3. To undertake case-study of some of the typical hostel inmates.

METHODOLOGY

Available secondary source literature has been tapped to gather necessary data on the problematic. The primary data has been collected from those institutions of 'Hostel' maintained by public trusts, private individuals and Government organizations in the city. 27 such hostel management has been investigated which includes 160 as its sample size. The personal details of the inmates and their perceptions on the hostel life has been gathered by way of structured open ended questionnaire and interview method on the basis of convenience and snow-ball sampling technique.

DATA ANALYSIS

The data thus collected has been presented in this paper under following heads: services provided by working women's hostels, hostel timings, advantages of hostel accommodation,reasons for continued stay in hostel, issues of concern, interpersonal constraints, social dynamics, interpersonal relation with hostel staff and contention of empowerment.

ISSN 2394 - 7780

Figure-1.1: Showing Services provided by the Working Women's Hostels in Mumbai

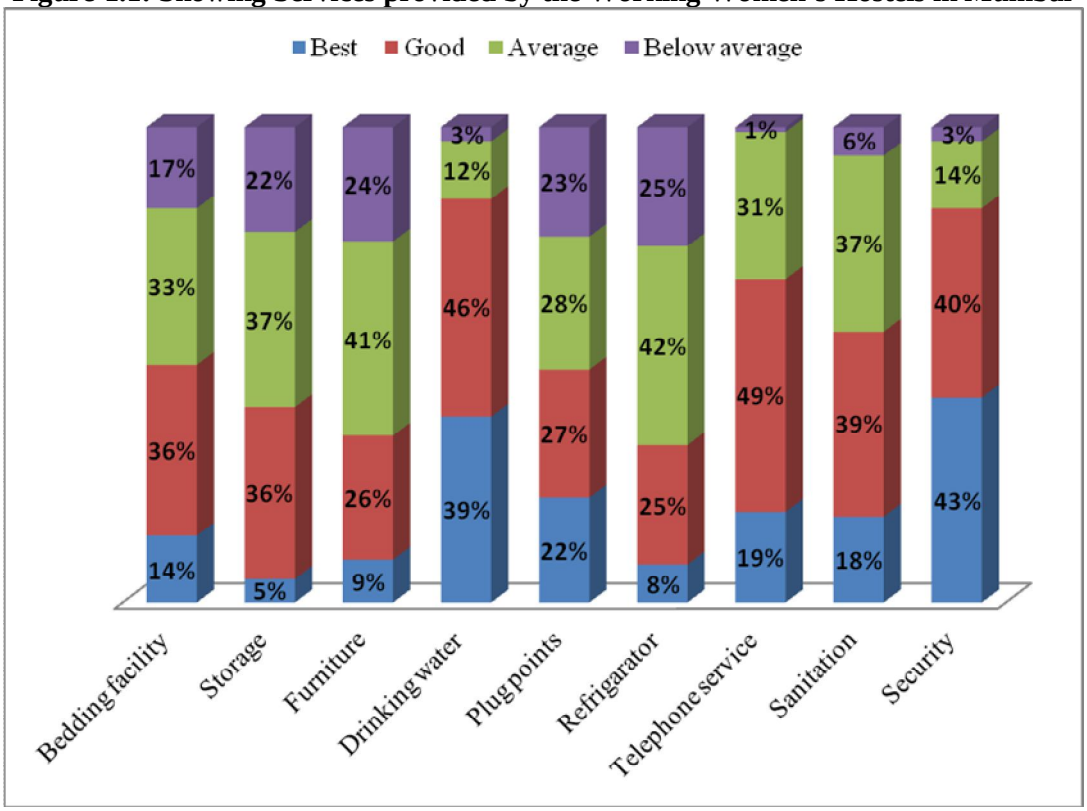


Figure 1.1 represents evaluation by respondents of essential facilities provided by hostels. 80 respondents rated bedding facility to be average and below average, and some asserted that at times the bed sheet are not often washed or changed.Provision of safe storage facility is another important aspect. Availability of sufficient furniture in the hostel room such as study table, chair and bed for each hostel inmate is listed as one of the basic requirement by the Government norms for establishment of working women hostel. 65% rated it to be average and below average which indicates lack of it or not in usable condition.

When asked about availability of clean drinking water facility 15% rated it to be average and below average. Though a small number yet it can cause trouble for hostelites as it may affect their health. It was also observed that most of them complained about lack of availability of water coolers which becomes a problem especially during summer due to scorching heat.

Due to advancement in telecommunications people frequently use mobile phones and laptops for several reasons. There is also shortage of sufficient number of plug pointsand some are not in working condition at few hostels as stated by the respondents[1].

Usually hostelites put forth the need to have refrigerator meant only for hostelites to store their excess food from getting stale and for later use. However cost can be a major issue among others. Telephone service is not much used by the hostelites but sometimes during emergency it can be advantageous. Maintaining sanitation is utmost important for healthy survival. The researcher observed that almost all of the hostels appeared to be clean but the people who reside are the best to judge it. Usually those who rated it below average indicate lethargic housekeeping and poor supervision on part of the hostel authorities.

Highest number of affirmative ranking is given to security which is one of the major functions of the hostel. However majority of the respondents have rated good to the essential facilities listed by the researcher followed by average, best and then below average.

[1]One of the hostel warden from South Mumbai asserted that they have kept plug points outside the room so that she can see who is using those plug points for what purpose.She reasoned that usually inmates use various equipment's such as water heaters, hair straightening machine and wax heater and most of them iron clothes. All these equipment's and other allied machines consume lot of electricity and thus they are not permitted in most of the hostels. Hence such forms of disciplinary rules are perceived to be problematic by the hostelites.

ISSN 2394 - 7780

Another essential function of working women's hostel is provisionof recreational facilities to its inmates. However the researcher found that various hostels lack in provision of recreational activities such as indoor and outdoor games, no library or poorly maintained library, insufficient number of newspapers and lack of varied types of newspapers and magazines.

The basic necessity of humans for survival is food, clothing and shelter. Hostel as an institution provides two of this i.e. food and shelter to its inmates. Thus the researcher during survey found that barring few exceptions majority of the hostel provide food to its inmates. Yet one of the major complains by hostelites related to quality of food served at hostels.

Bathroom facility is one of the basic necessity and important especially for females at the time of menstruation. Therefore there needs to be enough number of bathrooms to serve the needs of the hostelites. However it was noted that hostels located in Central Mumbai faced issue of irregular supply of water. Facilities for guests are another key area. Guests include hostelitesfamily members. A few of these hostels in Mumbai provide inmates' guest's accommodation overnight with additional charges.

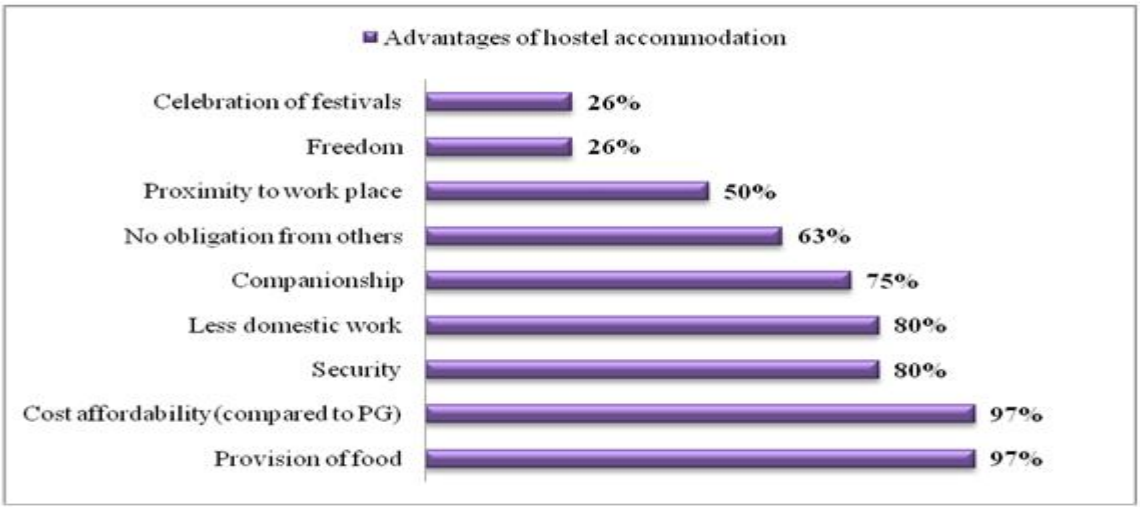
HOSTEL TIMINGS

One of the chief functions of hostel authorities is to maintain discipline within hostel and also to preserve trust committed to parents/guardians of hostel inmates. Parents prefer hostel accommodation over other types of accommodations because of its rules and one such disciplinary measure hostel in and out timings.

Each hostel has well laid late in and early out timings, visitor's timings during which friends, colleagues and other acquaintances can visit the hostelites. Hostels also have system of late night passes and to seek permission for those hostelites who come late or stay overnight out of hostel.

Genera lly the late in timings are (ten pm to twelve pm) and early out timings are (five am onwards). However 35% were unhappy with set hostel timings due to transportation woes, work and personal commitments.

Figure-1.2: Showing Advantages of Hostel Accommodation



Note: Respondents have given more than one response

The researcher attempted to inquire with the residents the comparative merits of hostel accommodation. 97% mentioned that provision of food is a great relief and biggest boon provided by hostels compared to residing in rented room or paying guests. Cooking food consumes lot of time which includes buying groceries, storing, cleaning and other allied chores. Thus hostel inmates save not only time but also energy and money by residing in hostel where cooked food is provided.Yet the biggest complaint of many hostelites was pertaining to the quality of food.

Further 75% mentioned companionship i.e. friendship as an advantage to stay in hostel. Residing together not only helps in bonding but many times reduces the caste/class/religion biases[1].

[1]To quote one of the hostelite she stated that, *before coming to Mumbai she only mingled with people of her own religious community as she did not prefer to talk to people belonging to other religious group. But hostel gave her the opportunity to interact with people of diverse religious background which also helped her in eradicating the prejudice she had against other religious groups.*

ISSN 2394 - 7780

Festivals such as Christmas, Diwali, Eid, national holidays, Holi among others are celebrated at various working women's hostels. Thus hostelites rarely miss out chance to enjoy themselves as hostel serves another important function of family which is recreational function. Many hostels also celebrate hostel foundation day that is the day when hostel came into existence and also at times cultural activities like singing and dancing are organized for hostelites as a part of recreational activity.

Table-1.1: Showing Reasons for Continued Stay in Hostel

Reasons	Response (in numbers)
Economical	155
Security	128
Favorable atmosphere	102
Good locality	80
Greater proximity to workplace	80
Companionship/friendship	80
Overall good facilities	61
Discipline	56
No other alternative	24
Privacy	8

Note: Respondents have given more than one response

Though the period of stay varies from one hostel to another and from one hostelite to another however this data will help divulge some information. 38% asserted to be content with available facilities provided by the hostels whereas 35% replied that the disciplinary measures and the rules set by hostel authorities as a positive determinant for their continued stay.

ISSUES OF CONCERN

44% claimed inadequate amenities in hostel such as unavailability of Wi-Fi connection, water-coolers, water-purifiers, refrigerator, hot water geysers, plug-points, ventilation, regular electricity, recreational facilities as a problem. 36% found hostel rules to be strict and authoritarian in nature.

34% replied issues relating to finance such as low savings, increasing cost of living and hostel fees. However the researcher found this to be contradictory as 97% replied cost of hostel shelter to be economical compared to other forms of accommodation.

INTERPERSONAL CONSTRAINTS

Individuals when stay together in groups thereis likelihood of strain/s arising among them due to various reasons. The respondents were asked to give more than one reply because it is necessary to provide voice to these hostelites which helps in revealing clear picture.

It was found that 56% claimed 'class' difference as a cause of strain among hostel inmates. It appeared that disparity in economic positions of hostelites and their varied ways of living may lead to differences and adjustment issues among them. 55% asserted unwillingness on the part of certain hostelites to follows hostel rules for instance negligence in maintaining room cleanliness, repeatedly disrespecting hostel rules and other related issues.

45% said miscommunication, gossiping and spread of rumors can create tension among hostelites. 44% claimed overcrowding and immaturity, unnecessary fights on minor matters as the causes of interpersonal strains among hostel inmates.

SOCIAL DYNAMICS

Maintaining sound interpersonal relations is an important social aspect in everyone's life. It was found that majority of the respondents asserted to have made friends in hostel. The researcher agrees to this statement because during visit and interaction with hostelites the same was observed. Living together under one roof provides chance to learn adjustments in life.

Hostel environment, behavior of hostel warden (whether co-operative, understanding or biased) and hostel authorities (approachable, biased, problem solver) and hostel rules (whether rules are equal for all) play prominent role in having good interpersonal relations among hostelites. Nonetheless hostelites do cultivate relations in hostels and few of such established relations are maintained and cherished lifelong.

ISSN 2394 - 7780

INTERPERSONAL RELATION WITH HOSTEL STAFF

67% view hostel supervisor to be helpful in various aspects. Hostelites described the warden to be kind, understanding, problem solving, to be conveying sense of security and care. Whereas 22% described hostel warden to be cordial, good natured but not always helpful. 6% described the supervisor to be not co-operative and rigid in behavior. 5% claimed the supervisor to be partial towards few hostelite/s in her behavior.

Another key part in the functioning of hostel is hostel administrative staff and kitchen staff. It was found that the relations with both the hostel staff was cordial and helpful without any soreness. Other important body in the functioning of hostel is hostel trustees. The researcher found that majority of them never met hostel authorities even when the inmates were willing to. Few of them termed hostel authorities to be unapproachable. However many respondents expressed no need to meet hostel authorities as they are content with the facilities provided.

CONTENTION OF EMPOWERMENT

The respondents were asked to express their views on what 'Empowerment' means to them. It can be summarized in their words which includes being independent (mentally, economically), freedom to choose the way one wants to live, freedom to choose life partner, decision making capacity.

To be matured, being confident to live independently, educated, ability to face problems and challenges in life, self belief, to develop one's own identity, to think and act as always being equal to men, equal importance given to women's voice, ability to balance home and work, equal opportunities and respect on par with men, independent decision making capacity and to be aware about the happenings around the world.

The data reveals huge affirmative response about Mumbai city from working women hostelites with 91% claimed that they feel safe and secure without having faced any form of sexual violence. Few of them asserted that they feel safer in Mumbai compared to their place of origin.

When inquired into the challenges and difficulties faced by respondents in Mumbai city it consists of lack of guidance related to city and buying things of requirement, getting access to healthy and cost effective food, loneliness, expensive to survive in Mumbai city, difficulty in making new friends, excess crowd in city and other allied reasons.

SUMMING UP

Having had the analysis of the data collected for the study it can be noted that working women hostelites are not a homogenous category. There is diversity according to their age, place of origin, educational qualification, nature of employment, family structure, religion, habits and preferences.It was observed that 70% of them belong to the age group of 20 to 30 years as after completion of education within this age group usually there is inclination to enter into gainful employment due to various reasons and the major factor is to be financially independent.

Majority of them both respondents and their family members prefer hostel lodging over other types as they believe in the institution and its functions of catering to the needs of working women hostelites which was also reflected in the merits of residing in hostel given by respondents.The reason/s that hostels are preferred over other types of accommodation includes: cost effectiveness, provision of varied facilities and companionship which helps to an extent to conquer the loneliness which is one of the outcome of urbanism. Majority of them have sound interpersonal relations with fellow hostel inmates and hostel warden.

Thus it can be said that hostel as an institution has survived as it is successful in fulfilling the needs of working women hostelites and their family by providing security and other basic necessities at reasonable rate to these women. Though hostel offers shelter at affordable rate yet there are troubles faced by working women in search of accommodation due to lack of vacancy and higher number of applicants compared to the number of hostels. However there are many women who aspire to have independent accommodation which promises more privacy and absence of rules compared to hostel accommodation but still prefer to seek accommodation in hostels.

However there is a need to establish more of such hostels which aids in achieving empowerment to many women. Though there are many private hostels in Mumbai but their main intention is to make profits which serve the need of only high income group. Inadequate funds are a major hindrance in the path of establishment and maintenance of hostel which needs to be urgently looked into especially by the Government.

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ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGY FOR ECONOMIC DEVELOPMENT IN INDIA: A STUDY WITH A FOCUS ON AGRICULTURE SECTOR

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ABSTRACT
Information and Communication Technology (ICT) has got a cardinal role to play for the sustained economic development of developing nations like India. For an economy like India where more than half of the population depends on agriculture for their survival, ICT adoption in agriculture and allied sectors has added significance. ICT and ICT-based tools can enhance the productivity and hence operational efficiency and competitiveness farming operations. The paper makes a macro level study of the relevance and significance of ICT for the sustained economic development of India with a focus on agriculture sector, and makes suitable policy suggestions.

Keywords: ICT, Knowledge Revolution, Digital India, Rural Development, Kiosks, e-Choupals.

1. INTRODUCTION

World is on the threshold of a new revolution namely Knowledge Revolution. Just like the shift from a hunting society to an agricultural society, then to industrial society and further to post-industrial society and so on, the present shift is to a knowledge society. The current development in respect of knowledge revolution is quite similar to the Agrarian Revolution, Industrial Revolution or such others in the past. In fact, the rapid advances in the field of Information and Communication Technology (ICT), often called ICT Revolution, have played a catalytic role in accelerating the pace of knowledge revolution. World over, these two developments (viz. ICT revolution and knowledge revolution) which are mutually inter-related and inter-dependent, have brought about a paradigm shift in the way in which business processes are being carried out, organizations are being managed, and governance of the state is being done. Government of India has embarked on a 'Digital India' initiative that touches upon all aspects of Indian economy, and agriculture, rural development, and allied sectors are no exception in this regard. Digital initiatives in the agricultural front (like, Kisan credit card) are being aggressively promoted by the union and state governments.

ICT has emerged as an important developmental tool since the 1980s both in developing and developed countries. But, it has assumed maximum significance during the last fifteen years or so; and more prominently since 2000. It has been observed that, all over the world rapid developments in the field of ICT and its fast proliferation into all walks of life, have brought about remarkable social and economic changes (Barton and Bear, 1999; Fullantelli & Allergera, 2003; and Liu and Luo, 2003). Further, it has been noted that apart from the development of information industry (Barton & Bear, 1999; and Bhasker, 2003), ICT has greatly enabled the development of traditional industries like manufacturing and service in a competitive market; locally, nationally and globally (Barton & Bear, 1999; Wang & Hou, 2003; and Pease & Rowe, 2003). Moreover, it has been observed that focus on IT-enabled operations can help organizations to improve quality on the one hand and provide various channels of delivery to meet customer expectations (Mohammed, 2002); by transforming the marketing and production activities that are considered necessary to directly produce a new product.

John Paul, Robert Katz and Sean Gallagher (2004) have observed "ICTs have great potential to catalyze development in some of the poorest regions of the world". Thus, in short, it may very well be stated that worldwide ICT is largely recognized as the vital ingredient and most important catalyst that facilitates the fast economic development of any economy; whether in its totality or parts/sectors thereof. By accelerating the pace of generation of 'knowledge societies' as well as 'knowledge economies', ICT has proved its tremendous developmental potential particularly during the last one and a half decades; the developments being more prominent in respect of many of the newly industrialized and some of the developing countries including India.

2. RELEVANCE AND SIGNIFICANCE OF THE STUDY

In view of the above, it may be stated that for an emerging economy like India, fast economic development is possible only by embracing ICT in a big way, as ICT alone can provide the requisite competitive edge essential for fast and sustained economic growth in a globalized environment. In its endeavor to become the 'global services hub', what India needs to attain is nothing but unmatched knowledge capital and this is more like an imperative rather than an option. In this context, it is relevant to make an analysis of the trend in respect of the performance of Information Technology and Information Technology Enabled Services (ie. IT-ITES, in short)

ISSN 2394 - 7780

industry in India over the last few years. As more than fifty percent of the population in India still depends on agriculture for their livelihood, ICT applications in agriculture sector can contribute towards the wellbeing of the vast majority of the population apart from ensuring faster economic development. So, this paper analyzes the role of ICT for economic development of the nation, particularly its primary sector viz. agriculture.

3. METHODOLOGY AND DATA SOURCES

Methodology for this paper consists of extensive review of relevant literature relating to ICT and its role in economic development. The type of research is both descriptive and analytical. It is descriptive because it discusses the current status regarding the ICT initiatives in India and the world. It is analytical also since it makes a critical and comparative analysis of the available data to arrive at pragmatic and realistic measures for effective use of ICT for economic development of the country. The data used are secondary data available from reliable and authentic sources, like, the official publications of NASSCOM, the publications of the World Bank, Government of India, and so on. Publications of the agriculture department of the Government of India, Reserve Bank of India (RBI), National Bank of Agriculture and Rural Development (NABARD) etc. have also been used extensively for this paper.

4. OBJECTIVES OF THE PAPER

(i) To make an overall study of ICT developments in the world from the perspective of its role as an enabler of rapid economic development;

(ii) To study the role of ICT in the economic development of India, with a focus on agriculture sector in the country; and

(iii) To make suggestions for the effective use of ICT for enabling faster and sustainable economic development of India, particularly its agriculture sector.

5. ROLE OF ICT FOR DEVELOPMENT: SOME PERSPECTIVES

Experts like Allen L Hammond, and also John Paul, Robert Katz and Sean Gallagher have been noted to be quite concerned about the 'Digital Divide' that is being brought about as a result of ever growing ICT initiatives as it proceeds in present fashion. They have suggested alternate developmental models. Their perspectives and suggestions are briefly noted here. Allen L. Hammond (2001) has pointed out that ICT has done more than almost anything else to drive the economic boom in the last decade and also for the integration of markets around the planet. The rapid pace of these developments, the corporate economic power that they embody, and the wealth they have created are truly astonishing. But alongside these positive trends are other, more sobering signs viz. ever-increasing disparities between haves and have-nots undermine the kind of social consensus essential for stability and political progress. He points out that if development does not accelerate and if the benefits of economic progress and new technology do not reach those at the bottom of society—then rather than increased prosperity for all, another, grimmer vision of the future may prevail - an unstable future. He suggests that "the imaginative use of emerging technologies and the creation of partnerships or cooperative approaches that combine the skills of major corporations with the growing strength of civil society can accelerate development in even the poorest regions and can reverse many of the most worrisome trends". John Paul, Robert Katz and Sean Gallagher (2004) have pointed out that 'Digital Dividends' grew out of the observation of certain "warning signs," signs especially visible among the four billion people -- more than half of humanity -- who live on less than $1,500 per year. Citing the suggestion made by Hammond they observe "A new development model is needed -- one that makes credit, communications, information, energy sources, and other self-help tools directly available to poor communities, empowering them to take charge of their own development. What makes such a model plausible, now, is the last decade's rapid expansion of global digital networks, the spread of the Internet, and the proliferation of tele-centers, village phones, and other forms of shared access to information and communications technology. Information and communications technologies (ICTs) have great potential to catalyze development in some of the poorest regions of the world."

Manoj P K (2007)[14] in his paper, "ICT Industry in India: A SWOT Analysis" in *Journal of Global Economy* has sought to point out the utmost significance of ICT industry in India for the faster development of the nation. Using a SWOT Analysis, the author has suggested strategies for the sustainable growth of the industry and hence the national economy as a whole. Manoj P K (2009)[15] in his another research paper, "Revival of Indian Agriculture for Sustainable Development: A Global Perspective", published in *Asian Journal of Environmental Science*, has made a macro level study on Indian agriculture sector and has suggested a few strategies for the revival of the sector. The author has noted that 'Technological Fatigue' is one of the root causes for the crisis in the sector. The need for adoption of most modern technologies like agricultural bio-technology, ICT-based tools etc. for gaining strategic advantage for the agricultural sector has been specifically pointed out by the author. A

ISSN 2394 - 7780

more recent paper by Manoj P K (2012) [16] entitled as "Information and Communication Technology (ICT) for Effective Implementation of MGNREGA in India: An Analysis" in P Arunachalam & M Rajarajan (Eds.) has sought to discuss the cardinal role that ICT can play in ensuring transparency and efficiency in the implementation of MGNREGA in India. This macro level paper has discussed success stories in this regard in selected states. The paper has suggested strategies for the effective use of ICT for transparent and corruption-free implementation of MGNREGA and sustained growth of rural India and hence the economy as a whole.

As against the positive observations as above, there are a few that support the evil effects of "Digital Divide". These include, inter alia, the observations of UNDP (2001), and Okinawa (2000). Accordingly, "one-third of the world's population has yet to make a phone call, fewer than one-fifth has experienced the Internet, and most of the information exchanged over the Internet is in English, the language of some 10 per cent of the world's population" (UNDP et. al., 2001). Likewise, in July 2000, the G8 underlined this growing gap and the importance of harnessing ICTs in the service of equitable development, by declaring that "everyone, everywhere should be enabled to participate in the benefits of the global information society." Among those who have apprehensions regarding the true worth of ICT as a developmental tool, particularly in fighting against poverty, include Heeks, Brown, Gomez, Hunt and so on. Heeks (1999, 2000) and Brown (2001) have been quite skeptical regarding the role of ICT in poverty reduction. Brown (2001), however, admits that although ICTs are not a magic bullet, they can provide "powerful ammunition in the fight against poverty". There are some who wonder about development opportunity costs, arguing that investment in basic literacy and healthcare will more directly address the problems of the poor than providing them with access to the Internet. Some other like, Gomez and Hunt (1999) wonder about the lack of any evaluative evidence for ICTD outcomes, when they observe, "Our euphoria is not matched by our understanding".

Regarding the ICT initiatives and its impact on the society in the form of 'Digital Divide', Prahalad (2002) has noted that in India, distributive justice is more important than wealth creation and that there does exist a real rural and urban divide. He further points out that the market forces cannot be trusted to cope with the problems of the poor; neither can we trust private sector with infrastructure investments and capital–intensive industries. He is of the opinion that income inequities can be alleviated through a system of overt and implicit subsidies. Regarding the ICT scenario in India, Joseph (2002) has observed that it is encouraging to note that in India there is an increasing awareness of the multiple roles that ICT could play in overall development of the country. He supports the view of the government "if any technology can create new opportunities to bridge the gap between haves and have-nots in society in the present times, it is IT", but points out that for IT to improve the lives of the 40 percent of the population which lives below the poverty line, the government must play "a catalytic and enabling role."

It is worth pointing out here that the available empirical evidence still indicates that ICT induced productivity and growth remains to a large extent a phenomenon of the developed countries. In this respect, Phojola (2002) argues that the inter- country differences in the levels of IT use is significantly related to general levels of socio economic development represented by per capita GDP, R&D expenditure and the levels of human development within the country. Hargittai (1999) as well as Rodriguez and Wilson (2000) have observed statistically significant correlation between the levels of diffusion of old media (like television, radios, telephones, news papers etc.) and new media (like PCs, internet, mobile phones etc) and have accordingly suggested that the possibilities for leapfrogging in economic development through ICT are limited. Similarly, Saith (2002) has observed that in the developing countries like India, digital divide is only one among many other divides and in the present socio-economic environment, ICT induced poverty reduction has more hype and less hope.

Regarding the use of ICT for developmental purpose, particularly with reference to the developing world, John Paul, Robert Katz, and Sean Gallagher (2004), points out such diverse applications as (i) Tele-centers: one of the most rapidly growing applications of ICTs in the developing world, (ii) Agriculture, wherein nearly two-thirds of the labor force in low-income countries is employed, (iii) Kiosks for Farmers – very much relevant for farmers in developing countries, (iv) Distance Education – an area which is instrumental in ensuring that future generations' leaders are well-informed and competent, (v) Healthcare – which is quite relevant for majority of the population in developing countries, since they live in rural areas devoid of adequate medical facilities, (vi) E-government – which is defined as "the use of information and communication technologies (ICTs) and the Internet to streamline and improve government processes and enhance the internal and external communications of government", (vii) Micro finance – which provides access to financial services to majority of the poor people in rural areas, (viii) Small and Medium Enterprises (SMEs) – application of ICT has been observed to be crucial in attaining long-term and sustainable economic growth of SMEs, (ix) Handicrafts – wherein application ICT can independent artisans create arts and crafts more effectively and efficiently, (x) Women's Empowerment –

ISSN 2394 - 7780

ICT being an important tool in ensuring that marginalized groups, particularly women, are included in the development of the global information society.

6. ICT AS A DEVELOPMENTAL TOOL: GLOBAL EXPERIENCES

Over the past three decades, the services sector has come to the forefront of economic activity the world over. This shift is characterised by an above average growth in the share of services sector in the total global trade as well as its increasing share of employment and value added in the world economy. Equally notable (as the growth itself) has been the growing participation of developing economies, like India, in this upward trend. While the value of worldwide exports of services has grown at an average of 7.6 percent annually, since 1980 (till 2004), that of export of goods has grown at an annual rate of 6.6 percent. The worldwide trade in commercial services has shown more than a five-fold increase in the past two decades, from under USD 400 billion in the early 1980s to over USD 2,100 billion in 2004. During the above period the contribution of exports of commercial services to total world exports (goods and commercial services) has risen from 16 percent (1980) to 19 percent (2004).

Advances in ICT and their applications over the past two decades have had a paradigm changing impact on the global trade in services. ICT has emerged as the world's fastest growing economic activity, and is transforming resource-based economies to knowledge-based economies. Over the last two decade there has been a mind-boggling levels of growth in information services, products and production processes. Pure data and information-oriented engineering of earlier days have already given way to knowledge engineering. The use of ICT and its impact are so pervasive and it affects issues as diverse as balance of payments, skill development, design competence, mass media reach, industrial competitiveness, publication, communication, transportation, health, financial infrastructure, industrial productivity and managerial efficiency. Worldwide, ICT has proved itself to be a tool of productivity and efficiency that can very effectively bring about better transparency in all administrative and managerial functions. Appropriate use of ICT can make the governance of the State extremely effective and citizen-friendly, contributing positively to the standard of living of the citizen. Internet is becoming so popular that e- commerce (electronic commerce) is going to be the way the world will do business in future. Innovative ways are getting evolved and using them the future Governments can function more effectively and efficiently.

7. ROLE OF ICT FOR SUSTAINED GROWTH OF AGRICULTURE SECTOR IN INDIA

Nearly two-thirds of the labor force in low-income countries is employed in agriculture, mostly through isolated small family farms that have comparatively limited involvement with markets. In recent years, several projects have begun using ICTs to provide relevant agricultural information in these rural areas, helping farmers to improve their labor productivity, increase their yields, and realize a better price for their produce. Resource Portals Most of the agriculturally-focused projects in our Clearinghouse have developed an online portal for farmers. These portals provide the farmers with a variety of information including market prices, weather reports, and farming best practices. Thailand's Agricultural Information Network, India's Agventures, and Jamaica's Agri-Business Information System are all subsidized projects that aim to enhance the living standards of farmers by offering such information. Some portals are for-profit, earning revenue through advertising or registration fees. In Senegal, Météo Marine provides fishermen with marine weather forecasts, as well as the transportation timetables and available freight capacity, helping them to improve both their safety and revenues. In Pakistan, Pakissan is creating new markets by using an Internet-enabled van to familiarize farmers on the uses of IT in agriculture. And in neighboring India, the JFarmIndia portal provides local-language advisory services about crops to farming communities throughout the country. Governments, too, are using IT to create online information portals. Bangalore-based Krishi Marata Vahini, the Uttar Pradesh Marketing Information System, and the national Agricultural Marketing Information Network (Agmarknet) are all government initiatives aiming to provide timely information to India's farmers. Other portals are relevant to farmers all over the world. The ICRISAT Online Database contains 50,000 records on crops and resources of interest to farmers in semi-arid tropical areas, while the Rice Knowledge Bank is a portal geared towards rice farmers that provides information on everything from pest control to irrigation. Through the portal, farmers can also access tools for both diagnosing field problems (Rice Doctor) and making crop management decisions (TropRice). Another portal, the Honey Bee Network, incorporates about ten thousand "green" grassroots innovations, including outstanding examples of traditional ecological and technological knowledge of farmers, artisans, pastoralists, and fishermen and women. E-Commerce Several portals provide not just information, but an e-commerce platform as well, allowing small farmers and farmer cooperatives expanded distribution channels for their produce. By bringing together online both producers and distributors, these portals help enable a more efficient marketplace that rewards both buyers and sellers. For example, B2Bpricenow.com is a free agriculture e-marketplace that provides updates via SMS messaging to Philippino farmers. An online trading and payment

ISSN 2394 - 7780

system for farmers and cooperatives is also available on the site. In India, Agriwatch provides information and analysis on agricultural commodities, and includes an online auction and e-commerce features for Indian producers and suppliers. Also in India, Media Lab Asia is developing an electronic trading platform for agro commodities called Digital Mandi.

Kiosks for farmers in developing countries frequently have neither the literacy nor connectivity that would allow them to benefit from these portals. To overcome such obstacles, some projects are also setting up a kiosk network that provide mediated access to them. Several such networks can be found in India. For instance, through its e-Choupal kiosks, agri-exporter ITC Limited is building an internationally competitive agriculture business by empowering, not eliminating, the independent small farmer. The IT-enabled Choupals not only provide the farmers with valuable information, but also allow them to sell their produce directly to ITC, thereby eliminating the middleman and bringing higher profits to both ITC and the farmers. EID Parry, an agricultural company in the southern Indian state of Tamil Nadu, has set up a network of 'Parry's Corners' through which farmers can access its India Agriline portal and e-commerce platform. The state government of Karnataka is doing the same through its Raita Mitra Yojane project. Beyond India, the Business Intelligence Trade Points project in Burkino Faso provides access to market information through both a national and regional centers. A similar hub-and-spoke system has been set up in Jamaica through the Central and Satellite Agriculture Information Centers project. In Bangladesh, one group has developed a Boat-Based Telecenter to provide agricultural information to farmers located in areas inaccessible by roads. Innovative Technology Use Technologies, both new and old, are providing innovative solutions to agricultural problems. AKASHGANGA is using simple technologies to revolutionize dairy cooperative societies in India. Through the use of automatic milk collection systems, procedures that used to take hours and days now take minutes. To enhance the utility of these new automated systems, the Center for Electronic Governance at the Indian Institute of Management in Ahmedabad has made the company an implementation partner for its Dairy Information Systems Kiosk (DISK) project, which provides data analysis and decision support aimed at improving the farmers' yields. Finally, in Senegal, the Cyber Shepard program has provided herders with Global Positioning Systems (GPS), cellular phones, and Internet-capable computers, helping them to make better decisions about where to graze their flocks.

8. ICT FOR ECONOMIC DEVELOPMENT OF INDIA: SOME STRATEGIES.

In view of the foregoing discussions, an attempt is made here to suggest a strategies for the effective use of ICT for promotion of agriculture and hence the economy as a whole.

(1) Given the special features of the Indian economy, the best IT strategy for the country appears to be that of stimulating the market for the service sector and, within it, the e-governance initiatives. It is widely recognized that this market offers the largest growth opportunities for the country in the immediate future, particularly for states like Kerala. As such, this strategy needs to be implemented on a war footing, primarily because it enables the use of ICT as an enabler of fast socio–economic development of the country. For successful implementation of such e-governance schemes, necessary pre-requisites like creation of applications and content, availability of adequate access to Internet and providing minimal IT literacy to the masses, and, after all, Government’s commitment to the success of the programme etc. are vitally important.

(2) For promotion of ICT as a production sector (which broadly comprises of three major sectors viz. IT Service, ITES and IT Hardware) urgent steps need to be taken for creating the requisite infrastructure, human capacity and urban amenities, including life style options. The potential of ITES sector to absorb the graduates in large numbers can be fully tapped, only if the students of the State are trained very meticulously to equip them with such requirements of the industry as high level of command over the language, communication skills, leadership qualities and such other skills. The Government can very well act as a facilitator for private initiatives in the above fields. Given the vast opportunity for training people for ITES businesses in Kerala, especially Call Centers, the State has already attracted many training companies. Now, the need of the hour is in establishing standardization and evolving guidelines for such training activities based on globally acceptable standards. Specialized training schemes on various ITES areas may be formalized for certification of personnel at agent – level as well as at the supervisory – level to ensure that highly skilled and suitably trained manpower is available to the industry.

4.1. CONCLUSION

In view of the quite favourable socio-economic environment of the State, particularly the abundant amount of technically qualified and skilled human resources, the State has got excellent potential for bringing in ICT-led economic development and that too with minimal digital divide. Accordingly, the State can become a role

ISSN 2394 - 7780

model for the industrially backward regions in other parts of the country. In spite of several weaknesses in the political system of the including the inconsistency in the policies, the ongoing Governmental initiatives themselves appear to be quite successful and sustainable in the State. Let us hope that the remarkable ICT achievements of the State, particularly those in e-governance, during FY 2005 and FY 2006 are the trend-setters for rapid economic development of the State in the days to come.

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POWER DOES MATTER: CONSUMER AWARENESS ON RENEWABLE ENERGY IN MUMBAI SUBURBAN HOUSEHOLDS

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ABSTRACT
In this growing population and growing demand on energy there is a high requirement of conservation and contribution towards renewable energy. The adverse effect of conventional energy on environment a major cause of climate change and global warming hence the purpose of this research is to find the awareness among the selected sample of Mumbai suburban on renewable energy according to their demographic factors and to find the constraints or challenges in shifting towards the renewable energy. This research provides a unique way to solve the constraint which is suggested in the conclusion. This is a pilot study for philosophy of doctorate thesis. Primary data in the parts of Mumbai suburban and secondary data was collected to carry out the research.

Keyword: Renewable Energy, Consumer Awareness and Environment.

INTRODUCTION
India population is increasing day by day. As per the latest UN estimates the population of India is approximately 1.34 billion and after Uttar Pradesh, Maharashtra being the second most populated state with the estimate of 121 Million (in 2018), 9.3% of India population stay in Maharashtra, with geographical area of approximately 3.08 lakh sq.km with 365 persons per square kilometre. Maharashtra is highly urbanised with approximately 45.2% living in towns. With this increase in population the demand for different energy is also increasing. If there is no proper watch on the usage of conventional energy it will lead to a raising alarm for global warming and disaster. As per the sources of financial express electricity consumption or power demand will raise upto 7% Compound annual growth in next five years, specifically electricity consumption between financial year 2017 to 2022 will grow upto 7.1% approximately. According to the Central electricity report of 2017 more than industrial sector, domestic sector will become the largest consumer segment in next 10 years.Renewable Energy will be alternative to cater to these high increasing demands of electricity As per report published in Economic Survey of Maharashtra, 2017-18, Directorate of Economics and Statistics, Planning Department, Government of Maharashtra, Mumbai

Maharashtra Source wise electricity generation, 2017-18

(MU)

Source	2014-15	2015-16	2016-17	2017-18+*	Per cent change in 2016-17 over 2015-16
In the State	**1,03,779**	**1,13,787**	**1,15,046**	**74,968**	**1.1**
Thermal	84,882	94,482	89,084	59,440	(-)5.7
Natural gas	4,626	5,302	9,481	6,229	78.8
Hydro	5,856	5,045	5,978	3,112	18.5
Renewable$	8,415	8,958	10,502	6,187	17.2
Received from central sector	**30,401**	**29,179**	**32,582**	**18,626**	**11.7**

Note : 1 Unit = 1 Kilo Watt Hour $ including captive * Provisional + upto December

Source: MAHAGENCO, Tata Power, Reliance Infrastructure, MAHADISCOM, Central Electricity Authority, GoI

ISSN 2394 - 7780

Maharashtra potential and installed capacity of Renewable Energy

(MW)

Source	Potential capacity	Installed capacity			
		As on 31st March			As on 31st October, 2017
		2015	2016	2017	
Wind	9,400	4,444	4,662	4,769	4,775
Bagasse co-generation	2,500	1,415	1,415	1,849	1,849
Small Hydro Projects (SHP)#	732	294	302	304	304
Biomass	831	200	200	215	215
Urban solid waste	287	3	3	3	3
Industrial waste	200	32	34	9	9
Solar	7,500	329	362	383	624
Total	**21,450**	**6,717**	**6,978**	**7,532**	**7,779**

SHP (less than 25 MW capacity) installed by Water Resource Department

Source : MEDA, 'Energy Statistics 2016', Water Resource Department, GoM

Above reports showcases the gap between potential and achieved capacity, all renewable energy have much more potential for growth.

LITERATURE REVIEW

Ramdas,T.N., (2014) , in the research "A study on consumers buying behaviour for solar energy equipment's and responses towards use of solar energy equipment's in Maharashtra" has brought about the emphasis on the challenges in shifting towards solar energy. Few of the key findings were that when consumer are deciding on the solar equipment's, the initial investment and installation is the first challenge or criteria due to which people do not dig into its environmental advantages. Here the social status is playing a role as the lower middle class will not be able to afford high installation charges. Also the researcher has identified that effective marketing communication of solar energy is required inorder to bring about a change in consumer buying behaviour. The researcher has also observed that awareness and marketing has to be increased inorder to have a proper positioning of solar equipments in the minds of customer.

Hina Fathima.A, Priya. K, Sudakar Babu.T, Devabalaji.K.R, Rekha.M, Rajalakshmi.K and Shilaja.C, in research paper on "Problems in Conventional Energy Sources and Subsequent shift to Green Energy" has conducted a study on India-Green Energy and its development. Three sources of green energy - Solar, Wind and Hydrogen Energy (Fuel Cells) have been studied. The world scenario on current and future scope of development in renewable energy contribution is studied. Researcher discusses the problems which are existing in conventional energy sources and the various renewable energy generation technologies which will help in creating green energy promotion. Researcher also studies that there is high need for finding and implementing alternative renewable energy sources for electricity production to save environment from further deterioration and there is high future potential in exploring new green energy Different Innovative ways of creating energy:

Fatima.N, Mustafa.J, in research paper on "Production of electricity by the method of road power generation" (2012) examined the following points. The researcher brings about optimal utilization method by creating energy from commonly used roads. Here Kinetic energy of the vehicles is converted to electrical energy. Moving plate is installed on the road which takes the stroke motion of the vehicles and converts it to the rotary motion by crank mechanism and it generates the electricity. This research gives a new pathway to create environment friendly energy- green energy through Road Power generation which can be optimally used for street lights and signals. This research must give a thought process to create one's own energy through various resources available in hand.

RESEARCH OBJECTIVE OF THE STUDY

1. To study the consumer awareness on different renewable energy is dependent on demographic factors within Mumbai Suburban
2. To identify the challenges and constraints in shifting towards renewable energy within Mumbai Suburban.

ISSN 2394 - 7780

RESEARCH METHODOLOGY

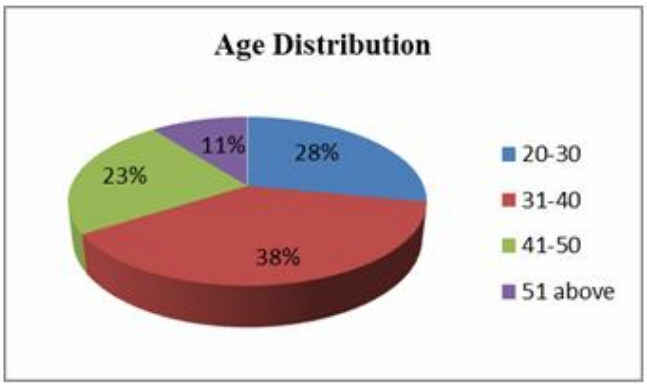
The area of research is within selected areas of Mumbai for which area random sampling has been used. A random Sample of 200 respondents from different households of Mumbai Suburban from Bandra, Kandivali, Borivali, Goregaon – East and West, Jogeshwari, Andheri, Dahisar, Dadar, Chembur, each of 20 samples have been taken into consideration. Primary data was collected through direct interview and Questionnaire was prepared and circulated to collect the responses from selected society and random flats were selected from the societies.

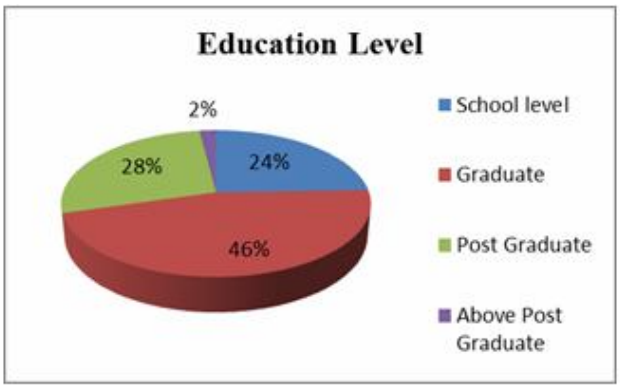
DATA ANALYSIS AND INTERPRETATIONS

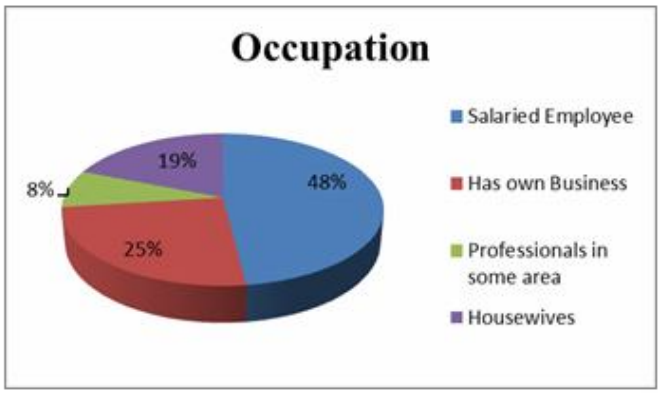
Statistical R Package was used to analyse the data and the results are as follows.

Age, Gender, Educational Qualification, Occupation were the demographic factors taken from the respondents.

Gender bifurcation: Male -96 and female-104







From the above demographic data-in age, majority of our sample survey included the age group from 20-50 as they are the deciding member in the household or salaried groups.70% being graduates or above respondents. In occupation 48% being salaried as in Mumbai the population is of more salaried employee.

AWARENESS ON DIFFERENT RENEWABLE ENERGY SYSTEMS

Firstly questions on climate change and global warming was asked to observe that whether respondents are keeping a watch on the surrounding changes occurring and how updated are they in terms of climate variations. An interesting outcome was observed that the respondents are aware that they are being affected by climate change and after knowing the facts 75% of them were eager to contribute for saving the environment. Awareness on different renewable energy systems like solar water heater, Solar Window panels , Solar rooftops, Solar Cooker, Wind Energy , Biomass, Biogas, Tidal, Geothermal, Hydroelectricity etc were asked , 80% of respondents were aware of Solar but only solar water heater and not the solar rooftop or the solar panels followed with 40% awareness for Biogas and 40% Wind energy. There was comparatively less response on other renewable energy such as hydropower, geothermal, tidal energy. Here on the basis of the renewable energy technologies their usage level consumers were categorized as aware and not aware category. But there was comparatively poor response for the usage of the renewable energy equipments . Hence on the above parameters and direct interview method the level of awareness whether the respondent is aware or not has been identified.

Hypothesis 1: Is there any association between consumer awareness on different renewable energy and the demographic factors.

ISSN 2394 - 7780

H1: Gender,Age, Education, Qualification are the influential factors in the consumer awareness SUMMARY: All the hypothesis are tested by chisquare test analysis and a brief summary is presented

Result conclusion	P Value
H1: Rejected, Gender is independent of consumer awareness level on Renewable energy	0.07
H1: Accepted, Age is dependent on Consumer Awareness level on Renewable energy	0.045
H1: Accepted, Qualification is dependent on Consumer Awareness level on Renewable energy	0.003
H1: Accepted, Occupation is dependent on consumer awareness level.	0.03

Qualification, occupation and age were factors which was driving the consumer awareness level on Renewable energy as there were some technicians/engineers in the response who were well versed with the technologies.

Constraints or challenges in shifting towards the renewable energy

88% of the respondents have the opinion of high Initial cost/ Initial investment is huge whereas the direct benefits are comparatively low. Everyone are aware that the global warming is increasing and environment is getting impacted, but they are ready to survive with the given situation. 75% of the respondents were happy with the current situation and hence they did not want change. Some of the constraints were that it is not as quick and relevant as the traditional or conventional methods. As this was a multiple response question hence percentages among 100 is shown below.

Constraints/Challenges	Percentage distribution
Expense on buying those equipment's and installing and maintaining is high	88%
There is no direct benefit for me	89%
I am not much aware of these hence need information/Marketing	76%
Its government responsibility	40%
Not aware of Government Plans/Schemes on renewable energy	80%
Happy with the current situation and I don't want any change	75%
It is not quicker as of conventional methods	60%
I am not affected due to these problems hence I not interested	30%
It takes more efforts	20%

CONCLUSION

The researcher highlights the results from this research study, demographic factors do not influence on the awareness of renewable energy. Upfront cost involved in the installation in solar systems was the major constraint brought about by the consumers and the there is no direct benefit as it is long term benefit which is not directly visible. Even though there is an inclination towards the environmental protection but at the same time investment of money is a challenge persisting for the shift towards green energy.

SOLUTION/SUGGESTION

Installation and Maintenance of solar for entire society can be handled by third part vendor with government intervention and support this will help in no installation or maintenance charges which are huge in the initial stage. Example as like LPG gas cylinder, cylinder and connection is provided by third party and its refilling is easier and above which a subsidy amount is provided to users bank account. Hence consumer feels it easier and beneficial. Hence a similar pattern has to be brought in place for the renewable energy installation which will also contribute to environment protection.

Although Indian Government is aiming for achieving the target of 175 GW of Renewable energy by 2022 and 100 GW solar by 2022 where the role of domestic sector needs to be also channelized in the same direction. Hence there needs to be a hand in hand coordination from Government, third party vendors and domestic sectors/industrial sectors while achieving the goal. It is the responsibility of each individual to conserve and contribute energy.

LIMITATION OF THE STUDY

- This research is limited to Mumbai Suburban due to limitation of time and cost involved.
- This research is restricted to selected households of Mumbai Suburban and if there is any alteration in location and sample size, results may or may not remain the same. The research is on a pilot study and more samples will be collected to check the awareness level.

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CUSTOMER SATSFACTION TOWARDS ONLINE SHOPPING WITH SPECIAL REFERENCE TO WOMEN

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ABSTRACT

Nowadays, internet is not just a method to be in touch with your customers, but it is an essential channel to trap your potential customers along with to retain your existing one. In the era of competitive marketplace where businesses are competing for customers, there is an utmost need and important to maintain customer satisfaction. As far as marketing is concerned customer satisfaction is a key and topmost element of business strategy.

According to the changing scenario, nowadays women are most powerful consumers and they play a very crucial role when it comes to buying decision. They are great influencers in the buying decision of the family. Also when individual buying is concerned, women are the sole decision makers. Online shopping is a privilege especially for women consumers which help them to manage their shopping and work equally.

In this research paper an attempt is made to study the customer satisfaction of women customers towards online shopping and to ascertain motivating factors influencing their buying behaviour.

Keywords: customer satisfaction, online shopping, women, factors.

INTRODUCTION

Online shopping is growing at a rapid pace. Online shopping can be considered as a direct process, where transactions are conducted over an electronic network (internet), wherein customers can purchase goods and services from a seller who is dispersed at different geographic locations without the intervention of the intermediary. It is also called as web-store, e-shop or online store. The online shoppers can access web stores from anywhere and at any time according to their preference.

There are several reasons for the inclination of customer's buying patterns, which has shifted towards online shops. The main purpose for online shopping is that it leads the customers to a convenient and whole new world of shopping. Further, it also helps them to experience novel experiences such as it saves their precious time and money and also helps them to retrieve all the product related information with few clicks in few minutes. With the web stores facility, it is easier for the online shopper to find a particular product as per his choice and compare it with a wide range of products for price, variety, flexible return policy in case of dislikes of the products and so on.

The Indian market for consumer has increasing disposable income due to the development of modern urban life which has led to increase in consumer awareness that has affected customer behaviour in cities, towns and even rural areas.

Customer satisfaction is a term used to measure how the customer's requirement is meeting his expectation.

As we are aware that online shopping has become a global phenomenon the overall internet users' worldwide is expected to increase at a diverse rate. Therefore, it's become very crucial to understand the customer's needs, their wants, their likes, their dislikes, their preferences and their satisfaction level towards online shopping.

LITERATURE REVIEW

Bartel Sheehn (1999) was of the view that there could be a link between risk and privacy. Women are usually more anxious about the loss and invasion of privacy and their anxiousness is increased when online as compared to offline. As they are unable to physically see the transaction which is actually being processed, the handling of data concerned and what moreover to add to their uneasiness is what happens with their details.

According to **Cyr et al (2007)** there is a direct correlation between social presence and online loyalty for women specially. After considering the inherent issues which women have while shopping online, the study revealed that females should be involved in shopping online in order that they can also enjoy the virtual experience pertaining purchase and returns.

Ankur Kumar Rastogi, (2010), Online purchase has gained vast popularity due to technological up gradation. The buying behaviour varies to some extent while comparing online buying with the traditional buying, while analyzing the online purchasing.

ISSN 2394 - 7780

Dr. Mubin Kiyici, (2012), In the present scenario, customers nowadays are the prime receiver in the whole online shopping bang. That's the reason why various businesses are globalizing their sales and marketing efforts for their products and services via the internet.

Nikhashemi et. al (2013) study revealed that the customer consider quality and security along with online payment method have very crucial positive impact on increasing customer satisfaction relating to internet shopping.

OBJECTIVES OF THE STUDY

- To understand the women customer's satisfaction level for online shopping.
- To study the motivating factors which influence women customers to shop online
- To ascertain the most preferred online shopping websites among the women users.

RESEARCH METHODOLOGY

Research Design

The research design taken up was descriptive in nature and various factors which were associated or which were affecting customer satisfaction due to which women customers prefer online shopping was explored.

Sample Size

50 women respondents were considered for sample size.

Data Collection

This study is on "Customer Satisfaction Towards Online Shopping With Special Reference To Women".

The data was collected in two phases i.e. Primary Data and Secondary Data.

In case of **Primary Data,** the data was collected directly from respondents with the help of structured questionnaires. The data collected was used for analysis which helped in sorting, tabulating and analyzing the objectives. The data was collected from households, professionals and so on.

In the second phase, **Secondary Data** was collected through several books, journals, websites, government publications and newspapers.

Statistical Tools

The data collected through questionnaires were analyzed using simple percentage analysis.

Table-1: Age of Women Respondents

Sr No	Age group of the Women Respondent	No of Respondent	Percentage
1	Below 20 years	02	04
2	25 - 30 years	28	56
3	31 – 35 years	11	22
4	Above 35 years	09	18
	Total	50	100

Interpretation

From the above table 1 it is revealed that 4% of the women respondents are below 20 years, 56 % of the women respondents are from 25 – 30 years, 22% of the women respondents are falling under 31 – 35 years whereas 18% of the women respondents are above 35 years.

Table-2: Occupation of the Women Respondents

Sr No	Occupation of the Women Respondents	No of Respondent	Percentage
1	Working	27	54
2	Housewife	23	46
	Total	50	100

Interpretation

Above table 2 reveals that occupation of 54% of the women respondent are working, 46% of the women respondent are housewife.

Table-3: Family Status of the Women Respondents

Sr No	Family Status of the Women Respondent	No of Respondent	Percentage
1	Nuclear family	28	56
2	Joint family	22	44
	Total	50	100

ISSN 2394 - 7780

Interpretation
Above table 3 reveals that 56% of the women respondents belong to Nuclear family, 44% of the women respondents belong to Joint family.

Table-4: Preferred Online Shopping Websites by the Women Respondents

Sr No	Preferred Online Shopping Websites	No of Respondent	Percentage
1	Myntra.com	33	66
2	Jabong.com	16	32
3	Koovs.com	10	20
4	Voonik.com	14	28
5	Yepme.com	12	24
6	Flipkart.com	08	16
7	ASOS.com	03	06
	Total	50	100

Interpretation
Above table 4 reveals that 66% of the women respondents preferred Myntra, 32% of the women respondents preferred Jabong, 20% of the women respondents preferred Koovs, 28% of the women respondents preferred Voonik, 24% of the women respondents preferred Yepme, 16% of the women respondents preferred Flipkart, 06% of the women respondents preferred ASOS.

Table-5: Sources of Awareness of Online Shopping Websites by the Women Respondents

Sr No	Sources of Awareness of Online Shopping Websites	No of Respondent	Percentage
1	Online advertisement	24	48
2	Offline advertisement	04	08
3	Print media	08	16
4	Friends	14	28
	Total	50	100

Interpretation
Above table 5 reveals that 48% of the women respondents get awareness from online advertisement, 8% of the women respondents get awareness from offline advertisements, 16% of the women respondents get awareness from print media and 28% of the women respondents get awareness from friends.

Table-6: Frequency of Purchase of the Women Respondents through Online Shopping

Sr No	Frequency of Purchase	No of Respondent	Percentage
1	Daily	07	14
2	Weekly	09	18
3	Monthly	26	52
4	Yearly	08	16
	Total	50	100

Interpretation
Above table 6 reveals that 14% of the women respondents make purchase on daily basis, 18% of the women respondents make purchase on weekly basis, 52% of the women respondents make purchase on monthly basis whereas 16% of the women respondents make purchases on yearly basis.

Table-7: Motivating factors of the Women Respondents towards Online Shopping

Sr No	Motivating Factors	No of Respondent	Percentage
1	Product Availability	25	50
2	Time saving	29	58
3	Review of the product	16	32
4	Less Expensive	07	14
5	Detail description of the Product	06	12
6	Accessibility	12	28
7	Variety	16	32
8	Best Deal	14	28
	Total	50	100

ISSN 2394 - 7780

Interpretation
Above table 7 reveals that 50% of the women respondents choose online shopping for product availability, 58% of the women respondents choose online shopping for time saving, 32% of the women respondents choose online shopping for review of the product, 14% of the women respondents choose online shopping for less expensive, 12% of the women respondents choose online shopping for detailed description of the product, 28% of the women respondents choose online shopping for accessibility, 32% of the women respondents choose online shopping for variety, 28% of the women respondents choose online shopping for best deal.

Table 8: Variety of Products purchased Online by Women Respondents

Sr No	Product Purchased Online	No of Respondent	Percentage
1	Clothing	27	54
2	Mobiles	31	62
3	Cosmetics	16	32
4	Footwear	07	14
5	Watches	04	08
6	Accessories	23	46
7	Baby Care	04	08
8	Toys	10	20
9	Bags/Purses	14	28
10	Home Appliances	17	34
11	Grocery items	28	56
	Total	50	100

Interpretation
Above table 8 reveals that 54% of the women respondents purchased clothing online, 62% of the women respondents purchased mobile online, 32% of the women respondents purchased cosmetics online, 14% of the women respondents purchased footwear online, 08% of the women respondents purchased watches online, 46% of the women respondents purchased accessories online, 08% of the women respondents purchased baby care online, 20% of the women respondents purchased toys online, 28% of the women respondents purchased bags/purses online, 34% of the women respondents purchased home appliances online, 56% of the women respondents purchased grocery items online.

Table-9: Factors considered by Women Respondents prior to Online Shopping

Sr No	Factors considered prior to online shopping	No of Respondent	Percentage
1	Product Rating	08	16
2	Product Review	20	40
3	Price Comparison	12	24
4	Discounts and Offers	04	08
5	Flexible Return Policy	02	04
6	Convenience & Time Saving	04	08
	Total	50	100

Interpretation
Above table 9 reveals that 16% of the women respondents consider product rating prior to online shopping, 40% of the women respondent consider product review prior to online shopping, 24% of the women respondents make price comparison prior to online shopping, 8% of the women respondents consider discounts and offers prior to online shopping, 4% of the women respondents take into consideration flexibility of return policy prior to online shopping whereas 8% of the women respondents consider convenience & time saving prior to online shopping.

Table-10: Availability of Detailed Information about the Product by Women Respondents

Sr No	Opinion	No of Respondent	Percentage
1	Strongly Disagree	-	-
2	Disagree	03	06
3	Neither Agree nor Disagree	12	24
4	Strongly Agree	11	22
5	Agree	24	48
	Total	50	100

ISSN 2394 - 7780

Interpretation
Above table 10 reveals that 6% of the women respondents disagree with availability of detailed information about the products available online, 24% of the women respondents neither agree nor disagree with availability of detailed information about the products available online, 22% of the women respondents strongly agree availability of detailed information about the products available online and 48% of the women respondents agree availability of detailed information about the products available online.

Table 11: Possibility of Comparison with other related Products

Sr No	Opinion	No of Respondent	Percentage
1	Strongly Disagree	01	02
2	Disagree	04	08
3	Neither Agree nor Disagree	09	18
4	Strongly Agree	10	20
5	Agree	26	52
	Total	50	100

Interpretation
Above table 11 reveals that 2% of the women respondents strongly disagree possibility of comparison of product with other related products available online, 8% of the women respondents disagree possibility of comparison of product with other related products available online, 18% of the women respondents neither agree nor disagree possibility of comparison of product with other related products available online, 20% strongly agree possibility of comparison of product with other related products available online, 52% of the women respondents agree possibility of comparison of product with other related products available online.

Table-12: Flexible and Hurdle Free Return Policy

Sr No	Opinion	No of Respondent	Percentage
1	Strongly Disagree	04	08
2	Disagree	08	16
3	Neither Agree nor Disagree	11	22
4	Strongly Agree	10	20
5	Agree	17	34
	Total	50	100

Interpretation
Above table 12 reveals that 8% of the women respondents strongly disagree availability of flexible and hurdle free return policy for online purchase, 16% of the women respondents disagree availability of flexible and hurdle free return policy for online purchase, 22% of the women respondents neither agree nor disagree availability of flexible and hurdle free return policy for online purchase, 20% of the women respondents strongly agree availability of flexible and hurdle free return policy for online purchase, 34% of the women respondents agree availability of flexible and hurdle free return policy for online purchase

Table-13: Reliability and Trust by Women Respondents on the Quality of Information provided by Online shopping

Sr No	Opinion	No of Respondent	Percentage
1	Strongly Disagree	01	02
2	Disagree	02	04
3	Neither Agree nor Disagree	16	32
4	Strongly Agree	08	16
5	Agree	23	46
	Total	50	100

Interpretation
Above table 13 reveals that 2% of the women respondents strongly disagree reliability and trust on the quality of information provided by online shopping, 4% of the women respondents disagree reliability and trust on the quality of information provided by online shopping, 32% of the women respondents neither agree nor disagree reliability and trust on the quality of information provided by online shopping, 16% of the women respondents strongly agree reliability and trust on the quality of information provided by online shopping, 46% of the women respondents agree reliability and trust on the quality of information provided by online shopping.

ISSN 2394 - 7780

Table-14: Online Shopping Satisfaction level of the women respondent

Sr No	Online Shopping Satisfaction Level	No of Respondent	Percentage
1	Highly Satisfied	08	16
2	Satisfied	36	72
3	Neither satisfied nor dissatisfied	05	10
4	Dissatisfied	01	02
5	Highly dissatisfied	-	-
	Total	50	100

Interpretation

Above table 14 reveals that 16% of the women respondents are highly satisfied with online shopping, 72% of the women respondents are satisfied with online shopping, 10% of the women respondents are neither satisfied nor dissatisfied with online shopping, 02% of the women respondents are dissatisfied with online shopping.

FINDINGS

- It is disclosed that majority 56% of the women respondents are between age group from 25 – 30 years.
- Majority 54% of the women respondents are working women.
- Majority 56% of the women respondents belong to nuclear family.
- Majority 66% of the women respondents preferred Myntra website for online shopping.
- Majority 48% of the women respondents get awareness about online shopping from online advertisement.
- Majority 52% of the women respondents make online purchases on monthly basis.
- Majority 58% of the women respondents prefer online shopping for time saving as a motivating factor.
- Majority 62% of the women respondents purchased mobiles online.
- Majority 40% of the women respondents consider product review prior making online purchase.
- Majority 48% of the women respondents agree availability of detailed information about the product available online.
- Majority 52% of the women respondents agree possibility of comparison of product with other related products available online.
- Majority 34% of the women respondents agree availability of flexible and hurdle free return policy for online purchase
- Majority 46% of the women respondents agree reliability and trust on the quality of information provided by online shopping.
- Majority 72% of the women respondents are satisfied with online shopping.

CONCLUSION

A satisfied customer usually sends more business back to the organization, whereas an unsatisfied customer prevents the business from growing.

The online shopping has become a regular part of our lives as it is very convenient. Moreover, as majority of the women are working women staying in nuclear family the web store provides the customer a comparison study and allows her to buy the most attractive deal along with saving her time and that also as per her convenience.

Many women may prefer to buy products of those brands and companies which they cannot find elsewhere or are not available for purchase in their home countries.

Online shoppers look forward for trust, security and privacy of data, accessibility, reliability, timeliness, convenience and customer service. Online shopping can be easy and pleasurable but one has to be cautious.

Hence, online shopping can become a comparative tool for expanding business and ensuring customer satisfaction.

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SUSTAINABILITY OF ECONOMIC DIMENSIONS OF CHICK-BARAIK TRIBE: A CASE STUDY OF SIMDEGA DISTRICT OF JHARKHAND

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INTRODUCTION

One of the most popular folk tales depicts that the suffix of the tribe name Chick–Baraik has been given to them in recognition to the bravery and heroic activities they belong to the Baraik area of the Mahabharat period. They were a part of Yadav (Gope) warriors. The term Baraik denotes brave or prestigious people. In addition to their heroic activities, they were also famous for their interest in music songs and dance. This proves their relationship with Lord Krishna. Again their Git-Govind contains songs related to their different season of the year. At the village level, the Akhara gave them an opportunity to practice continuously the songs, dance, and music. This, in turn, helped them to receive the patronage of the Zamindar, Raja, and Maharaja of the region. Under their patronage, they also participated in a number of competitive functions and came out as victorious. Their expertise coupled with the patronage of the Raja and Maharaja of the region helped them to develop a system of Saraikin which at one time was supposed to be then a useful ornament of the courtyard of Maharaja and Rajas.

From the aforesaid discussion, it becomes clear that these people proved their expertise in different walks of life. The famous Baraik warriors of Lord Krishna army who fought in favour of Kauravas enter Chotanagpur after their defeat in the Mahabharat war. In course of their stay in the area, they proved themselves to be great people in different fields of life and culture of this region. They were termed Baraik which has come from their homeland Barak. The prefix Chick has been added by the local rulers for their use of Chick in attracting the attention of the crowd. So they became the Chick Baraik.

COMMUNITY Vs TITLE

The term Baraik means great man for the Chick Baraik. Baraik was related to their original habitat Barak, but their supremacy in different activities also helped them to prove that Baraik is a really great man. In the field of military activities, their competitors were many. These competitors include the communities like Kawar (which is supposed to be an offshoot of Kaurav), Rawutia, Binjhie, Ahir, Paik and even the Rajput of this region. They were also anxious to be called as Baraik Sahab which is generally used for the zamindars who have proved their expertise in heroic activities. These people were generally the zamindars and other famous personalities who did not belong to the Baraik Community. Here mention may be made of a few families of same villages of this region who received the title Baraik Sahab from the British rulers –

- Kamdarik Baraik of Kamdara village in Gumla district belongs to this group. They are rautia by caste who have received the title Baraik.
- The zamindars of Kunti (proper) are also an example who earned the title Baraik Sahab. They also belong to the Rawatia caste and at one time he was one of the big zamindars of this area.
- The Baraik Sahab of Birda village in Kurdeg (Simdega District) who was supposed to be one of the richest and big zamindars of the region is also an example of earning the title. They belong to Kawar caste.
- The Raja Sahab of Chainpur in Plamu district belongs to a Rajput caste of high tradition and family. Their family has also earned the title of Baraik Sahab which they are still continuing.

Such a title used to be offered to a person for his bravery and heroic activities, but his other family members also used the title to express their supremacy over the other people. In course of time, their lineage people have also been using the same title which has created the problems of identifying the Baraik. It is such an umbrella which has nothing to do with the community but gives coverage to a number of communities whose ancestors earned the title. On the other hand, the Chick Baraik are those Baraik who have ended from the Baraik migrants to this region adhering to their typical customs and traditions as a unit or a homogenous group who are different from the other Baraik for the use of the Chick which is added as a prefix to the title Baraik.

THE NAME CHICK-BARIAK

It is supposed by some scholar that the name Chick Baraik have been given to them by their Hindu neighbors. The other tribes of this region use the term Chick Baraik due to their association with the work of weaving. To their neighbors, they are the people who have got the ability to do hard work intelligently and effectively. Their myths also reflect that initially they had the ability of warrior and they worked effectively in the military force

ISSN 2394 - 7780

of the local Raja and Maharaja. During the hideout of their ancestors in the bamboo grooves, he first took up the sound of Chick Baraik with the movements of the bamboos. At a later time when he took up the occupation of weaving very effectively, he also heard the sound Chick i.e., Chick while operating the loom.

The Chick Baraik is a scheduled tribe (ST) of the state of Jharkhand. They are mainly concentrated in Ranchi, Lohardaga, Gumla and Simdega district. At present they live in company with other tribal and non-tribal groups like the Munda, Oraon, Lohra, Seansi, Ahir, Kumhar, Bhogta etc. The Chick Baraik are supposed to be a branch of the great Munda tribe by many scholars. They had closed proximately with some of the major tribal groups of the region. They belong to the same social group, but the Munda consider them lower in the social hierarchy, but they do not accept a lower position. They, in turn, do not accept cooked food from a Munda or Oraon houses. Their adoption of weaving at a later stage has put them to a lower status to the Munda. Their myth proves that their ancestor was guarding Phani Mukut Raja when he was a child and laying under the cover of the Phani of the Nag Raj. Till then they are related to the king for giving him and his military support and personal guard. At a later stage, the negligence of duty by one of their ancestors annoyed the king. Their ancestor has driven away and threatened with death sentences. He took refuge in a bamboo grove and spends some time there. After some days he took shelter in a Munda family, but he was identified by the king's men. He had to fly away from the Munda family and he took his side out in a weaver's family. After sometimes he learned the art of weaving and practiced the same for his livelihood. This art of weaving was handed down from generation to generation. Now they are an endogamous group and do not have any endogamous branches bearing the same name. They do not observe a special initiation ceremony. However, like other tribes, their youngster's are given scar marks on their arms and legs and a forehead as the sign of their eligibility for settlement social status. The young women are also tattooed at this point of age on their chin, arm, and leg.

MATERIALISTIC LIFE

Material life is one of the important aspects of a culture. It presents a large number of materials including house type to the dress pattern as well as the pattern of behavior of the people. The ecological conditions of the people help them to use various types of material that are found in nature for various purposes. The need of the people is satisfied through the natural environment in which they live. The survival of any community is based on the systematic way of combining material equipment and techniques to meet their biologically determined and culturally acquired materials need. The material life of this artisan community who in traditional days mostly survived on weaving reflects the priorities of their living and culture. Their materials life used to move around the looming technology for making a living. Other aspects included the materials locally available and generally collected from their environment. For this their tools, houses and other equipment as well as their operation reflected the primitiveness of their culture. Their houses in the villages are not arranged in any systematic orders. Rather they are mostly scattered. It is customary for them to set up independent families after their marriage. However, a household may live together under the same roof. In general, their material possession also included the changing facts for their life not only due to their contact with the neighboring communities but also with a shift if their economic activities as well as due to education. However, it is not possible to delineate the impact of these factors on their material life and describe the changes that have penetrated due to these forces in general.

POVERTY

Poverty is a socio-pathological problem. It is a relative term because everybody feels as poor when he compares himself with persons having more property and wealth. But poverty as a socio-pathological problem is related to the maintenance of basic or minimum needs of survival when a person is not able to provide required calorie to his body, he is turned as poor. In village Sikariatand which is studied overall common in poverty line is about the ration of fifty-fifty. Fifty percent of the Chik Baraik people in the village are reported to below poverty line. In village way of causes are finding out to the context of poverty. The following are the main causes of poverty.

- Land alienation.
- Illiteracy
- Unemployment
- Lack of Cultivable land
- Lack of means of Irrigation
- Increasing health problems

ISSN 2394 - 7780

CONSEQUENCE OF POVERTY

The poverty leads to the following problems in the village

- The existence of Child Labour
- The existence of Migrant Labour
- Psychological frustrations
- Physical and Mental torture.
- Exploitation and oppression.

PROBLEMS OF UNEMPLOYMENT

One of the most difficult problems which the country faces has been to provide employment, opportunities to all those who enter the labour force from year to year. In the studied area Sikariatand village rural employment and underemployment is severe in the rural economy, both unemployment and under-employment exist side by side and the distinction between them is by no means sharp. In the studied area, increasing population implies an increasing pressure on land. This pressure on land or agriculture has resulted in an increase in the number of agriculturists and this has largely contributed to the problem of unutilized labour or disguised unemployment in the agricultural sector. A large labour force accumulates around primary occupations and the general in elasticity & occupational structure also prevents any large movement away from these in a period and slack demand. This leads to seasonal unemployment also.

REMEDIES

In regard to the larger problem of disguised unemployment, underemployment and low productivity employment in the village area and the mass poverty resulting, therefore economists are unanimous in their view that there is no other remedy than a massive programme of investment in rural development and massive injections of sciences and technology into the method of production followed in rural area in their agricultural as well as non-agricultural activities. Here some remedies are suggested to solve the problem of rural unemployment

1. Local Capital construction projects, particularly projects, conduct to a quick to a guide increase in agricultural production such as small and medium irrigation and drainage work. The construction of storage facilities and feeder roads and the development of local transport.

2. Land development and settlement.

3. More labor-intensive method of cultivation and the diversification of agricultural production.

4. The development of viable small-scale industries and handicrafts in a village.

CHIK BARAIK AND THEIR PROBLEM

The Chik Baraik is the only community who practices weaving. Prof. Vidyarthi has mentioned only four Artisan tribal communities in the Jharkhand - the Lohra, the Karmali, the Mahali and the Chik Baraik. They have a traditional and emotional attachment to this occupation and consider it a part of their flesh and bones. But due to social changes and impact, of modernization, their occupation is changed. Here some of the problems which are to be obtained the occupation of weaving are given:-

- The apathy of New Generation: - Development of education and modernization is the main problem of a new generation to obtain this traditional occupation.
- Average Profit: - According to the time and work or labour profit is average.
- Economy Problem**: -** Problem of an economy is the main theme to not adopting this occupation.
- Variety / Quality of product is very low.
- Weaving is a very slow process and painful.
- The weaving process is very ancient, the process of weaving is very laborious and the implementation is also ancient.
- Derivation of Market is also a problem of not adopting this occupation.
- Low level of school enrolment particularly in the case of female children.

ISSN 2394 - 7780

- High rates of drop-out from school especially the girl child.
- Participation of children in family economic activities like farming, cattle, weaving, cooking, fetching water and collection of forest produce.
- The poor childless aged couples are struggling for their livelihood every day and month.
- The transport facilities are very bad. There is no public transport. The transport facilities will be very useful for the villagers. Especially for aged to go out for the health check-up or other economic activity.
- Training programme for women is zero.

ECONOMY

Rural women play an important role in rural of Economic of the country. Role of rural and tribal women determines to a great extent the success or failure of several production programmes at a village level, which influences rural economic. They should also be trained in

1. Animal husbandry and Veterinary care.
2. Kitchen gardening
3. Mat making rope making etc. should be introduced in a large manner.

SOME SUGGESTION FOR OCCUPATIONAL DEVELOPMENT

1. Training facilities for a traditional weaver.
2. Their traditional looms are modified for better products.
3. For occupation (Cloths weaving) some research work is done and refresher course and orientation programmes are also arranged through proper channel.
4. Marketing of this weaves product is arranged by Govt. agencies.
5. Fixing the minimum prices of threads and good quality also.

The above recommendation should be sanctioned on the long-term basis, rather than on short-term basis, to ensure proper implementation and monitoring of programmes as well as to provide continuity to the project because development is a slow process.

PROBLEMS AND SUGGESTION FOR THE SOLUTION

Development of the tribal has been a major responsibility of. the government since independence. The present chapter takes some suggestion and recommendation for the development of Chik Baraik. As it is clear from the homographic report that this study has concentrated only on Chik Baraik people. The Government development programme should reach to door to door and help them to improve their present condition. In spite of various measures taken by the Government during the various plans. The success of any programme depends upon, the strict vigilance of the programme so that cent-percent benefits of the sanctioned money on various programme may reach to the beneficiaries. The suggestions have been classified into four basic groups

1. Education
2. Health
3. Economy and
4. Social life.

SOURCES OF ECONOMY

In the book "An Introduction to social anthropology" Majumdar and Madan (1960) have identified the main characteristics of the tribal economy. They have identified nine important traits of a primitive economy on the basis of the materials available to them on Indian tribes. These traits are:-

- The absence of technological aids.
- Use of barter and exchange.
- The absence of a profit motive
- Comparative and collective endeavor
- The slow rate of innovation

ISSN 2394 - 7780

- Regular market
- Manufacture of consumer innovations
- Absence of specialization
- 9. Display rather than an accumulation of wealth to show prosperity.

Prof. Vidyarthi (1958) made an attempt to classify the tribes of Bihar/Jharkhand in context of their ecology, economy, levels of integration and sequences of change. If we look to the Chik Baraik from this viewpoint, it will clearly show that the life of these people was organized on the basis of their specialized crafts which are in operation till today in certain parts of Chotanagpur.

ORIGIN OF THE CRAFT

The origin of the community and then development reflect that at one point of time they were very closely associated with the Nagabansi Raja and they were in the commanding capacity of the military force of the Raja. On being dissatisfied in the service their ancestor. Arjun Baraik was thrown away by the Raja and was threatened with dire consequences. In this hide out their ancestors took shelter in a Munda family. After being detected their he fled again away and took shelter in a rural weaver's family was in course of time he learned the art of weaving and took it as an occupation. His descendants have scattered themselves in the different village in search of better prospects of their occupation. In this way, their folk art was handed down from generation to generation and spread over the areas to change from nakedness on the lap of nature to a stage of using clothes and thereby hiding the natural beauty of the men and women.

PREPARATION OF THE LOOMS

In earlier days every family had a common loom for the use of the members of the family. The rooms were very traditionally which were used for generation and gradually handed down to their descendent as a common property. It needed ten to fifteen days of labour for preparing a loom. The different items needed are - Pirha, Bharne, Tagre, Dongi, Tane, Purni, Jhokhi, Baifare, Hatha, Hatha Dang, Bhandi, Bench, and Ponch. The working condition of most of the looms has detracted due to its unused in most of the villages. Some of the looms are still in their working conditions. Most of the looms are 30 - 50 years old as they were fixed by the grandfather of the present occupants. They informed that it may continue for another fifty years. However minor repairing must be made from time to time. In Sikariatand village only 3 looms are found and in Meromdega village 4 looms are found. But they do not weave clothes regularly. They informed that the season of weaving clothes starts from Kartik (Nov - Dec.) to Phagun (Feb. - Mar.) Sometime they also prepare clothes in Chait (Mar. - April) to Baisakh (April -May). Rest of the year they pursuing Agricultural work.

RAW MATERIALS

Cotton locally known as "Kapas" was the essential raw material needed for weaving. As mentioned earlier they used to grow cotton in their own land needed for the weaving. In present, they do not grow cotton. They purchase cotton thread from the nearest market. Traditionally charkha and Takli were used to prepare thread from the cotton. But in present days uses of Charkha and Takli is not founded. They purchase cotton thread from the market. The price of cotton thread in Simdega market is five hundred per Kg. Due to economically backwardness, they do not purchase cotton thread from the market. An informant Raju Baraik said that the raw material is produced by the trader. After founded Bundle of cotton thread from a trader or individually purchase from the market. The small bunches of cotton thread prepared by them were termed as Puni. Punnies were again combined to give the thread to a lasting variety.

COLORING OF THREAD

In earlier days white garments were supplied by these artisan tribes. But the colored items came later with the growing demand of their customers of the locality. They made experiments with the natural colors .and try to attract their customers to their colure clothes. At the initial stage, they collected red and purple-brown colors locally known as Katha color. Presently they also used green, dark green, yellow, blue etc. Colors in their garments. In earlier days coloring materials are made by natural products which are easily found in the forest. But in course of time, they do not color these garments. Because the different types of color threads are easily founded in the nearest market. Out of two villages, not any pieces of evidence were found that they are coloring the threads for weaving garments.

WEAVING PROCESS

The art of weaving needs the employment of both physical and mental labour. In addition to deep concentration, the mind and body must work in harmony at the time of weaving. The eyes of the weaver should take a proper

ISSN 2394 - 7780

view of each and every thread while he is operating the loom. If any thread is cut or dismantled, it should be joined or set properly with immediate action to get a good finished product. The process is very tedious.

The cross threads are prepared with the help of Pirha, Purni, and Tane for giving it the fera of the material. Lengthwise with the help of -these instruments threads are kept ready for weaving. For the use of the cross threads, the Bharne is hanged in the hole of the pirha which is fixed in the floor. The bundle of a thread is collected in the Bharne. Before the collection of the thread in Bharne, it must be deeper in the rice gruel to make it sticky and then it is dried. The bundle is collected in Bharne. One end of the thread is also twisted around the tesra which moves with the help of the hand in clockwise direction. The Bharne also moves according to the protecting spread to tesra. The required quantity of thread is collected from tesra and then transfer to Dongi. It becomes ready for weaving the cross lines threads. For the preparation of the lengthwise thread, pirha is fixed in the floor and the Bharne is fixed inside the whole of the pirha. Bundle of a thread is tied to the tane through purni. Tane is the fixed wooden poles fixed at a distance of four to six feet in length.

According to the requirement if a sari is needed to be weaved the length of the thread should be the length of the sari. For towel, it becomes of small length. The distance of tane is fixed according to the length of the weaving materials. After arranging the long threads they are transferred to the Racnh for weaving. It is made up of bamboo sticks with about seven hundreds of holes. Each stick contains the threads in a systematic way. The threads are passed to the wholes of Ranch with the help of Jhokni. It is also dependent upon the type of clothes they are preparing. The Ranch remains tightly connected with the Khairka Balait. With the help of Baifare, the Khairka Balait helps to lighten the long threads in the Ranch. Before properly tightening the thread in the Ranch the Baidare must be taken by the Khairka Balait. After loading the Ranch is placed in the looms (Hatha). The Hatha is kept hanging in the Hatha Dang which remain closely connected with the Bhandi. The unfinished materials for weaving are kept in a fixed position with the help of choupi. A bench is put behind the Bhandi on which the weaver sits at the time of weaving. Khundne remains connected at the bottom of the Hatha to be operated by the weaver with his legs. It is a paid of sticks directly connected with the Hatha. The weaver pushes down in the right leg Khundne which helps the right Dargi and right Thange to come down. The process continues with both the legs simultaneously.

For easy weaving, they put the sari in front of the Ranch which helps the long threads to come to the Ranch easily. The cloth is fixed at least two feet away -from the Ranch. In this way, the weaving can be completed in a day or two days.

PRODUCTS

Chick Baraik's main weaving products are Barki, Sari, Gamcha, Karya, Pichori, and Urmala. Of this presently Karya is not weaved, which is mostly used by Grazier. Due to uncertainty demands of clothes like Pichori (Chader), Urmala and four-sided angle bags are not weaves these days. Presently the weaving products are Barki, Sari, and Gamcha which is easily founded. The statements of the weaves products which is mostly used are given below:-

Barki:- It is also known as Bapa Sari. It is twelve hands long and four Bit a Broadcloth. One Baki is weaved in a minimum of two days. The labour charge of four weaves Barki is only Rs. eighty given by the traders.

Maya Sari:- In a tribal community, this sari is very important like Banarsi sari on occasion of marriage. It is twelve hands long and six and a half bita broad which is made on the white and red thread. In sari red threads are used in pars.

Gamcha -.-Most famous product of Chik Baraik. It is small in size which is generally one and a half longhand. It is generally used in the shoulder and covering the head.

MARKETING

The marketing of the Chik Baraik weaves product is not very good because they have clothes only on occasion they sell their few clothes. In the marketing curriculum, I observed that mostly the marketing segment is done by the Manre who is the trader of Chik Baraik clothes. I have seen mostly that in this region due to economic backwardness that the impossibility of purchase raw materials from the market so some traders produces raw materials to them. After weaves the product they gave some labour charges to Chik Baraik people which is sixty - eight rupees. One Kg weaves product. Here some prices product is given which is founded in this region of a market.

ISSN 2394 - 7780

Product	Selling prices
Sari	Rupees 300 - 350
Sail	Rupees 80 - 120
Gamcha	Rupees 40
Bags	Rupees 30-75

RELIGIOUS SIGNIFICANT

The local tribal and backward caste communities give due importance to the hand weaves clothes for the Chik Bariak during their ceremonial occasions like Chetti, marriage and death rituals.

NATURAL RESOURCES

Forest

Like other tribes of this reason, the collection of forest produces supplement their economic activities. It is a source for the collection of food items, raw materials, fuel houses construction materials, medicinal plants etc. the dependence on forest has to some extent reduced. But it helps them to improve their livelihood due to the fact that in addition to consuming a number of food items they can sell them in nearby urban areas. Among the number of sale items mention may be made of tooth cleaning sticks, leaf plates, wood, the twig of religious plants bamboo etc. They also get seasonal fruits roots, flowers, ropes etc. to them. The female members also with the children go to the forest for collecting these items during the season. During the rainy season, the Chik Baraik go to the forest and collect baby bamboo shoots for preparing sandhava. They also do casual and ceremonial hunting. Fishing has also retained its importance in the life of these peoples. However, it is a seasonal activity. During the monsoon season, they collect edible items like rugra and various types of mushrooms. The Chik Baraik collect all the items for consumption.

In the life of Chick Baraik, a forest has also got its religious importance. Karma and Sarhul are some festivals in which we see such importance.

The forest herbs, shrubs, creepers, roots, flowers, leaves, shoots \etc. also, provide a source of traditional medicine to these people. The Mahuwa plants play a very important role in the economic life of the tribal people of this region. The Chik Baraik are also mostly benefited by this trees. They collect Mahuwa flowers during the season which are consumed in different forms. The flower and fruits are used as food material and its seeds are also used for extraction of oil. The women collect the flower in a group. They fetch them in a basket make it dry in sun and preserve it for future. The main purpose of storing flowers is to prepare liquor.

Land

In different Chick, Baraik villages land can be differentiated into two broad categories which are for an agricultural purpose. Don is the best variety and Tanr is the worst types of land and varieties are named according to the composition and structures of the soil and the power of preservation of water in it. Don is quite suitable for paddy for which water is available for more than 4-6 months and rarely for the whole year. But tar is a barren type of land.

Share Cropping

Some owner of the land gives his land to a sharecropper due to large landed property on which he is unable to work himself. Generally, the rich persons prefer a poor man as a favor to sharecrop in his field.

Fertilizer

The villagers generally use cow dung as well as the mixture of the dung of goat etc. Cow dung used as fertilizer are collected in a pit either daily from cattle shed, or from outside (grazing ground). The size of the pit for dung varies from family to family in accordance with the number o£ cattle wealth. The Chik Baraik are also not against the use of chemical fertilizer.

Agricultural Requisites

The Chick Baraik tribe depends on their own traditional resources for the seeds and agricultural equipment. The seeds for sowing purpose are preserved in large earthen pots, the vegetable seeds can be had either from their neighbors or from the market. Regarding their agricultural implements, the traditional plough, axe, yoke, spade, sickle are yet in use. The iron part of the implement, used in the cultivation are generally made by the locals and sold in a local weekly market. But the Chik Baraik makes wooden part of each instrument themselves.

ISSN 2394 - 7780

Crops

There are two main crops grown by the Chik Baraik people which are practiced in the regular cycle. Almost all the Kharif and Rabi crops are grown at the beginning of the rainy season and start of the winter season. Accordingly, Kharif crop is known as "rainy season crop" and Rabi crop is called as "winter crop" the Kharif crops includes paddy, maize, Gondali, Marua etc.

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PROPERTY RIGHTS AND DEFORESTATION: A CASE STUDY OF RURAL DUMKA OF JHARKHAND

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INTRODUCTION

Forest cover in Dumka has been decreased by more than 35 percent over a period of less than fifty years. In some northern parts, the situation is even worse where as much as 75 percent of the forest-cover has disappeared since 1950. The government introduced an ambitious reforestation programme some years ago but the deforestation continues, especially in poorer areas and where the forest resources are open access in character. We see that poorer households utilize forest resources to a great extent, and consequently, the poorer strata bear the greatest burden of the continuing deforestation.

The prime cause of deforestation is fuel-wood collection, which accounts for more than 60 percent of the total Indian deforestation (World Bank 1995). It is therefore interesting to analyses in some detail how households produce and consume fuel-wood. This paper explores the fuel-wood linkages between open access areas and other forest plots with usufruct rights using a Random Parameter Logit (RPL) model with the aim of exploring potential substitution patterns between collection sites and the market alternative. These substitution patterns can be used by policy makers in their quest to halt the deforestation of open access areas by encouraging the substitution of open access fuel with energy from other types. To this end, a change in property right regime might be necessary and this paper will gain insights that can be important for this process.

Historically, the state was the holder of property rights but due to difficulties in monitoring and enforcing the rights, households looked upon the forests as open access resources. Recently, the forest act has allocated user rights together with managerial responsibilities to households. The reallocated lands show signs of forest recovery. The government has however, not been able to allocate all forest lands and the remaining unallocated areas are ridden with deforestation problems much like those associated with open access resources. The problem becomes critical because of adoption of new policy of industrial development.

The transfer of rights for state-managed public forests is a key feature of the forest policy dialogue in many developing countries. Its examples are infrequent and the economics literature discussing them is ineffective. Kant (1996), with examples from India identifies the combined conditions of large and homogeneous demands on the forest as necessary for successful forest management. Johnson (1988), reminds us with an example from Honduras that the residual claimant (usually the state's interest in final timber harvest values) generally suffers as local communities responsible for forest management extract their preferred forest products first. Hyde & Amacher (1998), with a Philippine example, concludes that when forest ministry requirements are too stringent, no community will be interested in a shared arrangement for management of the resource. The problem in Dumka is slightly different. In Dumka the no household contracts with the community and State, but they exist in the same communities where we also observe problems of forest depletion of open access forests for which no household is willing to enter an agreement. Amacher, Hyde, and Kanel (AHL, 1998), with examples from Nepal hypothesis that this situation occurs when fuel-wood (or resource) prices are high enough to justify private forest management on nearby lands, while the entire resource value on the more distant open access lands is dissipated in the collection activity. Insufficient resource value remains to justify management and protection of the household's (or community's) own investment in these lands and this is probably why households in our sample are reluctant to agree on supplying labour for resource protection (they must for example protect the area from unlawful use) and other managerial responsibilities. The contract offers compensation, but the level of this reward is too small to make up an effective economic incentive for engaging in forestry.

Our interest in open access areas is based on two concerns. First, there are external benefits from the protection of these areas such as erosion control and improvements in water quality. Second, if poorer households are more reliant on open access areas, there are distributional aspects that might be important to consider in policy making.

This paper uses household data from northern Dumka to assess preferences between fuel-wood sources. Households have in total four fuel-wood sources:

i) Market purchase, *M*, and collection from,

ii) The natural forest lands with newly established user rights *NF*,

iii) User-right plantations *P*, or

ISSN 2394 - 7780

iv) The open access state forest estate *OA*.

All households do not have access to all sites since user rights are exclusive. Hence, a household without a user right plantation is excluded from collecting plantation fuel. This implies that labour inputs are not substitutes across collection sites, and therefore we cannot aggregate the production.

A logit choice model is instead used to describe the choice of fuel-wood mix of the household. In particular, we use an extension of a multinomial logit model, or Random Parameter Logit (RPL), which allows for household specific heterogeneity and avoids the IIA property of ordinary logit models. Early contributions using the RPL were notably in the economics of transportation see Louviere et al (1999), but also Revelt and Train (1997). Recently, Train (1998), and Carlsson (1999), have used the framework for analyzing preferences for fishing sites and environmental considerations in the choice of transportation modes.

As explanatory variables in the choice probability model, we use the calculated shadow prices from a series of production function estimations, one for each fuel-wood source. Using this insight together with the predicted values of each production function, we subtract labour's share to obtain the producer's share.

2 Model Specification

Underlying the choice of fuel-wood source is the random utility model; see Ben-Akiva and Lehrman (1985), Long (1997), or Louviere *et al* (1999). The random utility model (RUM) assumes that a household chooses the alternative that maximizes the utility gained from the choice made. The alternative is described by a set of characteristics $\boldsymbol{X}$. We have chosen to carry out an empirical strategy with the aim of achieving a parsimonious set of parameters that captures the most essential economic aspects of the Choice decision. The empirical strategy is therefore to start with estimations of these production functions. Then we predict the producer's surplus from each source and discuss these in the context of contractual arrangements.

3 Description of the Data

The data is from a survey conducted during the third quarter of 1998. The data set contains 300 households in three communes, Dumka Block, Raneswer and Kathikund, and ten hamlets. The area under study is found in the predominantly hilly areas of Dumka district of Santhal Pargana province roughly 340 kilometers northwest of Ranchi the capital of Jharkhand. Seasonal patterns consist of two separate seasons; a rainy season between April and October and a dry season between November and March. The most frequent period used for fuel-wood collection is during the third quarter though large variations exist.

In total, there are about 22,500 households in the district of which roughly 11,700 have their primary income from agriculture. Two ethnic groups are represented, Santhal and Ho, of which the Santhal are in the overwhelming majority. Fuel-wood prices refer to rupaya, Indian currency. Though price is observed in most cases, we lack fuel-wood price information for 97 observations. For these, we have imputed the village average means as the relevant market price faced by the household.

The most frequently used source of energy supply is the private user right plantations (*P*) which are also closest in distance to household premises. These plantations are usually made up of fast growing species such as eucalyptus and acacia and not primarily designated for energy production. There are 229 households with access to plantation areas of which 145 have been collecting fuel-wood.

Second in order of importance for fuel-wood collection is the natural forest with user rights (*NF*). Of 149 households with contracts on natural forestland, almost all have been collecting fuel-wood. From these areas, households are allowed to take dry wood, and presumably, twigs from thinning. With the user right for natural forest, households agreed to protect the area.

Less frequently utilized for energy purposes are the deforestation stricken state forests, which are open access areas (*OA*). It was not possible to allocate these areas as households refused to obtain the user rights under the contractual regulations. Households do nevertheless collect fuel-wood and other non-timber-forest-products from *OA* areas. These areas are the primary targets for deforestation activities.

The data on fuel-wood collection includes male and female hours spent per trip, number of trips per month, forest area utilized, together with a variety of household and village characteristics. This wealth is measured by the value of durables within the households and valued by the respondent. If we in addition consider the value of forestland (which must be regarded as essential), the picture becomes even more dramatic. Besides being low in wealth, the average household that collects from open access areas has roughly one third less forestland. Obviously, this is a main reason for these households using *OA* as a source of fuel-wood. Gender and age of the collectors differ slightly depending on which source we examine. For *OA* areas, it is primarily

ISSN 2394 - 7780

adults conducting the collection. The same pattern is evident for collection from natural forests as well. In the plantation the pattern is different however; here, young household members are relatively more involved in the collection. Both genders contribute to the collection of fuel-wood. Two factors encourage males to engage in fuel-wood production. First, there is a non-negligible risk of being robbed or attacked while walking to and from the forest area. This risk increases the further away from the village centre the area is located. Male participation is therefore needed to reduce the risk of being attacked. Second, we also know that households have an incentive for protecting their forest and might in the case of interlopers, be liable to the Govt. and or see their fuel-wood collection diminish. The male participation in natural forest fuel-wood production is not as frequent as in the case of open access case though on average, males spend only half the time of female in the collection of fuel-wood from natural forests.

4 Econometric Specification

There are some econometric issues to be dealt with. First, it is not possible to aggregate the output and estimate one production function since factor inputs are not substitutes. Consider a household with an *NF* plot but without a plantation area *P*, and assume that they collect from an *OA* source as well. If we were to aggregate these into one aggregated output and run the estimation for all households, it would potentially lead to a miss-specified econometric model. The labour input to production of fuel-wood from *P* would most accurately be a missing value as the household is excluded from this production possibility. Transforming these from missing values to zero would also be inappropriate since we then would assume that the household chose not to invest in labour due to particular preferences when they in fact are prevented from doing it. Hence, aggregating all three production possibilities would result in a very small sample inadequate for making inference on.

On the other hand, we could strive to use a logit model for the choice of production of fuel-wood. There are two obstacles to this approach: first, we will have no information on those households which conduct market purchases and will therefore not be able to estimate cross effects from collection sites on market behavior. Second, considering the small sample and the relatively large number of exogenous variables in each production function, random parameter logit estimation might become exceedingly difficult. We opt instead for conducting the analysis in two steps, where in the first stage we estimate shadow prices that are used in the second step to analyze the choice of fuel-wood mix. A drawback of this procedure is lack of precision in our parameter estimates since we are not able to correct for the standard errors that accompany our covariates in the choice estimation.

Another question is related to the relevant sample for each of our fuel-wood sources and the subsequent econometric technique used. In the case of fuel-wood production (*FW*) from plantation land (*P*), there are 229 households that have plantation land (of a total of 300) and obviously all 229 households are potential collectors from *P*. Only 145 have conducted any collection however. If there is a systematic and unobserved pattern among non-collectors, OLS estimates will be biased. We need then to correct for the selection effect. If furthermore selection occurs for households with plantation land, the estimation requires a double hurdle where the collecting household, has to pass two selection procedures before the final estimation (first it has to possess *P* and secondly, it has to collect *FW* from *P*). The path chosen here is a robust sample selection model since we could not find any significant double hurdle effect (first selection criterion was insignificant) that could explain the two-tier selection bias.

In the *NF* production, there are 149 households with *NF* areas and of these, 145 collect fuel-wood. Hence, an econometric technique such as the Heckman is suitable if we are concerned to about correcting for sample bias. This is also the path chosen. The same bias is potentially valid for the case of *OA* production as well.

Hence, we need to correct for sample selection in all three estimations. This means that we have to decide on what exogenous variables to use in the selection or decision equation. In general, it is likely that resource availability and substitutes affect the decisions. Likewise, factor input availability and composition are also two reasonable candidates for being important factors affecting the decision. This implies that labour availability and its composition should be included when we try to model the decision process. The composition is important if there are special requirements put on labour such as stamina needed for walking long distances.

There is furthermore a common view that poor households dominate the use of open access resources, thus, the wealth level could be significantly affect the decision to collect. Finally there might be cultural differences in preferences for forestry, and therefore we have included a dummy for ethnic background.

Some of the decision indicators differ between collection sources, since there are differences between the

ISSN 2394 - 7780

samples. In the collection from *P* and *NF* for example, the relevant indicators of labour availability are assumed to be the size of the household and the share of females, while in the case of production from open access, the availability is better explained by the number of adults since few young household members collect from these areas. Other differences are present, see further below.

5 Empirical Results

Here we use our data to estimate a series of fuel-wood production functions from our three distinct sources. The objective is to calculate shadow prices for each source are:

A. Production from Plantations

B. Production from Natural Forests

C. Production from Open Access Resources

D. Producer Share

F. Choice of Source

We do have market prices for most households and the prices of the collected fuel-wood. The latter must theoretically be the lower bound of fuel-wood prices from *OA*, otherwise households would prefer *OA* fuel under the assumption that they are being rational. It is slightly more difficult to find the upper bound since there is nothing that guides us to which exact upper bound to choose. The market price is one candidate, and a reasonable one since it is higher than shadow prices for all observations. But there is no theoretical guiding principle that states the correct choice. It might as well be slightly higher than the market price. Generating this mean is the ethnicity of the household, and this implies that Santhal and Ho households have significantly different estimates.

From a policy perspective, it is interesting to analyses the cross price effects, that is, to see how a change in the price of one fuel type affects the collection of other fuels. This will enable us to detect potential entry points for policy interventions since our shadow prices are influenced by changes in the contractual agreement between households and governmental bodies.

Of the available sources, market transactions are most rare and at the other end, plantation fuel is most commonly used as a source of fuel. Not many households use both open access and natural forest simultaneously; much more frequent is the simultaneous use of plantation and open access. We would therefore expect that there is a strong opportunity to switch between open access sources and plantations while less of a possibility between natural forest and open access.

In effect, there are a number of potential avenues for Indian forest policy makers. First, if Govt. would change the contracts on the management of P, it would have a relatively strong impact on OA collection. Second, authorities can decide to impose heavier enforcement on the protection of OA areas. Third, and perhaps the most tractable in the long term is to improve the productivity of P, thus increasing availability of fuel and making it cheaper to collect. This option requires, for example, targeted subsidies to households for increased planting of trees. The latter option also has a positive impact on sustainability. In the short term this option would have less of an impact of course, but already in the medium term households would be able to produce twigs from the newly planted stock. A combination of contractual relief and investment subsidies is obviously the most attractive alternative.

Given the budget constraint faced by relevant institutions, it is unlikely that any of the more effective policy suggestions will be implemented. Nevertheless, judging, if authorities and international donors are anxious to save the remaining open access forest in Rajmahal, Pakur they should concentrate on policies that primarily affect fuel from *P* since the cross price effect is strongest between *P* and *OA* resources. Since supplying necessary funds can be difficult with Vietnamese budget constraints there is great scope for international assistance.

CONCLUSIONS

In the past, households were left to use areas that in effect were open access despite the fact that they originally belonged to state. Thus, the introduction of user rights for natural forests and plantations has meant a substantial improvement for the households as a relatively large share of their energy demand is now under their control. Still, remaining open access areas are ridden with deforestation problems, implying that the present energy supply is not sustainable. Clearly, we have found that poorer households are utilizing the open access areas more frequently relative to other household categories. Deforestation of these areas therefore implies a

ISSN 2394 - 7780

serious threat to the poorer strata. The wealth impact must be regarded as expected. Hence, protecting these areas from deforestation would yield benefits to poverty reduction schemes and consequently increasing the attractiveness of reforestation schemes to international donors. We have also found evidence of differences in preferences between ethnic groups. The Santhal are to a greater extent forced into long-term commitment of supplying labour to forestry activities that in turn might impede their future welfare levels by limiting available income generating activities. There are some broad issues for the Govt. to consider. One potential avenue is for the Govt. to change the forest regulations in favour of household.

In principal then, the paper supports three policy interventions. Assuming that stricter enforcement of *OA* is too costly, policies should focus primarily on the rules that regulate collection of energy from plantations, for example by making it possible to increase the collection from these plots (remembering of course that the production should be sustainable). Second, *OA* forest plots could be allocated to present users with a minimum of managerial responsibilities thus benefiting those receiving user rights. Third, preferably this allocation could be accompanied by a cash and seedling compensation scheme to increase future productivity of the plantation (and perhaps *NF*) plots that serve as substitutes to the open access land.

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EFFECT OF METRONIDAZOLE COMPOUND, ANTI-JUVENILE HORMONE ON BIVOLTINE SILKWORM, *Bombyxmori* L.

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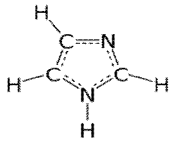
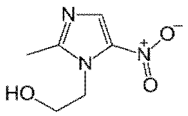
ABSTRACT
Effect of Metronidazole, anti-juvenile hormone on different metamorphic stages of silkworm BombyxmoriL. was studied. Experiments were performed by 100 mg/l, 200mg/l concentration of Metronidazole. A control set was also maintained with each set of experiment. Economic parameters viz., fecundity, hatching percentage, larval duration, larval body weight, Single Cocoon Weight (SCW), Shell Percentage etc. (SR%), of Bombyxmoriwere recorded. Larval duration of treated batches is reduced by 4-5 days helping for reducing cost of labour and leaves leading to success of crop are the interested findings with the application of 400mg/l of metronidazole. Application of Metronidazole will be useful for producing fine denier silk filament in the interest of academic work.

Keywords: Bombyxmori, Larval period, Metronidazole compound , Shell Ratio %

INTRODUCTION
Larval growth, moulting and metamorphosis of insects are generally known to be under the direct regulation of two hormones, Juvenile Hormone (JH) and moulting hormone (ecdysone). Anti-JH activity has been reported on some natural and synthetic compounds (Murakoshi&Ichimoto, 1972). A new class of compounds with anti-JH activity against silkworms, *Bombyxmori* L. has been found in a group of terpenoid imidazole (Kuwanoet al.,1983 and 1984). One of them, metronidazole, was demonstrated to be effective in the induction of precocious metamorphosis in IV instar and V instar silkworms when fed with food. In silkworm *B.mori*, precocious metamorphosis could be induced by manipulating external factors such as temperature and moisture (Iwashita, 1963). Some chemical with anti-JH activity have recently been demonstrated to be useful for sericulture for producing fine denier cocoon filament (Akai et al.,1984; Guet al.,1988).This compound was assumed to be a kind of anti-juvenile hormone which inhibits the juvenile hormone synthesis in corpus allatum (Asano et al.,1984 b ; Kuwanoet al.,1985). Metronidazole (2-methyl-5-nitroimidazole-1-ethanol) is the derivative of imidazole whose structures are as follow:



IMIDAZOLE



METRONIDAZOLE

Imidazoles inhibit ecdysone synthesis in prothoracic gland of silkworm without killing the cells (Kadono-Okuda et al.,1987, 1994; Yamashita et al.,1987). Effective induction of precocious metamorphosis in *B. mori*larvae has been reported after the use of these imidazole derivatives (Kuwanoet al.,1983, 1984, 1985). Among the imidazoles reported to be useful in sericulture from the standpoint of producing fine cocoon filament in *B. mori* (Akai et al., 1984, 1986; Kanda et al., 1985), increase in SR% by application during fifth instar in *B. mori* (Kiuchi and Akai, 1985; Kiuchi, et al., 1985), increase in fecundity in *B. mori* (Kawaguchi et al., 1993).

MATERIAL AND METHODS
B. mori L. (Breed: Nistari) were used for experiment and reared with the standard schedule of rearing (Krishnaswami, 1986). The silkworms reared with S1 variety of mulberry leaves. IV instar larvae at '0' hour were taken for experiment. Three replications with 100 larvae per replication were kept. The experiment was conducted during September-October (Season-1), December-January (Season-2) and February-March (Season-3) seed crop seasons for two years (2014 and 2015).

Metronidazole tablets of 100 mg. and 200 mg. were purchased from local market (Make:Unique, Batch No. DM 85112). The tablet has been dissolved in Fresh mulberry leaves were dipped into respective concentrations of solution for 15 minutes in order to facilitate soaking of the chemicals. Then the mulberry leaves were kept on plastic rearing tray for 25-30 minutes for semi- drying and fed to the treated silkworm larvae at an interval of 6 hours. In control lots, fresh mulberry leaves were dipped in distilled water for 15 minutes, then semi-dried and fed to the silkworms simultaneously.

ISSN 2394 - 7780

The data on economic parameters viz., fecundity, hatching percentage, larval duration, larval body weight, Single Cocoon Weight (SCW), Shell Percentage etc. (SR%), of *Bombyxmori*were recorded from experiment and control batch.

RESULTS

(i) **Effect on the larval period:** The larval duration of IV. Instar was prolonged by 2-3 days and the 5th instar was completely skipped off by applying the Metronidazole solution. As a result the total larval period was significantly reduced, when compared to control (Table-1) and most of the larvae entered into precocious metamorphosis without ecdysis at higher dose of chemical.

(ii) **Body weight: The** larval, pupal as well as adult weight significantly decreased in all the treated larvae with the chemical, when compared to the control (Table-2). The result agrees with the findings of Kuwanoet al. (1985), Akai et al. (1984) and Trivedyet al. (1994).

(iii) **Single Cocoon Weight (SCW):** The cocoon weight of treatment lots was significantly decreased in all the three seasons compared to controls. Average maximum single cocoon weight (0.522 g) was recorded during September in treatment (T1) lots (Table-3).

(iv) **Cocoon Shell Percentage (SR %):** Cocoon shell percentage was significantly lower in treatment lower in treatment lots in comparison to control lot in all three seasons.

(v) **Sex ratio:** Interestingly, it was observed that male percentage was more than the counter female in treatment lots compared to the control lots. In the treatment lots **(**T2**)** male % (91.66%) was reported during February.

(vi) **Fecundity & Hatching %:** Fecundity of the treatments lots were found lower than that of control lots. But no significant difference was observed in hatching percentage among the treatment and control lots.

Table-1: Effect of metronidazole at different concentration on larval period of IV & V instar of silkworm (Con. = Control; T1 = Treatment at 100 mg/l concentration; T2 = Treatment at 200 mg/ l concentration).

Season	Larval period (days)								
	IV instar			V instar			TOTAL (IV & V)		
	Con	T1	T2	Con	T1	T2	Con	T1	T2
S-1	4	9	7.5	7	no IVmoulting		11	9	7.5
S-2	4.5	9.5	8.5	7.5	no IVmoulting		12	9.5	8.5
S-3	4	9	7.5	7.5	no IVmoulting		11.5	9	7.5

Table-2: Effect of metronidazole at different concentration on larval, pupal and adult moth weight of silkworm. Duration of larval period of IV instar, V instar and Total at control, T1 (100 mg/l) and T2 (200 mg/l).Vertical axis indicating the number of days. Con = Control; T1 = Treatment at 100 mg/l concentration ; T2 = Treatment at 200 mg/l concentration.

Season	Pupal weight (g)						Adult moth weight (g)		
	Con	T1	T2	Con	T1	T2	Con	T1	T2
S-1	2.1	1.5	1.6	0.092	0.050	0.057	0.450	0.250	0.280
S-2	2.2	1.6	1.7	0.090	0.050	0.056	0.498	0.270	0.300
S-3	2.1	1.5	1.6	0.090	0.048	0.055	0.426	0.265	0.292

Table-3 :Effect of metronidazole at different concentration on SCW, SR% of cocoon of silkworm.Con = Control ; T1 = Treatment at 100 mg/l concentration ; T2 = Treatment at 200 mg/l concentration.

Season	**Single Cocoon Weight [SCW] (gm)**			**Cocoon Shell Percentage (SR%)**		
	Con	T1	T2	Con	T1	T2
S-1	1.254	0.493	0.485	14.73	13.79	13.36
S-2	1.210	0.501	0.496	13.86	11.77	11.39
S-3	1.269	0.524	0.512	13.12	12.02	11.87

Table-4: Effect of metronidazole at different concentration on sex ratio percentage of silkworm.

Season	**Sex-ratio percentage**					
	Con		**T1**		**T2**	
	Male	Female	Male	Female	Male	Female
S-1	61.4	39.6	79.3	20.7	91.6	8.4

ISSN 2394 - 7780

S-2	61.2	39.8	73.7	26.4	80.2	19.8
S-3	57.3	42.7	72.4	27.6	78.8	21.2

Con = Control ; T1 = Treatment at 100 mg/l concentration ; T2 = Treatment at 200 mg/l concentration.

Table-5: Effect of metronidazole at different concentration on Facundity, hatching % of cocoon of silkworm.Con = Control ; T1 = Treatment at 100 mg/l concentration ; T2 = Treatment at 200 mg/l concentration.

Season	Facundity			Hatching Percentage		
	Con	T1	T2	Con	T1	T2
S-1	448	187	182	96 %	92.5 %	92 %
S-2	426	178	171	94 %	92 %	92.5 %
S-3	405	177	166	93.5 %	91 %	90 %

Fig-1: Larval growth in control and treatments (T1 and T2) lots.

RESULT AND DISCUSSION

The chemical induction of precocious metamorphosis in silkworms has been demonstrated by dietary application of kojic acid (Murakoshi, 1972), its related compounds (Murakoshi and Ichimoto, 1972), imidazole derivatives (Akai et al., 1984; Kiuchiet al., 1985) and these chemicals strongly inhibit the ecdysteriod levels in haemolymph (Kadono-Okuda et al.,1987; Kiuchi and Akai, 1988). In order to trimoulting induction to tetramoulter strain, used metronidazole compound solution (100 mg/l and 200 mg/l), a derivative of imidazole, with the mulberry leaves. Their feeding period was prolonged by 2-3 days in the IV instar and V instar was completely skipped off. As a result, total larval period was reduced by 4-5 days compared to that of the control. The said chemical treatment might have upset the hormone levels in the 4th. instar and resulted in the production of trimoulter cocoons. Similar results were observed in the silkworm treated with KK- 42 (Trivedyet al., 1994; Banerjee and Deb, 1999; with SSP-11 (Kiuchiet al., 1985; Akai *et al.*, 1984). They also reported that precocious metamorphosis in *Bombyxmori* can clearly be induced by treatment of imidazole derivatives and that these chemicals strongly inhibit the ecdysteroid levels in haemolymph (Kadono-Okuda et al., 1987; Kiuchi and Akai, 1988).

The larval period was shortened by the anti-JH action resulting in smaller matured larvae followed by smaller cocoon and miniature pupae. Emerged adults from the pupae of treatment lots were about 65% normal size and all could mate and laid viable eggs. The decrease in the larval weight might be attributed to the reduction in the larval duration. Similar observations were recorded by Akaiet al., 1984 in SSP-11 treated silkworms. The moths, though smallerwereas viable as controls, as also observed by Kuwanoet al., 1983; Banerjee and Deb 1999.

Significant reduction in fecundity was observed in treated than controls which agree with the observations of Kimura et al., (1986). As the juvenile hormone plays an important role in oogenesis, its inhibition by the AJH may be the reason of the reduced fecundity. But the treatment males, in the study, were in no way inferior to the control males as breeding partner who corroborates the findings of Banerjee and Deb (1999).

Staalet al.,(1981) reported that the mechanisms of AJH in silkworm can be interference with the neural and hormonal regulation of corpora allata, interference with JH biosynthesis in corpora allata and interference with JH transport and JH receptor. These facts suggest that the present test chemical might have epoxidation inhibition to juvenile hormone in corpora allata of the insects.

The cocoon weights have been reduced by about 30% of the cocoon weight of control lots. This is due to the less food intake during shortening larval period of treatments lots following metronidazole (a derivative of imidazole) treatment. Imidazole induced reduction of cocoon weight corroborates the earlier finding of Staal

ISSN 2394 - 7780

(1981), Kanda et al., (1985), Akai et al., (1986) Kiuchiet al., (1986), He and He (1994), Himantharajet al., (1996) and Banerjee and Deb (1999).

The cocoon and shell weight have been 20% reduced of the control lots which conformity with the observation of Kanda et al., (1985), Kiuchiet al., (1986) and Himantharajet al., (1996).

In this finding, only 38% egg production was noticed in treatment lots in comparison to control lots. Kawaguchi et al., (1993) also reported that the egg production in treated lots of KK-42 was only 40% than their control counterparts.

Considering the advantages of rearing of *B. mori* larvae through the application of metronidazole (derivatives of imidazole), it appears that better rearing management is possible due to the following reasons : a) it shortens the duration of larval span by 4-5 days thus saving labour and leaf; b) due to the skipping off of the 5th. larval instar, incidence of diseases are less resulting in better survival of larvae and good pupation rate and c) moths of treatment lots are more active compared to those of control lots with less percentage of fertilized eggs (Xueet al., 1990, 1994; Xue 1992; He and He, 1994).

This justifies the present attempt of using metronidazole (derivatives of imidazole) for the induction of trimoulters and to find out the impact of these compounds on economic and reproductive characters of *B. mori* for further utilization of these compounds in large scale.

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UNCERTAINTY ANALYSIS FOR SOLAR PARABOLIC COLLECTOR

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ABSTRACT
Globally demand for unconventional energy is increased due global warming and pollution created by limited sources of convectional energy. Solar energy is abundantly available on earth and non-depletion in nature. Solar energy is excellent choice but utmost drawback of it that is dispersed in nature which need a device called concentrator, which is used to gathered and amplify concentration of solar insolation. Parabolic trough collector is extensively used concentrator for industry and power plant. Parabolic trough collector has many designed and operating parameters, certain variations in these parameters may affect the final outcome of the system. It is required to know uncertainty of these measurement of given prototype of SPC to find its effectiveness. Uncertainty analysis is performed for designed and developed prototype of SPC.

Keywords: Solar Energy, Parabolic Trough Collector, Uncertainty, Measurement, Uncertainty analysis of PTC.

1. INTRODUCTION
There is substantial requirement of clean energy is increasing nowadays due to increasing population, increasing utilization pattern of energy by mankind & Industry, increasing global pollution and limited source of fuel for conventional form of energy leads increasing the dependency on fossil fuel. Therefore need to have non convectional form of energy like ocean, wind, geothermal, and solar energy. Number of countries now focusing on solar energy.

There are two ways to gain electricity from the sun energy. First by using the concentrating solar thermal system. In this method heat from sun is focused to produce steam. The steam will run a generator to produce electricity. This type of configuration is typically used in solar power plants. In other way photovoltaic (PV) cell is used to convert heat to electricity.

2. THEORETICAL BACKGROUND OF THE SOLAR PARABOLIC TROUGH
2.1 Solar Parabolic Trough
The distinguishing feature of the parabolic structure is that it reflects all the parallel rays to the focal length. The two dimensional design of a parabolic concentrator is equals to a parabola. It is extensively used as a reflecting solar concentrator. Its distinctive property is that it can focus all the parallel rays from the sun to a single focus point, it is not needed to use the whole part of the parabola curve to construct the concentrator. Most of the parabolic concentrator employs only a truncated portion of the parabola. Although this concentrator could provide a high concentration, it requires larger field of view to maximize the sun energy collection. To obtain maximum efficiency, it needs a good tracking system, which is quite expensive. That is why this type of concentrator is not preferred in a small residential house.

A large amount of solar energy is available in thermal form. The collection and concentration of solar thermal energy on the object is done with the help of Parabolic Trough Solar Collector (PTSC) for the temperature range 60- 600°C. Solar flat plate collectors are available for temperature range lesser than 100°C.

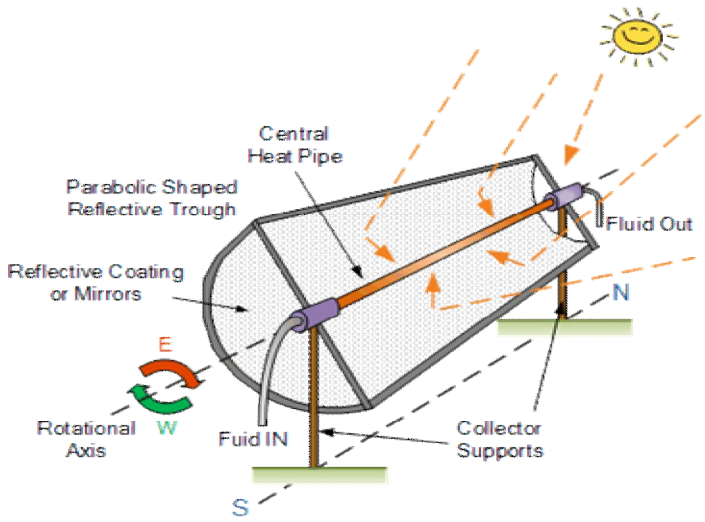

Fig-1: Schematic of parabolic trough collector

ISSN 2394 - 7780

2.2 Different components and measurement used for SPTC system

Following are main components of parabolic through collector. Assembling of all part to form PTC. Absorber tube of PTC is very important component which transfer heat to fluid flowing inside of absorber tube which it received from outer surface of absorber tube which is being reflected by reflective surface.

A. Component used to form PTC system.

- *Parabolic Shaped Structure*
- *Reflective Surface*
- *Receiver Tube or Absorber Tube*
- *Support Structure or stand*
- *Water supply and storage*

B. Measuring instruments used for PTC system

- *Thermometer*
- *Thermocouple*
- *Flow measurement*
- *Solar Insolation measurement*
- *Wind velocity measurement*

3. UNCERTAINTY

In experimentation, measurement uncertainty is a non-negative parameter characterized by the spreading of the values attributed to a measured quantity. All measurements taken with instruments are liable to have uncertainty and result of measurement considered completed only when it is supplemented by a statement of the linked uncertainty.

The aim of a measurement is to get the true value of the measurand. All possible efforts are made to optimize the measurement procedure to ensure closeness of measured value to the true value. In spite of due care taken, our measurement result will be just an approximation of the true value, not the actual or true value which will at all times persist anonymous to us. Therefore, we can't know the exact closeness of our measured value to its true value, due to some uncertainty associated with our approximation. The difference between the measured value and the true value is called error. The error can have either a positive or negative sign.

All measurements have a certain degree of uncertainty irrespective of precision and accuracy of the instruments. This is produced by two factors, the constraint of the measuring instrument (called systematic error) and the skill of the operator making the measurements (called random error).

The quality of the measurement result, its accuracy, is characterized by measurement uncertainty which defines a probable range around the measured value where the true value lies.

4. UNCERTAINTY ANALYSIS FOR SPTC

4.1 Measured Parameters of SPTC

In Table 1 various design dimensions used in the experiment and its measuring instruments with their least count and uncertainty are listed. Instrument uncertainty equals the half of its least count value. This means any measurement taken with instrument have an equal probability that it lies within + half of its least count. However, to safeguard the mean of the frequent measurements to lie within the uncertainty domain, uncertainty in measurements is taken equal to the least count value of the instrument.

Table-1: Uncertainty range of the various instruments and measurements

Sr.	Parameters used	Symbol	Instruments used	Least Count	Uncertainty
1	**Parabolic Trough** Dimensions:				
	Length: 1.85 m	L	Measure tap	0.1 cm	± 0.1 cm
	Width: 1.1 m	W	Measure tap	0.1 cm	± 0.1 cm
	Focal length: 0.4 m	F	Steel Scale	1 mm	± 1 mm
2	**Absorber tube :**		Vernier calipers		
	Pipe diameter: 0.0159 m	D_o	Measure tap	0.02 mm	± 0.02 mm
	Pipe length: 2 m	L		0.1 cm	± 0.1 cm
3	**Glass cover:**				

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	Cover length: 2 m Cover diameter: 0.058 m	L D_{co}	Measure tap Vernier calliper	0.1 cm 0.02 mm	± 0.1 mm ± 0.02 mm
4	Temperature	T	Thermocouple	0.1°C	± 1.1°C
5	Solar Insolation	I(t)	TES-1333R	10 W/m^2	± 10 W/m^2
6	Wind Velocity	V	Anemometer	0.1 m/s	± 0.1 m/s
7	Flow measurements:	ml	Measuring Jar	10 ml	± 10 ml

4.2 Spreading of Uncertainty in Measured Parameters

The technique (suggested by Omar Badran, 2007) for the estimating the uncertainty in the experimental results are presented here. To compute some desired result of the experiment (R) assume a set of measurements are made in order to measure "n" number of experimental variables. These measurements are then used thus,

$$r = f(X_1, X_2, X_3.....,X_n) \quad (1)$$

Let ω_r be the uncertainty in the result and ω_1, ω_2, ω_3,.....ω_n be the uncertainties in the independent variables. The Resultant uncertainty is calculated according to the equation proposed by (J P Holeman, 1994) as follows:

$$\omega_r = \left[\left(\frac{\partial r}{\partial X_1}\omega_{X_1}\right)^2 + \left(\frac{\partial R}{\partial X_2}\omega_{X_2}\right)^2 + ...+ \left(\frac{\partial R}{\partial X_n}\omega_{X_N}\right)^2\right]^{\frac{1}{2}} \quad (2)$$

Eq. (A2) is divided by the result r and rearranging it into the form

$$\frac{\omega_r}{r} = \left[\left(\frac{1}{r}\frac{\partial r}{\partial X_1}\omega_{X_1}\right)^2 + \left(\frac{1}{r}\frac{\partial R}{\partial X_2}\omega_{X_2}\right)^2 + ...+ \left(\frac{1}{r}\frac{\partial R}{\partial X_n}\omega_{X_N}\right)^2\right]^{\frac{1}{2}} \quad (3)$$

4.3 Calculation of Uncertainty in Measured Parameters

4.3.1 Parabolic Trough aperture area, (A)

$$A = L \times W$$

$$\frac{\partial A}{\partial L} = W \text{ and } \frac{\partial A}{\partial W} = L$$

Therefore, from Eq. (A3)

$$\frac{\omega_A}{A} = \left[\left(\frac{1}{A}\frac{\partial A}{\partial L}\omega_L\right)^2 + \left(\frac{1}{A}\frac{\partial A}{\partial W}\omega_W\right)^2\right]^{\frac{1}{2}} \quad (4)$$

$$\frac{\omega_A}{A} = \left[\left(\frac{\omega_L}{L}\right)^2 + \left(\frac{\omega_W}{W}\right)^2\right]^{\frac{1}{2}}$$

$$\frac{\omega_A}{A} = \left[\left(\frac{0.001}{1.85}\right)^2 + \left(\frac{0.001}{1.1}\right)^2\right]^{\frac{1}{2}}$$

= 0.00106 or 0.106%

4.3.2 Absorber tube area (A_a)

$$A_a = \pi D_o \times L$$

$$\frac{\partial A_a}{\partial L} = \pi D_0 \quad \text{And} \quad \frac{\partial A_a}{\partial D_o} = \pi L$$

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Therefore, from Eq. (3)

$$\frac{\omega_{Ao}}{A_o} = \left[\left(\frac{\omega_D}{D}\right)^2 + \left(\frac{\omega_L}{L}\right)^2\right]^{\frac{1}{2}} \quad (5)$$

$$\frac{\omega_{Ao}}{A_o} = \left[\left(\frac{0.00002}{0.0159}\right)^2 + \left(\frac{0.001}{2.0}\right)^2\right]^{\frac{1}{2}}$$

= 0.00135 or 0.135%

4.3.3 Glass cover area (A_c)

$$A_C = \pi D_C \times L$$

$$\frac{\partial A_c}{\partial L} = \pi D_c \text{ and } \frac{\partial A_c}{\partial D_c} = \pi L$$

Therefore, from Eq. (3)

$$\frac{\omega_{Ac}}{A_c} = \left[\left(\frac{\omega_D}{D}\right)^2 + \left(\frac{\omega_L}{L}\right)^2\right]^{\frac{1}{2}} \quad (6)$$

$$\frac{\omega_{Ac}}{A_c} = \left[\left(\frac{0.00002}{0.058}\right)^2 + \left(\frac{0.001}{2.0}\right)^2\right]^{\frac{1}{2}}$$

= 0.00061 or 0.061%

5. CONCLUSION

It is required to have minimum value of uncertainties it can achieved by properly selection of measuring instrument, timely calibration of instruments, correction to compensate error, repeating measurement or checking by other method etc. Measurement are taken for PTC on daily basis for Performance evaluation. Almost all care taken to for measurement and calculation of uncertainty for solar parabolic trough concentrator's design and operations. It is found that evaluated uncertainties are within limit or nearer to its least count.

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