Volume 6, Issue 2 (XXIV)
April - June 2019

ISSN 2394 - 7780

International Journal of
Advance and Innovative Research

Indian Academicians and Researchers Association
www.iaraedu.com

International Journal of Advance and Innovative Research

Volume 6, Issue 2 (XXIV): April - June 2019

Journal - 63571

UGC Journal Details

Name of the Journal :	International Journal of Advance & Innovative Research
ISSN Number :	
e-ISSN Number :	23947780
Source:	UNIV
Subject:	Multidisciplinary
Publisher:	Indian Academicians and Researchers Association
Country of Publication:	India
Broad Subject Category:	Multidisciplinary

International Journal of Advance and Innovative Research

Volume 6, Issue 2 (XXIV) : April - June 2019

CONTENTS

Research Papers

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019

ISSN 2394 - 7780

A REVIEW ON EDUCATIONAL DATA MINING IN FIELD OF EDUCATION

Sonali Sagar Kharade
Assistant Professor, (C.S.), SSR College of Arts Commerce and Science, Silvassa

ABSTRACT

Educational Data Mining(EDM) means using data to learn about students and instructors. Educational Data Mining (EDM) describes a research field concerned with the application of data mining, machine learning and statistics to information generated from educational fields like universities, higher schools, colleges and intelligent tutoring systems. Educational Data Mining (EDM) is an emerging discipline, concerned with developing methods for exploring the unique types of data that come from educational fields, and using those methods to better understand students, and the settings in which they learn.

The main objective of higher education institutions is to provide quality education to its students. One way to achieve highest level of quality in higher education system is by discovering knowledge for prediction regarding enrolment of students in a particular course, detection of unfair means used in online examination, detection of abnormal values in the result sheets of the students, prediction about students' performance and so on. Present paper is designed to justify the capabilities of data mining techniques in context of educational settings by offering a data mining model for education system in the university. In this paper a review on uses of data mining in educational field were discussed, the classification task is used to evaluate student's performance and as there are many approaches that are used for data classification, the decision tree method is used here. By this task we extract knowledge that describes students' performance in semester examination. It helps earlier in identifying the dropouts and students who need special attention and allow the teacher to provide appropriate Information.

Keywords:-Data Mining, Educational Data Mining, Methods of EDM used in educational field, Application and trends.

INTRODUCTION

While reviewing and understanding the concept of EDM in Educational Field it was observe that doing analysis of educational data is not enough is not itself a new practice, recent developments in educational technology including the increase in computer power and the ability to log crisp and clear data about student's, use of computer based learning environment have led to an increased interest in developing techniques for analyzing the large amounts of data generated in educational field. This interest translated into a series of EDM workshops held from 2000 till now as part of several international research conferences.

As interest in EDM continued to increase, EDM researchers established an academic journal in 2009, the Journal of Educational Data Mining, for sharing and disseminating research results. In 2011, EDM researchers established the International Educational Data Mining Society to connect EDM researchers and continue to grow the field.

With the introduction of public educational data repositories in 2008, such as the Pittsburgh Science of Learning Centre's (PSLC) Data Shop and the National Center for Education Statistics (NCES), public data sets have made educational data mining more accessible and feasible, contributing to its growth. Baker and Yacef describes the following four goals of EDM:

1. ***Predicting student's future learning behavior*** - With the use of student modeling, this goal can be achieved by creating student models that incorporate the learner's characteristics, including detailed information such as their knowledge, behaviors and motivation to learn.
2. ***Discovering or improving domain models*** - Through the various methods and applications of EDM, discovery of new and improvements to existing models is possible.
3. ***Studying the effects of educational support*** - It can be achieved through learning systems.
4. ***Advancing scientific knowledge about learning and learners*** - By building and incorporating student models, the field of EDM research and the technology and software used.

The purpose of this paper is to synthesize and share my personal experience by reviewing some research papers and observing the behavior of educational settings.

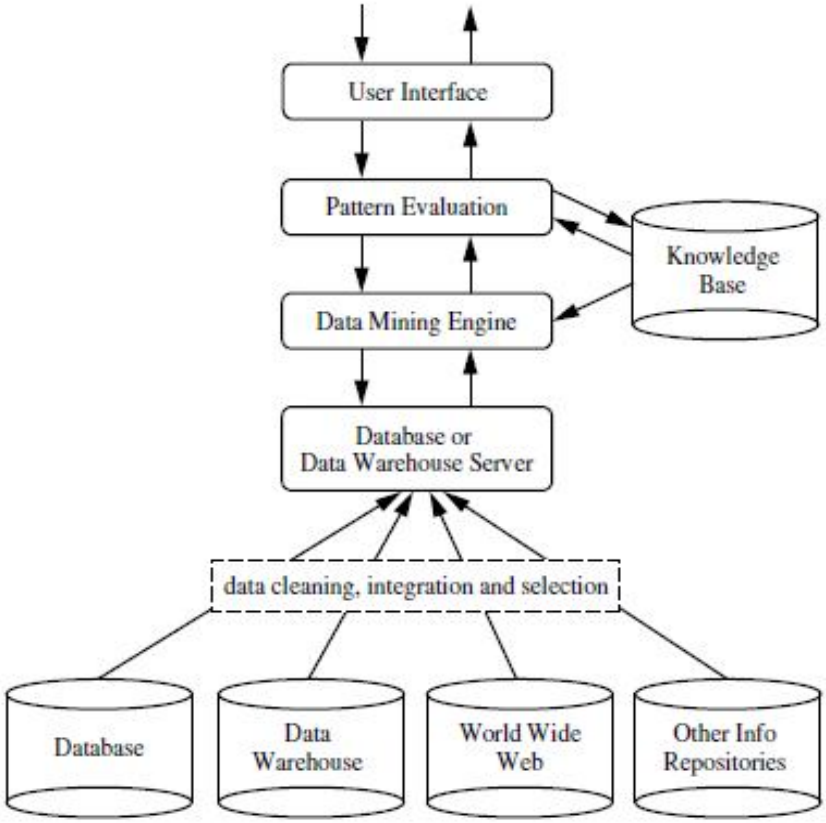
ISSN 2394 - 7780

What is data mining?

Data mining, *the extraction of hidden predictive information from large databases*, is a powerful new technology with great potential to help any enterprise focus on the most important information in their data warehouses. Data mining tools predict future trends and behaviors, allowing businesses to make proactive, knowledge-driven decisions.

Thus, data mining should have been more appropriately named as knowledge mining which emphasis on mining from large amounts of data. It is the computational process of discovering patterns in large data sets involving methods at the intersection of artificial intelligence, machine learning, statistics, and database systems. The overall goal of the data mining process is to extract information from a data set and transform it into an understandable structure for further use. The key properties of data mining are

1. Automatic discovery of patterns
2. Prediction of likely outcomes
3. Creation of actionable information
4. Focus on large datasets and databases



ARCHITECTURE OF DATA MINING

Knowledge Discovery in Databases(KDD)

Some people treat data mining same as Knowledge discovery while some people view data mining essential step in process of knowledge discovery. Here is the list of steps involved in knowledge discovery process:

Data Cleaning - In this step the noise and inconsistent data is removed.

Data Integration - In this step multiple data sources are combined.

Data Selection - In this step relevant to the analysis task are retrieved from the database.

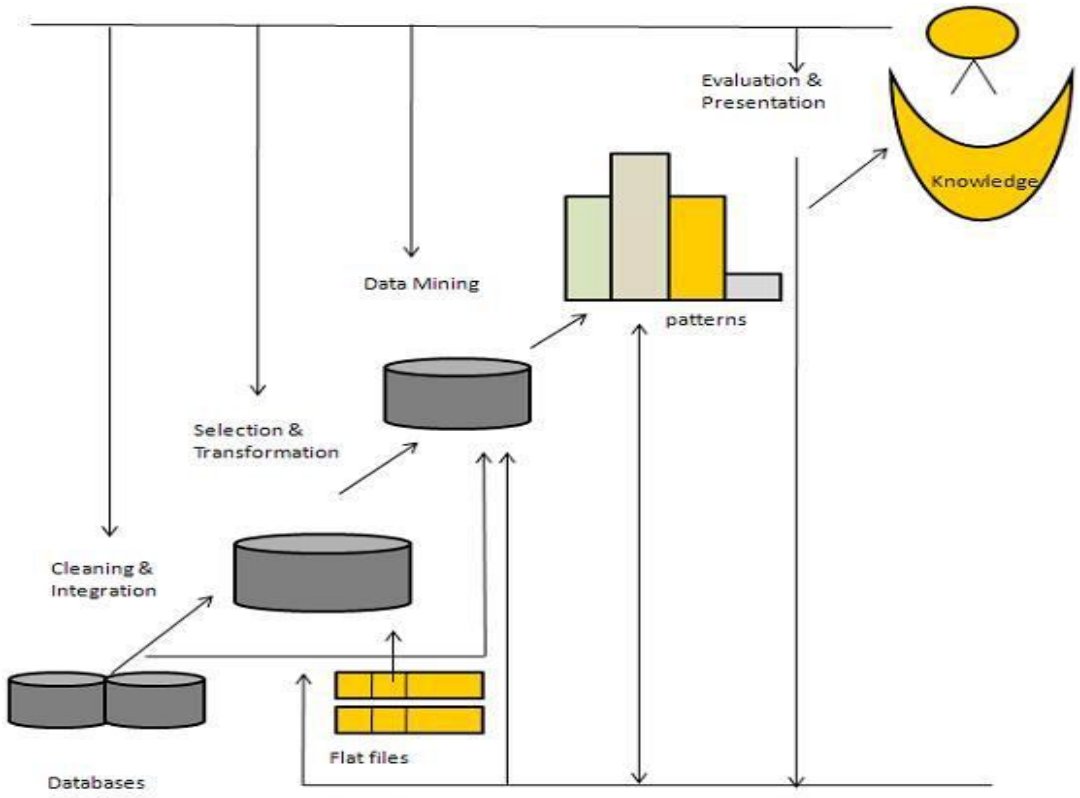
Data Transformation - In this step data are transformed or consolidated into forms appropriate for mining by performing summary or aggregation operations.

Data Mining - In this step intelligent methods are applied in order to extract data patterns.

Pattern Evaluation - In this step, data patterns are evaluated.

Knowledge Presentation - In this step, knowledge is represented.

ISSN 2394 - 7780



KDD ARCHITECTURE

What is Educational Data Mining?

The Educational Data Mining community website, www.educationaldatamining.org, defines educational data mining as follows: "Educational Data Mining is an emerging discipline, concerned with developing methods for exploring the unique types of data that come from educational settings, and using those methods to better understand students, and the system which they learn in."

Data mining, also called Knowledge Discovery in Databases (KDD), is the field of discovering novel and potentially useful information from large amounts of data [Witten and Frank 1999]. It has been proposed that educational data mining methods are often different from standard data mining methods, due to the need to explicitly account for (and the opportunities to exploit) the multi-level hierarchy and non-independence in educational data [Baker in press]. For this reason, it is increasingly common to see the use of models drawn from the psychometrics literature in educational data mining publications [Barnes 2005; Desmarais and Pu 2005; Pavlik et al. 2008].

After reviewing all these research papers and definitions I observe that today EDM Methods and tools are used in some educational settings. Educational Data Mining technology are really helpful for the students as well as teachers to improve their teaching and learning methods.

METHODS OF EDUCATIONAL DATA MINING

There are various methods of educational data mining but all kind of methods lie in one of following specified categories:

1. **Prediction**: ***Ryan S. J. d. Baker*** has given a detail explanation of prediction in his paper. He mentioned that " In prediction, the goal is to develop a model which can infer a single aspect of data from some combination of other aspects of data. If we study prediction extensively then we get three types of prediction: classification, regression and density estimation. In any category of prediction the input variables will be either categorical or continuous. In case of classification, the categorical or binary variables are used, but in regression continuous input variables are used. Density estimation can be done with the help of various kernel functions. Basically, **Prediction** is used to predict missing or unavailable numerical data values rather than class labels. Regression Analysis is generally used for prediction. Prediction can also be used for identification of distribution trends based on available data. **Classification** predicts the class of objects whose class label is unknown. Its objective is to find a derived model that describes and distinguishes data classes or concepts. The Derived Model is based on the analysis set of training data i.e. the data object whose class label is well known.

ISSN 2394 - 7780

Classification Methods

- Decision Tree Induction
- Neural Networks
- Bayesian Classification
- Association-Based Classification
- K-Nearest Neighbour
- Case-Based Reasoning
- Genetic Algorithms
- Rough Set Theory
- Fuzzy Sets

Prediction Methods

- Simple Regression
- Multiple Regression
- Non-Linear Regression

How Does Classification Works?

With the help of the student's performance evaluation application , let us understand the working of classification. The Data Classification process includes two steps:

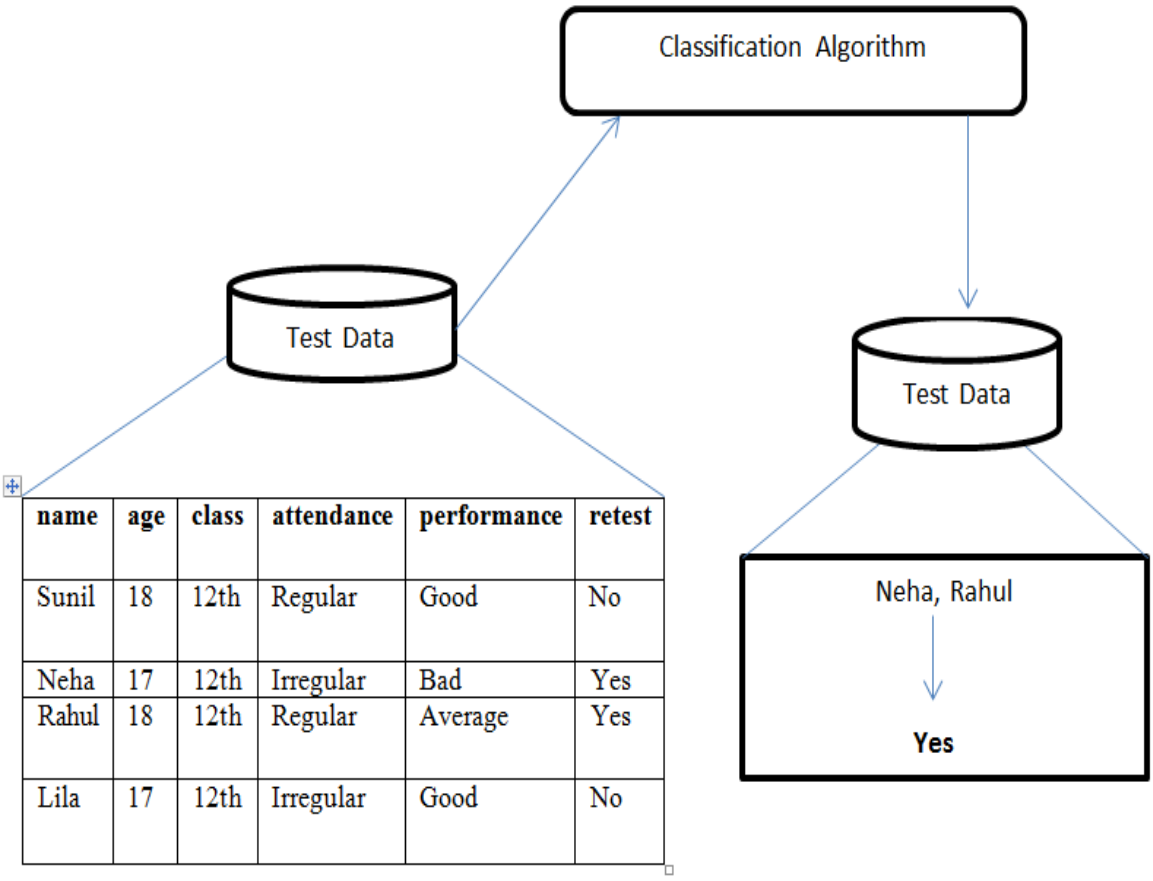
1. Building the Classifier or Model
2. Using Classifier for Classification

1. Building the Classifier or Model

This step is the learning step or the learning phase. In this step the classification algorithms build the classifier. The classifier is built from the training set made up of database tuples and their associated class labels. Each tuple that constitutes the training set is referred to as a category or class. These tuples can also be referred to as sample, object or data points.

2. Using Classifier for Classification

In this step, the classifier is used for classification. Here the test data is used to estimate the accuracy of classification rules. The classification rules can be applied to the new data tuples if the accuracy is considered acceptable.



name	age	class	attendance	performance	retest
Sunil	18	12th	Regular	Good	No
Neha	17	12th	Irregular	Bad	Yes
Rahul	18	12th	Regular	Average	Yes
Lila	17	12th	Irregular	Good	No

ISSN 2394 - 7780

CLASSIFICATION AND PREDICTION ISSUES

The major issue is preparing the data for Classification and Prediction. Preparing the data involves the following activities:

Data Cleaning − Data cleaning involves removing the noise and treatment of missing values. The noise is removed by applying smoothing techniques and the problem of missing values is solved by replacing a missing value with most commonly occurring value for that attribute.

Relevance Analysis − Database may also have the irrelevant attributes. Correlation analysis is used to know whether any two given attributes are related.

Data Transformation and reduction- The data can be transformed by any of the following methods.

1. **Normalization** - The data is transformed using normalization. Normalization involves scaling all values for given attribute in order to make them fall within a small specified range. Normalization is used when in the learning step, the neural networks or the methods involving measurements are used.

2. Generalization - The data can also be transformed by generalizing it to the higher concept.

Note − Data can also be reduced by some other methods such as histogram analysis, and clustering.

COMPARISON OF CLASSIFICATION AND PREDICTION METHODS

Here is the criteria for comparing the methods of Classification and Prediction −

Accuracy − Accuracy of classifier refers to the ability of classifier. It predict the class label correctly and the accuracy of the predictor refers to how well a given predictor can guess the value of predicted attribute for a new data.

Speed −This refers to the computational cost in generating and using the classifier or predictor.

Robustness − It refers to the ability of classifier or predictor to make correct predictions from given noisy data.

Scalability − Scalability refers to the ability to construct the classifier or predictor efficiently given large amount of data.

Interpretability − It refers to what extent the classifier or predictor understands.

2. Clustering: In clustering technique, the data set is divided in various groups, known as clusters. When data set is already specified, then the clustering is more useful. As per clustering phenomenon, the data point of one cluster and should be more similar to other data points of same cluster and more dissimilar to data points of another cluster. Regarding to data mining, this methodology partitions the data implementing a specific join algorithm, most suitable for the desired information analysis.

Clustering Methods

Clustering methods can be classified into the following categories −

Partitioning Method

Hierarchical Method

Density-based Method

Grid-Based Method

Model-Based Method

Constraint-based Method

APPLICATIONS OF CLUSTER ANALYSIS

● Clustering analysis is broadly used in many applications such as market research, pattern recognition, data analysis, image processing and also in educational settings.

● Clustering can also help teachers to discover distinct groups in their students base performance. And they can characterize their student groups based on the skills set.

● Clustering also helps in classifying documents of particular student on the web for information discovery.

● Clustering is also used in outlier detection applications such as detection of fraud students in examination hall.

ISSN 2394 - 7780

● As a data mining function, cluster analysis serves as a tool to gain insight into the distribution of data to observe characteristics of each cluster.

REQUIREMENTS OF CLUSTERING IN DATA MINING
The following points throw light on why clustering is required in data mining −

● **Scalability** −We need highly scalable clustering algorithms to deal with large databases.

● **Ability to deal with different kinds of attributes** − Algorithms should be capable to be applied on any kind of data such as interval-based *numerical* data, categorical, and binary data.

● **Discovery of clusters with attribute shape** −The clustering algorithm should be capable

of detecting clusters of arbitrary shape. They should not be bounded to only distance measures that tend to find spherical cluster of small sizes.

● **High dimensionality** −The clustering algorithm should not only be able to handle low dimensional data but also the high dimensional space.

● **Ability to deal with noisy data** − Databases contain noisy, missing or erroneous data.

Some algorithms are sensitive to such data and may lead to poor quality clusters.

● **Interpretability** −The clustering results should be interpretable, comprehensible, and usable.

3. Relationship Mining: Relationship mining generally refers to contrive new relationships between variables. It can be done on a large data set, having a no of variables. Relationship mining is an attempt to discover the variable which is most closely associated with the specified variable. There are four types of relationship mining: association rule mining, correlation mining, sequential pattern mining and causal data mining. Association data mining is based on if- then rule that is if some particular set of variable value appears then it generally have a specified value. In correlation mining, the linear correlations are discovered between variables. The aim of sequential pattern mining is to extract temporal relationships between variables.

4. Discovery with Models: It includes the designing of model based on some concepts like prediction, clustering and knowledge engineering etc. This newly created models predictions are used to discover a new predicted variable.

5. Distillation of Data for Human Judgment: There are two objectives for human judgment for which distillation of data can be done: Identification and Classification. As per phenomenon of identification, data is represented in a way that human can easily recognize the well specified patterns.

APPLICATION AND TRENDS IN EDUCATIONAL DATA MINING METHODS:
I. APPLICATIONS OF EDUCATIONAL DATA MINING METHODS
Some applications of Data Mining in education sector are given below:

1. Analysis and Visualization of Data
It is used to highlight meaningful information and support decision making. In the educational sector, it can be helpful for course instructor and educators for analyzing the usage information and student's activities during course to get a brief idea of a student's learning.

Visualization information and statistics are the two main methods that have been used for this task. Statistical analysis of educational data can give us information like where students enter and exit, how many times they utilize library properly, monitor their behavior in classrooms, the most important pages students browse, how many number of downloads of e-learning resources, how many number of different type of pages browsed and total amount of time for browsing of these different pages. It also provides information about reports on monthly and weekly basis, usage summaries, how much material students will study and the series in which they study topics, patterns of studying activity, timing and sequencing of activities.

Visualization uses graphical methods to help people in understanding and analyzing data. There are number of studies related to visualization of different educational data such as patterns of daily, quarterly and annual student's behavior on online forums.

2. Predicting Student Performance
In student performance prediction, we predict the unknown value of a variable that defines the student. In educational sector, the mostly predicted values are student's performance, their marks, knowledge or score.

ISSN 2394 - 7780

Classification technique is used to combine individual items based upon quantitative traits or based upon training set of previously labeled items. Student's performance prediction is very popular application of DM in education settings. Different methods and models are applied for prediction of students performance like decision tree, neural networks, rule based systems etc. This analysis is helpful for someone in predicting student's performance Several regression techniques are used for prediction of student's marks such as **linear regression** to predict student's academic performance, **stepwise linear regression** to predict time spent by a student on a learning page and **multiple linear regression** for identification of variables that are helpful for predicting success in courses and exam results in distance courses.

3. Enrolment Management

Enrolment management is frequently used in higher education to explain well-planned strategies and ways to shape the enrolment of college to meet planned goals. It is an organizational concept and also a systematic set of activities designed to allow educational institutions to exert more influence over student's enrolments. Such practices often include retention programs, marketing, financial aid awarding and admission policies.

4. Grouping Students

In this case groups of students are created according to their customized features, personal characteristics, etc. These clusters/groups of students can be used by the instructor/developer to build a personalized learning system which can promote effective group learning. The DM techniques used in this task are classification and clustering. Different clustering algorithms that are used to group students are hierarchical agglomerative clustering, K-means and model-based clustering. A clustering algorithm is based on large generalized sequences which help to find groups of students with similar learning characteristics like hierarchical clustering algorithm which are used in intelligent e-learning systems to group students according to their individual learning style preferences discriminating features and external profiling features.

5. Predicting Students Profiling

Data mining can help management to identify the demographic, geographic and psychographic characteristics of students based on information provided by the students at the time of admission. Neural networking technique can be used to identify different types of students.

6. Organization of Syllabus

Presently, organization of syllabi is influenced by many factors such as affiliated, competing or collaborating programs of universities, availability of lecturers, expert judgments and experience. This method of organization may not necessarily facilitate students' learning capacity optimally. Exploration of subjects and their relationships can directly assist in better organization of syllabi and provide insights to existing curricula of educational programs. One of the applications of data mining is to identify related subjects in syllabi of educational programs in a large educational institute.

7. Detecting Cheating in Online Examination

Now a day's exams are conducted online remotely through the Internet and if a fraud occurs then one of the basic problems to solve is to know: who is there? Cheating is not only done by students but the recent scandals in business and journalism show that it has become a common practice. Data mining techniques can propose models which can help organizations to detect and to prevent cheats in online assessments. The models generated use data comprising of different student's personalities, stress situations generated by online assessments, and common practices used by students to cheat to obtain a better grade on these exams.

8. Planning and scheduling

Planning and scheduling is an important factor in educational field it requires lots of stratigies to plan the courses according to particular subjects and class, after planning the course proper timetable should maintain so that at particular given time the syllabus should complete, meanwhile schedule curriculum activities etc. Different data mining techniques are used such as classification, clustering and visualization etc.

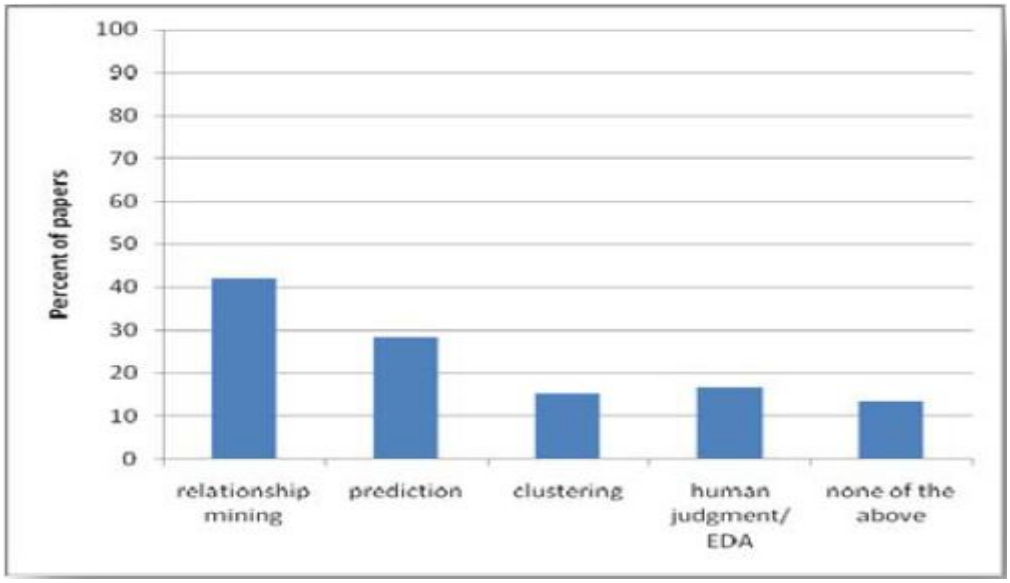
Decision tree and Bayesian models have been proposed to help management of educational settings to explore the probable effects of changes in recruitments, admissions and courses.

II. TRENDS IN EDUCATIONAL DATA MINING METHODS

Romero and Ventura's survey of Educational Data Mining research from 1995 to 2005, 60 papers was stated that developed EDM methods to answer research questions of applied interest. Relationship mining methods of various types were the most prominent type of EDM research between 1995 and 2005. 43% of papers in those years involved relationship mining methods. Prediction was the second most prominent research area, with 28%

ISSN 2394 - 7780

of papers in those years involving prediction methods of various types. Human judgment/exploratory data analysis and clustering followed with 17% and 15% of papers .



Whereas relationship mining was leading between 1995 and 2005, in 2008- 2009 it slipped to fifth place, with only 9% of papers involving relationship mining. Prediction, which was in second place between 1995 and 2005, moved to the leading position in 2008-2009, representing 42% of EDM2008 papers. Human judgment/exploratory data analysis and clustering remain in approximately the same position in 2008-2009 as 1995-2005, with (respectively) 12% and 15% of papers .

Drastic changes were seen during the period 2009-2014. During this period various research has been done on Classification, clustering methods of EDM. Along with this research various open source tools are also used during this period few are very famous and most preferable tools that researchers used like WEKA and SPSS tools.

A survey on EDM trends during the period 1998-2013.

Year	Data Mining methods	Data Mining Tools
1998	Time Series Analysis	DB Miner
1999	Classification	-
2000	Web Mining	-
2001	WebLogMiner	WebSift
2002	Association rules Mining	-
2003	SPSS analyzer software	-
2004	Bayesian Knowledge tracing algorithm	-
2005	Classification DT, Clustering, Association Mining	Excel, Clementine, Tada-Ed, SODAS
2006	Statistical method-Hypothesis testing, Frequent sequential pattern mining algorithm	-
2007	Statistics, Visualization, Classification-DT, Clustering, Association Mining	WEKA
2008	Statics, Clustering, Classification, Association Rule Mining, Visualization, web mining, Neural Network	WEKA
2009	Clustering, Sequential pattern mining	-
2010	Classification, Clustering, Market Basket analysis, Decision Tree	WEKA, MS Excel add-in ,MS SQL Server, Oracle Data Miner
2011	Classification-Decision Tree, Support Vector Machine, Regression Tree, Web mining	SPSS Clementine
2012	Regression Tree, Association pattern Mining	-
2013	Decision Tree Algorithm	WEKA

ISSN 2394 - 7780

LIMITATIONS OF THIS RESEARCH

This survey work studied EDM research papers from various journals/conferences of repute in the context of DM techniques/methods, Tools, educational outcomes, useful commercial / open sources/ open access tools with their features, data set and links. Eventhough it is not possible to cover all the research papers, from all corners and explores each and every tools with their functional properties, popular tools, techniques and most cited research papers were discussed which may be considered as representatives of this research area.The features discussed in this work are comprehensive rather than inclusive.

CONCLUSION AND FUTURE WORK

Data mining is a tremendously vast area that includes employing different techniques and algorithms for pattern finding. Some predictions I have discussed in this paper are the ones used in education mining. These methods have shown a remarkable improvement in strategies like course outline formation, teacher student understanding and high output.

The way I have performed classification may seem rough, as only few variables and few number of exercises have been consider to classify and predict students in homogeneous groups. Even if they differ in their difficulty, they do not fundamentally differ in the concepts students have to grasp. I have discovered a behavior rather than particular abilities. In a different context, classifying, predicting and clustering students to find homogeneous groups according to their skills sets. An appreciable research is still being done on various algorithms. I hope this review paper appreciates and inspires the current algorithm researchers and the new ones to explore further.

As an extension of this work I will try to solve the issues of Predictive and Classification model using some EDM methods and tools.

REFERENCES

1. "EducationalDataMining.org". 2013. Retrieved 2013-07-15.
2. BakerRSJd, Yacef K. The state of educational datamining in 2009: A review and future visions. J EduData Min 2009.
3. C. Romero, S. Ventura. Educational Data Mining: A Review of the State-of-the-Art. IEEE Transaction on Systems, Man, and Cybernetics, Part C: Applications and Reviews. 40(**6**), 601-618, 2010.
4. Baker, R.S.; Yacef, K (2009). "The state of educational data mining in 2009: A review and future visions". JEDM-Journal of Educational Data Mining **1** (1): 2017.
5. Romero, C. and Ventura, S. (2007) „Educational data mining: A Survey from 1995 to 2005‟, Expert Systems with Applications (33).
6. *International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 5 Issue 1, January 2016* 78 ISSN: 2278 – 1323 All Rights Reserved © 2016 IJARCET
7. U. K. Pandey, and S. Pal, "A Data mining view on class room teaching language", (IJCSI) International Journal of Computer Science Issue, Vol. 8, Issue 2, pp. 277-282, ISSN:1694-0814, 2011.
8. Gupta,D., Jindal,R., Dutta Borah,M (2011), "A Knowledge Discovery based Decision Technique in Engineering Education Planning" *in Proc. Int. Conf. On Emerging Trends & Technologies in Data management.* Institute of Management Technology Ghaziabad, pp. 94-102.
9. Mercheron, A., and Yacef, K. (2005), "Educational Data Mining: a case study" *in Proc. Conf. on Artificial Intelligence in Education Supporting Learning through Intelligent and Socially Informed Technology*. IOS Press, Amsterdam, The Netherlands, pp. 467-474.
10. Baradwaj,B.K., and Pal,S.(2011), "Mining Student Data to Analyze Students' Performance". *International Journal of advanced Computer Science and applications.*2,6.
11. Romero, C., and Ventura, S. (2007), " Educational Data Mining : A survey from 1995 to 005" *Expert Systems with Applications.* Vol. 33, pp.135-146.

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

ARUN JOSHI'S NOVEL "THE APPRENTICE"REFLECTION OF SOCIETY

Dr. MangalaTomar
G. S. College of Commerce, Wardha

ABSTRACT
The novel "The Apprentice" reflects the Indian beliefs, myths, cultural, social and spiritual imprints and ways of thinking. It mirrors the present day life.The outer surroundings of society stand for empty materialism, which is symbolic of the inner emptiness of modern human beings. The moral values are the true spirit of human culture and if it collapses, it creates a deserted path for future. It is the tale of conscience torn man with a curious mixture of idealism and docility, a vague sense of values.

Man, basically is a rational creature. Being a part of its social structure he must fit himself at home in these religio-social norms. If he feels uprooted for want of scientific evidences he is totally frustrated and finds support of a society through language. For him this life becomes simply a journey from nothingness to nothingness leading to dilemma. Thus, it is said ***"Literature is the mirror of society."*** Every aspects of the life of the people are reflected through literature. The modern Indian literature which was born on Indian side in the hands of Indians is widely acclaimed even outside the land of its birth. It becomes more picturesque, crystal clear and deep penetrating when the author is skillful and expert in delineating the situations, circumstances, dark crisis of characters and efforts of men of our time. The portrait delineated in ***"The Apprentice"*** has become a mirror of contemporary society the image of all and of no one." It has become the symptomatic symbol of "A man of our times" and a revelation of inner world of Ratan Rathor. The dreams of Ratan Rathor are a sort of revolt against the system of society existing in that generation.

Ratan Rathor was a child of double inheritance, brought up in an atmosphere of anti-athetical philosophies of life with Gandhian values. His mother had a pragmatic approach towards life and money that influenced Ratan because his mother was suffering from tuberculosis and he had no money for her treatment. Thus it is clear that no one can survive in this phony and materialistic world without money. So efforts were made by him to acquire wealth by any means. The sophisticated and materialistic attitude of his wife was compelling him to satiate her day to day needs engrossing himself for corruption. The futile effort of job hunting has shattered Ratan's hope of idealism but the humiliation, insult, starvation and the trauma of physical breakdown drained his hopes and brought him to the verge of collapse. Once, Ratan managed to procure the job of temporary clerk in the department of war purchasing with the help of fellow inn-dweller. Ratan was constantly pursuing the aim of making career and for that he was ready to do whatever was possible. For the sake of money he decided to marry his boss's niece. Seeing the girl before marriage for seeking mothers consent was mere formality for him, because he has already finalized the deal. Another corrupt deal at the end of the novel costs the life of Brigadier, who was Ratan's closest friend. He becomes the modern man in real sense by following cunningness, deceptiveness, selfish and easy going attitude.

From the beginning of his career under the tutorship of Superintendent it seemed more profitable to him to follow the zeitgeist than the idealism of his father. The pomp and show of the modern world engaged him for a bribe of hundreds of rupees to change the note on the file. The thirst for power and money compelled him to disregard the rules, no respect for nation's security deceiving his own friend and never admitted his guilt for manipulating the war materials of degrading quality which led to the lives of people. Now a day's people adopt favorable end. They desire to become rich regardless of any means. The character of Ratan painted by Joshi represents the trend of modern people for fulfilling his ends. He does not care for the life of soldiers who are devoting their life for protecting the integrity of the nation. Joshi tries to make his hero a portrayed mask and mirror of the modern man baffled as much as by the loss of parameters to judge right from the wrong as by the absence of moral values.

In ***The Apprentice***Arun Joshi has correctly painted the picture not of the contemporary society but also the problems of modern India. The character of Ratan tells the young and present generation that situation is very dismal so the future is uncertain. He penned down that still there is a ray of hope for the youth of the country who are willing to learn and ready to sacrifice.

In fact "The Apprentice" is an X-ray vision of RatanRathor's soul, a character fighting against many inner violent forces and with the unfortunate destiny. The character of Ratan in "The Apprentice" is a combination of humanism and religion which teaches the society that whosoever is steeped in corruption can save the society by way of following the path of religion.

ISSN 2394 - 7780

In this way Arun Joshi succeeds in drawing the Kaleidoscopic picture of modern youth facing numerous odds. The hero feels that it is necessary to alienate in this phony worlds to adjust him in this modern society. The modern man tries and adjusts to others, society, system abdicating his true self or he may strive to keep himself fit in the corrupt society. Ratan's moving towards corruption under various compelling forces is the demand of the modern world. Ratan is a model icon for the youth's that there is nothing wrong to try to lose heart, and not yield at any cost. These facts and figures are the mirror of today's modern world.

NOTES

1 .Joshi Arun, 1993, *The Apprentice*, Delhi: Orient Paper Backs, pg. 102

2. Joshi Arun, 1993, *The Apprentice*, Delhi: Orient Paper Backs, Pg 20

.3 .Joshi Arun, 1993, *The Apprentice*, Delhi: Orient Paper Backs, Pg 137

4. .Joshi Arun, 1993, *The Apprentice*, Delhi: Orient Paper Backs, Pg 144

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

CONSUMER PERCEPTION TOWARDS COMFORT FOODS

Kanu Raheja
Assistant Professor, Management, Institute of Innovation in Technology & Management, New Delhi

ABSTRACT
Based on findings related to physiological and psychological motivations of food preference, this research aims to develop a framework to examine consumer perception towards comfort foods. The study includes survey of 56 people to determine preferences for these foods across gender and across age and across occupation using a convenience sample. Consistent with hypotheses, the findings showed there is no difference in comfort food preferences across gender and across age and occupation. Males & females both preferred warm, hearty, meal-related comfort foods & snack related In addition, it also shows that there is no difference in perception among younger people and older people.

Keywords: Comfort foods, Snacks, Meals, Food preference.

INTRODUCTION
Comfort foods are foods whose consumption evokes a psychologically comfortable and pleasurable state for a person. It has been generally found that social-affective contexts can influence food preferences [1, 2] and that childhood experiences can be critical in forming life-long food consumption preferences and habits. It is well established that emotions exert a powerfulinfluence on food choice and eating behavior. Thisinfluence is particularly profound on comfort food consumption,which is typically motivated by the goal ofensuring emotional well-being. Thus far, comfort foodconsumption has seen primarily considered as a strategy toalleviate anxiety, sadness, and other negative emotions,whether tied to the distress resulting from prolonged dietaryrestraint or to more general life events includingeveryday hassles and threats to one's physical or egointegrity. Although not yet considered in relationto comfort food specifically, pleasure and positive emotionsare other types of affect with a known determining influence on food choice and on consumption behavior ingeneral. People eat food to satisfy hunger, because food tastes good, out of habit, and even out of boredom. Recent research suggests another reason why people eat: certain kinds of food – foods people identify as comfort foods – can trigger feelings of relational connection, particularly among those with strong social ties (i.e., secure attachment style, Comfort foods are foods thatpeople consume in order to attain psychologically comfortable or pleasant states, and they often do so when specific circumstances elicit a desire for their consumption

COMFORT FOOD AND ITS SOCIAL UTILITY
Although many would describe comfort foods as foods that are lowing healthful properties, research shows that such foods are better defined as foods which help people attain a psychologically comfortable or pleasant state and by reducing feelings of loneliness after a social threat . Lending credibility to the fact that comfort food is not a term simply synonymous with unhealthy food, the foods people cometo consider comfort foods differ based on factors such as gender , age), and geographical region. Indeed, comfort foods are idiosyncratic to the individual and most people's perceptions of comfort food seem to highlight social factors related to thefood. Self-reported definitions of comfort food highlight aspects of the food related to the consumption context, the consumption experience, and relational ties and associations with the food.

COMFORT FOOD CONSUMPTION AND PREDICTORS OF AFFECT ASYMMETRY
Gender
Abundant empirical evidence shows that men and women vary considerably in terms of how they experience,express and regulate emotions .Women, possibly because of their tendency for detailedprocessing in combination with the more differentiated nature of negative effects, tend to focus more on thenegative aspects of their affective experiences and to relymore on negative emotions in decision making andbehaviors In contrast, men have a strongertendency to distract themselves from negative emotionalexperiences, focusing instead on positive emotions andbuilding up morale .This tendency is likely toimpact the nature of emotional triggers for comfort foodconsumption such that men may be more likely to eatcomfort foods to maintain or enhance positive emotionswhereas women may do so to alleviate negative emotions.This proposition is consistent with results from a recentexperimental study showing that normal-weight men ate more chocolate and found its taste more pleasant underexperimentally induced joy compared to sadness . Onthis basis, we propose that men's comfort-seeking consumptionis more likely to be triggered by and enhancepositive affects, while being relatively unaffected bynegative emotions. In contrast, women's comfort-seekingconsumption is expected to be driven by negative affects.

ISSN 2394 - 7780

Age

Age has also been linked to affect asymmetry. With age,one learns to better regulate one's emotions, developingboth the ability and the tendency to focus on maintaining orincreasing positive affect . In addition, research hasalso shown that as age increases so does the relativedominance of positive affect in decision making andbehavior. Thus, it is expected that for older adultspositive emotions should be a more powerful trigger ofcomfort-seeking consumption than negative emotions. Thisis consistent with recent evidence from a sample of geriatricpatients where positive emotions were shown to have amore powerful influence on food intake than negativeeffects.

Food type

We also propose that the type of food eaten to provideemotional comfort is another factor that can be tied to affectasymmetry. High-calorie sweet (HCS) foods, like ice cream,cookies or chocolate, have been linked to the production ofendogenous opiates and serotonin,both neuroendocrine mechanisms operating on the experienceof negative affects and less directly on positiveemotions. Further, it has been suggested that the palatabilityof HCS foods is the critical factor in their ability to alleviatenegative affects under stressful conditions . In fact,stress is typically tied to heightened preference for HCSfoods .In an ad lib consumption experiment includingsweet, salty, or bland foods of varying fat contents,participants ate more sweet fatty foods when stressed whileconsumption of other foods and overall intake remainedunchanged . Even under experimentally induced stress,sweet fat foods are preferred and consumed in largerproportion than salty and bland foods . Outside of thestress-induced eating literature, robust evidence shows thatHCS foods are often the object of cravings and are typicallyconsumed to alleviate negative emotions . This isparticularly true for women experiencing premenstrual symptoms and for obese individuals. Analysesof food records have further shown that depressed individualsconsume more carbohydrates (primarily sucrose) whilenon-depressed individuals consume more protein .Thus, we expect that the consumption of HCS foods is morelikely to be triggered by negative affects than is the case forhigh-calorie non-sweet (HCNS) foods or for low-calorie(LC) foods regardless of their dominant nutrient. Thisproposition is consistent with results from prior surveysshowing that foods other than high-fat sweet snacks, such asprotein-rich and less energy-dense foods , wereparticularly prevalent comfort foods for men and olderindividuals, two factors known to be tied to positiveasymmetry.

THE RATIONALE FOR COMFORT FOODS

Many motivations behind our selection of foods—particularly comfort foods—can be broadly attributed to acombination of both physiological and psychological motivations. Physiological motivations behind food preferences can involve the body's aforementioned natural response to correct energy and nutrient imbalances, while psychological motivations can concurrently influence the pleasure one derives from certain foods . Both physiological and psychological motivations influences behavior but they will separately be discussed in terms of their influences on comfort food preferences on the basis of gender and age.

2.1. Physiological responses toward comfort foods

Part of the preference that a person has toward differentcomfort foods can be based on a physiological need. For certain individuals, certain foods can have seemingly addictive qualities. Evidences for various studies that when palatable foods areconsumed, the body releases trace amounts of opiates, which elevate both mood and satisfaction. Although released in small amounts, opiate-related food rewards couldreinforce a preference for foods that are most associatedwith these feelings. In some ways, this can be thoughtof as an analogue to addiction. That is, in some cases, noteating a particular opiate-related food can cause discomfortingor distracting cravings. Indeed, a study of chocolateaddiction found that cravings for chocolate may be drivenby a desire to obtain the reward of consumption in place ofthe negative consequences of not consuming it .The physiological basis for comfort food preference is supported by the fact that eating a particular comfort food helps one achieve a desired level of arousal by way of balancing nutritional deficiencies .The body seeks to gain balance in nutrients by decreasing the pleasantness of food after its consumption so, a single food cannot be provided with nutrition. That is, following the consumptionof food, the pleasantness of a food's taste, smell,appearance, and texture declines. This change in hedonicresponse to a food is associated with the decreased consumptionof that food and a shift to other food choices thatmay provide important nutritional and dietary variety. The resulting variety can shape normal eating patterns.The need for such dietary variety can be initiated by foodcravings—intense desires to eat particular foods .These cravings can reflect the body's natural response tonutrient or caloric deficiencies and can influence snackingbehavior. Yet nutritional deprivation is not necessaryfor cravings to occur . Stress, for instance, candisrupt normal eating patterns , causing an increase infat consumption and a propensity towards morepalatable salty or sweet foods.

ISSN 2394 - 7780

2.2. Psychological responses toward comfort foods

Psychological motivations toward consuming comfortfoods can be related to factors such as social context, social identification , and conditionedresponses that influence the development of foodperceptions and comfort food preferences . Social contextsserve important functions in teaching animals how toselect food with needed nutrients and how to avoidingesting toxins . For example, experiments byMason et al. involved birds that watched their fellow birds become ill after feeding from a yellow cup. Following this, the observing birds avoided the yellow feeding cupcompletely. Similarly, social interactions helps teach food preferences in response to a wide range of environmental challenges .The social and psychological context of the taste experience is important in determining food preferences. Chocolate is considered pleasurable by most people, for instance, because it combinesfavorable sensory qualities with positive connotationsof gift giving and reward developed from childhood . Incontrast, if a specific food were to be repeatedly associatedwith negative social experiences, it is possible such experiencescould analogously create an aversion to that food.These aversions can encourage people to develop or reinforcestronger ties to foods that carry positive connotationsand experiences. Positive social contexts in combination with positive orosensory attributes provide the importantassociations needed for foods to become comfort foods Indeed, externally stimulated eating bouts have been shownto be correlated with either high aromatic salience or highvisual salience .The social context of comfort food consumption, alongwith environmental factors, can play a role in formingconditioned responses—a learned compensation reaction—to consuming comfort foods. That is, some of the samefactors that can cause a person to overeat popcorn in amovie theatre can also operate in other contexts, such as athome . Studies show that it is not hunger but environmentalcues (such as mealtime) that are most often cited asthe reason for eating . Indeed, environmental cues thathave preceded mealtimes (such as driving home from work)often become associated with hunger during those specificsituations . When these cues become associated with particular consequences of ingesting comfort foods,they can trigger the need for orosensory stimuli.

REVIEW OF LITERATURE

Ganley, 1989; Buckroyd, 2011 Emotional eating is being increasingly considered in the understanding of obesity and weight change This review examined qualitative research grounded in emotional eating being a key factor of obesity and weight change. Six electronic databases were searched between August 2012 and January 2013. Included articles were published between 2000 and 2013 from the USA and Western Europe. Twenty-one articles were analysed using thematic analysis to integrate findings and generate relevant themes. Four core themes were identified: Vulnerability; Triggers; Function; and Emotional Aftermath. The findings indicated how emotional eating formed a cyclical pattern of behaviour with weight gain implicated as a primary consequence.

Heatherton &Baumeister,1991 Emotional eating was defined as van Strien*et al*. (2007) by 'the tendency to overeat in response to negative emotions such as anxiety or irritability' (p.106). The study aimed to explore women's experiences of comfort eating, a form of emotional eating which provides self-comfort or self-soothing. Seven semi-structured interviews were conducted and analysed using Interpretative Phenomenological Analysis (IPA), finding three superordinate themes: 'The private experience of comfort eating'; 'My emotional relationship with comfort eating'; and 'Mind-body connection'. Themes linked to comfort eating being used to mask (Polivy& Herman, 1999) or escape negative emotion,. Vulnerabilities to comfort eating included restrained eating (Herman and Mack, 1975) childhood eating patterns and critical parental rules around food.

Buckroyd, 2011 Emotional eating is being increasingly considered in the understanding of obesity and weight change. This review examined qualitative research grounded in emotional eating being a key factor of obesity and weight change. The review aimed to explore the construct of emotional eating, and how it is implicated in obesity. The review analysed twenty-one articles that explored emotional eating within a context of obesity or weight gain. Four core themes were identified: Vulnerability; Triggers; Function; and Emotional Aftermath. The findings indicated aspects of emotional eating formed a cyclical pattern of behaviour. Weight gain was implicated as a primary consequence of frequent emotional eating.

Greeno and Wing (1994) used psychosomatic theories to explain how 'stress-induced eating' originated as a difficulty in differentiating between stress related emotion and sensations of hunger (Kaplan & Kaplan, 1957; Bruch, 1964). The psychosomatic framework is useful to explore how emotional eating could develop. If negative emotion is misinterpreted as hunger, yet alleviated by eating, the association between emotional eating is reinforced (Greeno& Wing, 1994). The misinterpretation of negative emotion for hunger could lead to overeating and eventual weight gain.

OBJECTIVES OF THE STUDY

i) To study whether comfort food preference is influenced by gender.

ISSN 2394 - 7780

ii) To study whether comfort food preference is influenced by age.

iii) To study whether comfort food preference is influenced by Occupation

HYPOTHESIS

H_{01}: Comfort food preference is not influenced by gender.

H1: Comfort food preference is not influenced by gender.

H_{02}: Comfort food preference is not influenced by age.

H_2: Comfort food preference is influenced by age

H_{02}: Comfort food preference is not influenced by occupation.

H_2: Comfort food preference is influenced by occupation.

RESEARCH METHODOLOGY

Type of Data: Primary Data has been used for the study.

Sample size: 56

Sampling Technique: Convenience sampling

Test: Kruskal Wallis Test

		Chi square Value	Degree of freedom	Significance	H0	H1
Boredom	Age	4.76	3	0.19	Accept	Reject
	Occupation	4.344	3	0.227	Accept	Reject
	gender	0.057	1	0.811	Accept	Reject
Stressed	Age	5.09	3	0.168	Accept	Reject
	Occupation	1.228	3	0.746	Accept	Reject
	gender	0.007	1	0.932	Accept	Reject
Angry	Age	4.07	3	0.254	Accept	Reject
	Occupation	0.909	3	0.823	Accept	Reject
	gender	0.046	1	0.83	Accept	Reject
Tired	Age	1.149	3	0.765	Accept	Reject
	Occupation	3.18	3	0.365	Accept	Reject
	gender	1.11	1	0.292	Accept	Reject
Happy	Age	0.336	3	0.953	Accept	Reject
	Occupation	2.31	3	0.511	Accept	Reject
	gender	1.052	1	0.305	Accept	Reject
Excited	Age	4.217	3	0.239	Accept	Reject
	Occupation	4.22	3	0.238	Accept	Reject
	gender	0.38	1	0.537	Accept	Reject
Confident	Age	0.745	3	0.863	Accept	Reject
	Occupation	0.782	3	0.854	Accept	Reject
	gender	0.29	1	0.59	Accept	Reject
Healthy	Age	1.604	3	0.659	Accept	Reject
	Occupation	1.254	3	0.74	Accept	Reject
	gender	1.709	1	0.191	Accept	Reject
Guilt Feeling	Age	2.94	3	0.401	Accept	Reject
	Occupation	2.13	3	0.546	Accept	Reject
	gender	1.206	1	0.272	Accept	Reject
Nutritional value	Age	3.054	3	0.383	Accept	Reject
	Occupation	1.4	3	0.703	Accept	Reject
	gender	3.283	1	0.07	Accept	Reject
nutritional Info	Age	3.814	3	0.282	Accept	Reject
	Occupation	0.67	3	0.88	Accept	Reject
	gender	0.353	1	0.553	Accept	Reject
Taste	Age	2.111	3	0.55	Accept	Reject

ISSN 2394 - 7780

	Occupation	2.167	3	0.538	Accept	Reject
	gender	1.998	1	0.158	Accept	Reject
Convinience	Age	4.882	3	0.181	Accept	Reject
	Occupation	1.101	3	0.777	Accept	Reject
	gender	1.338	1	0.247	Accept	Reject
Price	Age	1.675	3	0.642	Accept	Reject
	Occupation	0.716	3	0.87	Accept	Reject
	gender	0.083	1	0.773	Accept	Reject
Availabilty	Age	4.88	3	0.181	Accept	Reject
	Occupation	3.693	3	0.297	Accept	Reject
	gender	0.019	1	0.89	Accept	Reject
Shelf Life	Age	4.122	3	0.249	Accept	Reject
	Occupation	4.791	3	0.188	Accept	Reject
	gender	0.346	1	0.557	Accept	Reject

The above table shows that the significance values of occupation, gender & age are greater than .05 hence, we accept our null hypothesis that comfort food preference is not influenced by Gender, age & Occupation.

FINDINGS

By examining the dual physiological and the psychologicalneeds for food, we have suggested a framework forexamining comfort foods. Although comfort foods are oftenportrayed as low nutrient ‘‘junk foods’’ surveys reported here found that gender, age & occupation does not influence one’s preference of comfortfoods. In some contexts, it has beensuggested that social identification can help drive foodpreferences. Similarly, one’s personal identificationwith a food might contribute to the development of comfortfood preferences.

REFERENCES

1. Arnow B, Kenardy J, Agras WS. Binge eating among the obese: a descriptive study. J Behav Med 1992;15:155– 70.
2. Wansink B, Sonka ST, Cheney MM. A cultural hedonic framework for increasing the consumption of unfamiliar foods: soy acceptance in Russia and Columbia. Rev Agric Econ 2002;24(2):353– 65.
3. Macht M. Characteristics of eating in anger, fear, sadness and joy. Appetite 1999;33:129– 39.
4. Macht M, Simons G. Emotions and eating in everyday life. Appetite 2000;35:65 – 71.
5. Macht M, Gerer J, Ellgring H. Emotions in overweight and normalweight women immediately after eating foods differing in energy. PhysiolBehav 2003;80:367– 74.
6. Paquet C, Arnaud-McKenzie D, Kergoat MJ, Ferland G, Dube´ L. Direct and indirect effects of everyday emotions on food intake of elderly patients in institutions. J Gerontol A BiolSci Med Sci 2003;58:153– 8.
7. Wansink B, Cheney MM, Chan N. Exploring comfort food preferences across age and gender. PhysiolBehav 2003;79:739– 47.
8. Polivy J, Zeitlin SB, Herman CP, Beal AL. Food restriction and binge eating: a study of former prisoners of war. J AbnormPsychol 1994;103:409– 11.
9. Heatherton TF, Herman CP, Polivy J. Effects of physical threat and ego threat on eating behavior. J PersSocPsychol 1991;60:138–43.
10. Ruderman AJ. Dysphoric mood and overeating: a test of restraint theory’s disinhibition hypothesis. J AbnormPsychol 1985;94:78 –85.
11. Greeno CG, Wing RR. Stress-induced eating.PsycholBull 1994;115:444– 64.
12. Oliver G, Wardle J. Perceived effects of stress on food choice. PhysiolBehav 1999;66:511– 55.
13. Letarte A, Dube´ L, Troche V. Similarities and differences in affective and cognitive origins of food likings and dislikes. Appetite 1997;28:115– 29.
14. Rozin P, Fischler C, Imada S, SarubinA,Wrzesniewski A. Attitudes to food and the role of food in life in the U.S.A., Japan, Flemish Belgium and France: possible implications for the diet– health debate. Appetite 1999;33:163–80.

ISSN 2394 - 7780

15. Shiv B, Fedorikhin A. Heart and mind in conflict: the interplay of affect and cognition in consumer decision making. J Consum Res 1999;26:278–92.
16. Chandon P, Wansink B, Laurent G. A benefit congruency framework of sales promotion effectiveness. J Mark 2000;64:65–81.
17. Dube´ L, Le Bel JL. The content and structure of laypeople's concept of pleasure.CognEmot 2003;17:263–95.
18. Diener E, Emmons RA. The independence of positive and negative affect. J PersSocPsychol 1984;47:1105– 17.
19. Davidson RJ. Affective style and affective disorders: perspectives from affective neuroscience. CognEmot 1998;12:307–30.
20. Davidson RJ. Emotion and affective style: hemispheric substrates

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019

ISSN 2394 - 7780

CRITICAL ANALYSIS OF MACHINING PERFORMANCE OF FERROUS MATERIALS USING ARTIFICIAL NEURAL NETWORK

Dr. Mangesh R. Phate[1*], Dr. Manish S. Deshmukh[2] and Shraddha B. Toney[3]
Associate Professor[1,2], Department of Mechanical Engineering, All India Shri Shivaji Memorial Society's, Pune
Assistant Professor[3], Department of Computer Engineering, Sinhgad Institute of Technology & Science, Pune

ABSTRACT
This paper is focused on artificial neural network (ANN) based model for Power Consumption (PC) in the turning of ferrous(En1A, En8 and S.S.304) in a Indian small scale industry. PC from the Field data based model was proved with the testing data and artificial neural network (ANN) model was developed for the analysis and prediction of the relationship between inputs and output parameters during the turning of ferrous and nonferrous materials. The input parameters of this model are operator, work piece, cutting process, cutting tool, machine and the environment. The ANN model consists of a three layered feed forward back propagation neural network. The network is trained with pairs of inputs/outputs datasets generated when machining ferrous material. A very good performance of the neural network, in terms of agreement with field data, was achieved. The model can be used for the analysis and prediction of the complex relationship between dependent (Power Consumption) and the independent parameters in turning operations.

Keywords: Artificial Neural Network Model, Ferrous Material, Generalised Model , En1A, En8, S.S.304, Univarent Analysis.

1. INTRODUCTION
Turning is a widely used machining process in manufacturing. Therefore, an optimal selection of cutting parameters to satisfy an economic objective within the constraints of turning operations is a very important task. Traditionally, the selection of cutting conditions for metal cutting is left to the machine operator Surface roughness, power consumption, material removal rate and productivity has received serious attention for many years. A considerable number of studies have investigated the general effects of the speed, feed, and depth of cut on the turning process. Some researchers studied on the machinability of aluminum-silicon alloys [2-6]. Liu et. al compared the influence of several factors (cutting speed, feed rate and depth of cut) on cutting force and surface roughness by orthogonal tests in turning Si-Al alloy. The results showed that the surface roughness could be improved by using diamond tool [2]. Recently, in order to obtain reasonable cutting parameters in turning casting aluminum alloy ZL108.Wei, Wang, et al analyzed main influential factors of cutting force using carbide tool YG8. The results indicated the depth of cut had great influence on stability of whole cutting process in rough machining. Armarego et. al (1969) investigated unconstrained machine-parameter optimization using differential calculus. Brewer et.al (1963) [3] carried out simplified optimum analysis for non-ferrous materials. For cast iron (CI) and steels, they employed the criterion of reducing the machining cost to a minimum. A number of monograms were worked out to facilitate the practical determination of the most economic machining conditions. They pointed out that the more difficult- to-machine materials have a restricted range of parameters over which machining can be carried out and thus any attempt at optimizing their costs are artificial. Brewer (1966) [3] suggested the use of Lagrangian multipliers for optimization of the constrained problem of unit cost, with cutting power as the main constraint. Walvekar et.al [10] (1970) discussed the use of geometric programming to selection of machine they optimized cutting speed and feed rate to yield minimum production cost. Petropoulos [6] (1973) investigated. Gopalakrishnan et.al (1991) described the design and development of an analytical tool for the selection of machine parameters in drilling. Geometric programming was used as the basic methodology to determine values for feed rate and cutting speed that minimize the total cost of machining SAE 1045 steel with cemented carbide tools of ISO P-10 grade. Surface finish and machine power were taken as the constraints while optimizing cutting speed and feed rate for a given depth of cut. Mangesh Phate et al [18-24] (2012-2019) worked on artificial neural network and the dimensional analysis approach to model the machining and advanced machining performance of ferrous, nonferrous and composite materials.

2. EXPERIMENTAL SETUP DESCRIPTION
2.1 List of parameters under Investigation
The term variables are used in a very general sense to apply any physical quantity that undergoes change. If a physical quantity can be changed independent of the other quantities, then it is an independent variable. If a physical quantity changes in response to the variation of one or more number of independent variables, then it is termed as dependent or response variable. If a physical quantity that affects our test is changing in random and uncontrolled manner, then it is called an extraneous variable. The variables affecting the effectiveness of the

ISSN 2394 - 7780

phenomenon under consideration are operator data, single point cutting tool, lathe machine, work piece, process parameters and the environmental parameters. The dependent or the response variables in this case of turning operation is Power Consumption. The list of various process variables which affects the machining phenomenon is as shown in table 1.

2.2 Reduction of variables by using Buck ham's Pi therom

According to the theories of engineering experimentation by H. Schenck Jr. [12] the choice of primary dimensions requires at least three primaries, but the analyst is free to choose any reasonable set he wishes, the only requirement being that his variables must be expressible in his system. There is really nothing basis or fundamental about the primary dimensions. For this case, the variables are expressed in mass (M), length (L) , time (T), temperature (θ) and angle (Δ).The final dimensionless pi term is as shown in table 2. The dimensions of the finished work piece are as shown in figure 1.The dimensionless pi term for the dimensionless ratio is given by the following equation.

2.3 Experimental Setup for the Experimentation

The three different types of ferrous materials are used for the experimentation.En1A, En8 and the S.S.304 materials are considered for the traditional turning process. The geometry of the finish work piece is as shown in the following figure 1. The experimental setup for the work is as shown in figure 2.

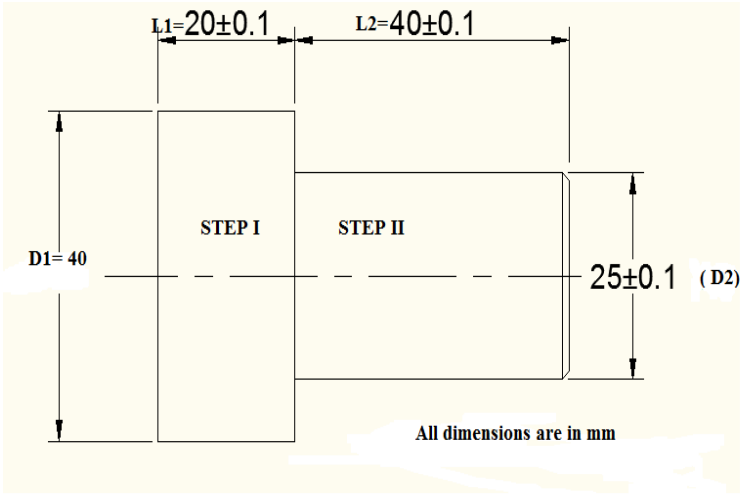


Fig-1: A schematic view of the geometry of the finished work piece.

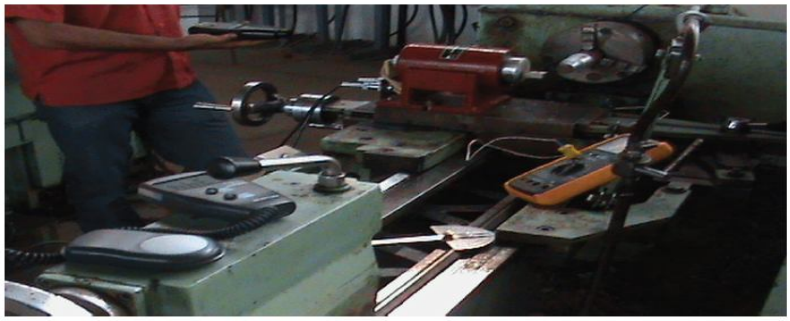


Fig-2: A schematic view of the Experimental setup for the Turning of Ferrous Material.

3. ARTIFICIAL NEURAL NETWORK MODEL FORMULATION

With the advent of digital sciences, numerous techniques are evolved for problem solving. ANN provides the causal basis and strong promise to any unknown relation. ANN is replication of the human brain. A scientist has observed that human brain works with relational algebra.Computers really cannot work on the basis of relations. A quantified equivalence of any entity is essential. Neural network is the huge network of neurons where every neuron may establish connections to hundreds of neurons in the vicinity. The behaviour of these brains cell is studied and the approach of problem solving has been copied under the title ANN. Obviously, ANN has larger capacities to solve the problems.

There is the difficulty in construction of gigantic network using computers. Moreover, one cell connected to all remaining cells responses difficulty in the signal flow diagram. To overcome these difficulties scientists have simplified the network using layer. In fact all ANN's today are constructed using layers. Every layer has cells; every cell of any layer is connected to all the cells of preceding and succeeding layers as shown in figure 3.

ISSN 2394 - 7780

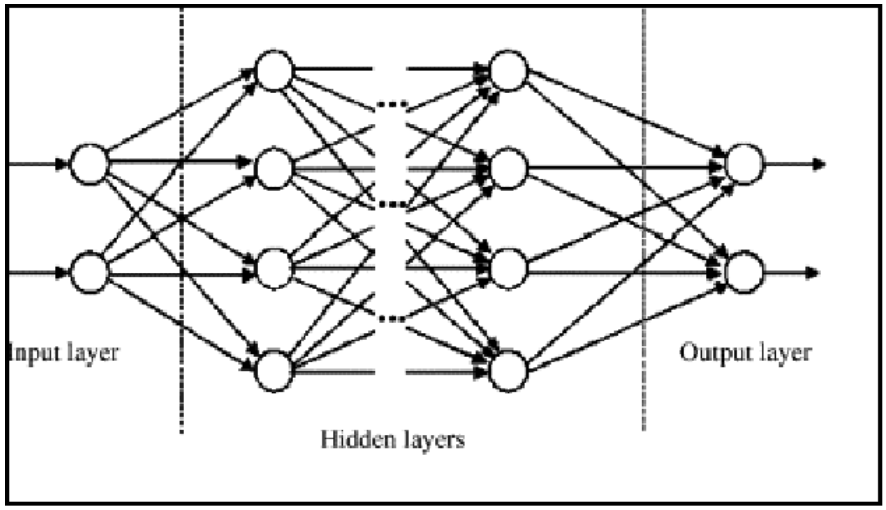


Fig-3: Basic Layers in the Neural network.

Table-1: List of parameters under Investigation

Sr No.	Independent Variables		Sr No	Independent Variables	
	Description	**Symbol**		**Description**	**Symbol**
1	Anthropometric of the operator.	An	22	Tool shank Height	SH
2	Weight of the operator.	W_p	23	Work piece hardness	BHNW
3	Age of the operator.	AGP	24	Weight of the raw work piece.	W
4	Experience	EX	25	Shear stress of the work piece	σ_{sut}
5	Skill rating	SK	26	Density of the workpiece material	DST
6	Educational qualifications	EDU	27	Length of the raw workpiece	LR
7	Psychological Distress	PS	28	Diameter of the raw workpiece	DR
8	Systolic Blood pressure	SBP	29	Cutting Speed	VC
9	Diastolic Blood pressure	DBP	30	Feed	f
10	Blood Sugar Level during Working	BSG	31	Depth of cut	D
11	Cutting Tool angles ratio.	CTAR	32	Cutting force	FC
12	Tool nose radius	R	33	Tangential Force.	FT
13	Tool overhang length	Lo	34	Spindle revolution	N
14	Approach angle	α	35	Machine Specification ratio	MSP
15	Setting angle	B	36	Power of the Machine motor	HP
16	Single point cutting Hardness	BHN	37	Weight of the machine	Wm
17	Lip or Nose angle of tool	LP	38	Age of the machine	AGM
18	Wedge angle	WG	39	Air flow	Vf
19	Shank Length	LS	40	Light Intensity	LUX
20	Total length of the tool	LT	41	Sound Level	DB
21	Tool shank width	SB	42	**Power Consumption**	**PC**

Table-2: List of dimensionless pi term.

Pi term	Dimensionless pi term	
	Ratio	**Nature**
Π_1	An*SBP*SK*Ag*Wp*SPO2/ DBP*PS*EDU*EX*BSG*D^3	Operator
Π_2	AR * r * β * BHNT * LT*LP*LS / α * LO* SW * SH * WG	Cutting Tool
Π_3	BHNW * W raw* LR * τ / D * FC * ϱ * DR	Work Piece
Π_4	f * FT * N * θ_{wp}* VB_{Tool} / $VB_{Machine}$ * FC*VC	Cutting process
Π_5	SP * P_{HP} * $W_{m/c}$ / AGM* FC^2	Lathe Machine
Π_6	HUM*DTO *Vf *DB*VC*FC/ LUX*D^3	Environment
ΠD_1	PC /FC*VC	Power Consumption

3.1 Back Propagation Method

In Figure 4, the individual nodes, or perceptrons are representative of the neurons. The input to the node is the input to the neural network (NN) or if the node is on hidden layer or the output, the from a previous layer.

ISSN 2394 - 7780

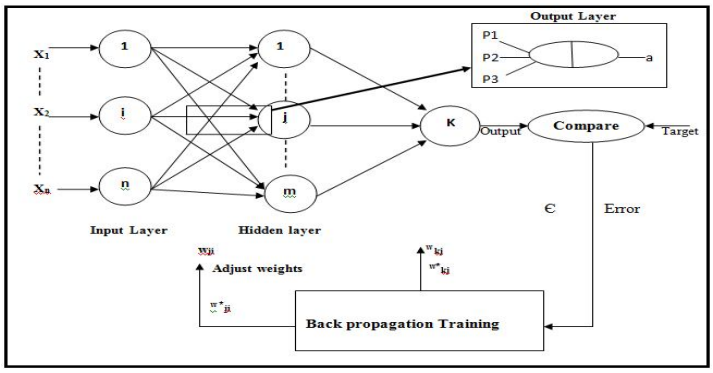


Fig-4: Fully Connected Feed-forward Neural network.

Where

- Wji = Weight in the hidden layer connecting the ith neuron in the layer.
- Jth = Neuron on the hidden neuron.
- f = Activation function of the hidden neuron.
- Wkj = Weight in the output layer connecting the jth neuron in the hidden layer.
- Kth = Neuron in the output layer.
- bk = Bias for Kth output neuron.
- fo = Activation function for the output neuron.

Figure 4 shows the flow chart of the back propagation neural network.

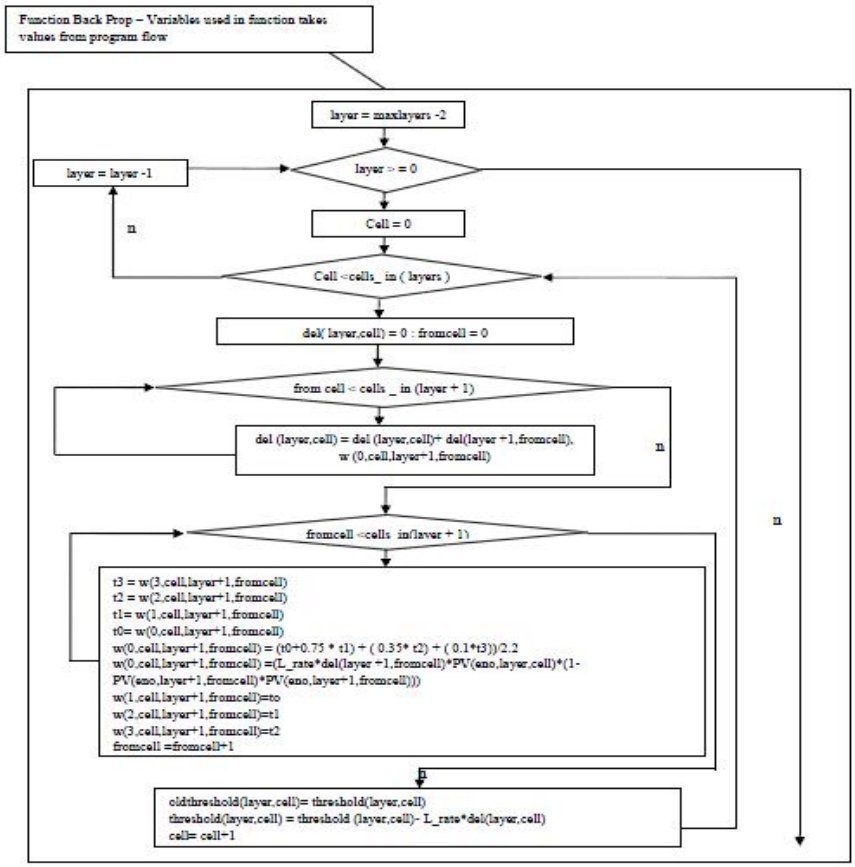


Fig-5: Flow Chart for Back-propagation in Neural network.

3.2 ANN Model for the Ferrous Material

6,5,1 Ann network is used to predict the power consumption in the turning of ferrous materials. Following figure shows the network developed for the power consumption data. Figure 6 shows the ANN network developed for the PC in the turning of ferrous material.

ISSN 2394 - 7780

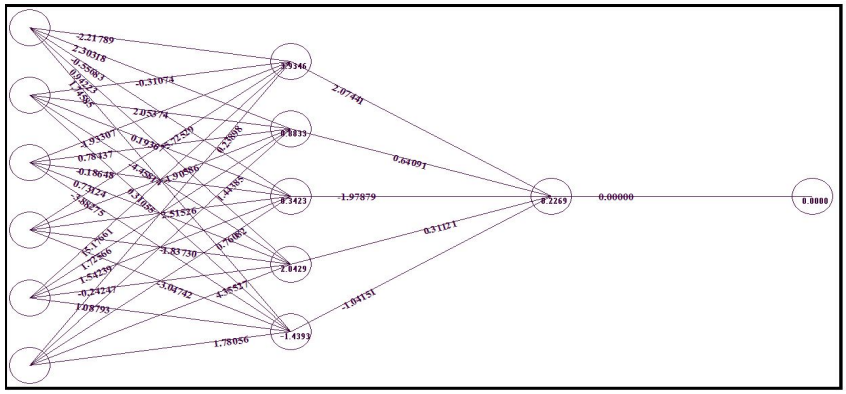


Fig-6: Artificial Neural network for Power Consumption in the Turning of Ferrous Material.

- Correlation Coefficient =0.90320924131
- Root Mean Square Error(RMSE) =0.0240276870486
- Reliability =98.624268767 %

The following ANN model is developed using the above network. Majorities of the sigmoid function are observed to be of exponential nature. Any function with an infinite scope (-∞ to +∞) be suitable, provided that it is continuous. Typical preferences go to hyperbolic tan and. Selection of such function is decided by experienced programmers. A define methodology about selection of sigmoid function (1/1+e $^{-}$X) is devoid of reasons.

$$X_{1,1} = (1 - e^{-1*Sum(layer1Cell0)})/(e^{-1*Sum(layer1Cell0)})$$

Where;

$$Sum(layer\ 1\ Cell0) = -2.21789 * X_{0,1} - 0.31074 * X_{0,2} - 1.93307 * X_{0,3} - 5.72529 * X_{0,4} + 15.17661 * X_{0,5} + 0.23898 * X_{0,6} - 3.9346$$

$$X_{1,2} = (1 - e^{-1*Sum(layer1Cell1)})/(e^{-1*Sum(layer1Cell1)})$$

Where;

$$Sum(layer\ 1\ Cell1) = 2.30318 * X_{0,1} + 2.05374 * X_{0,2} + 0.78437 * X_{0,3} - 1.90586 * X_{0,4} + 1.72566 * X_{0,5} + 1.44385 * X_{0,6} - 0.8833$$

$$X_{1,3} = (1 - e^{-1*Sum(layer1Cell2)})/(e^{-1*Sum(layer1Cell2)})$$

Where;

$$Sum(layer\ 1\ Cell2) = -0.556830 * X_{0,1} + 0.19367 * X_{0,2} - 0.18648 * X_{0,3} + 2.51526 * X_{0,4} + 1.54239 * X_{0,5} + 0.76082 * X_{0,6} - 0.3423$$

$$X_{1,4} = (1 - e^{-1*Sum(layer1Cell3)})/(e^{-1*Sum(layer1Cell3)})$$

Where;

$$Sum(layer\ 1\ Cell3) = 0.94223 * X_{0,1} - 4.45814 * X_{0,2} + 0.73124 * X_{0,3} - 1.83730 * X_{0,4} - 0.24247 * X_{0,5} + 4.35527 * X_{0,6} - 2.0429$$

$$X_{1,5} = (1 - e^{-1*Sum(layer1Cell4)})/(e^{-1*Sum(layer1Cell4)})$$

Where;

$$Sum(layer\ 1\ Cell4) = 1.74585 * X_{0,1} + 0.31055 * X_{0,2} - 3.88275 * X_{0,3} - 3.04742 * X_{0,4} + 1.08793 * X_{0,5} + 1.78056 * X_{0,6} + 1.4393$$

$$PC = (1 - e^{-1*Sum(layer2Cell0)})/(e^{-1*Sum(layer2Cell0)})$$

Where;

ISSN 2394 - 7780

$$Sum(layer\ 2\ Cell0) = 2.07441 * X_{1,1} + 0.64091 * X_{1,2} - 1.97879 * X_{1,3} + 0.31121 * X_{1,4} - 1.04151 * X_{1,5} + 0.0000 \quad (1)$$

4. RESULTS AND DISCUSSION

4.1 Optimization of ANN Model

The following algorithm is used for the univarent analysis which gives the optimization and the sensitivity analysis of the formulated model. The results obtain are as shown in the table 3 and 4 respectively.

Algorithm used for optimization and Sensitivity analysis for ANN model.

Step 1: Set neurons = Number of neurons in input layer.

Set minOut = 99999

Set all input to -1 value (base value) and determine output of ANN.

Set i=0

Step2: Increment base value of ith input variable by 0.01,i.e, base value (i)=base value(i)+0.01.Determine output Out(i) of ANN .

base value (i)=base value (i)-0.01.

Set i=i+1

Step 3: Repeat step 2 until i<ineurons

Step 4: Set oldmin Out=minOut

Step 5: Find minimum value 'minOut' of 'Out' array and corresponding input element number j.

This input variable I most influential variable.

Step 6: Set base value (j) =base value (j)+0.01

Step 7: Repeat step 2 through 5 until 'minOut'<oldminOut'or any of elements of elements in 'base value' vector is less than 1.

Step 8: Print optimal input vector = base value vector.

Table-3: Optimization for the ANN Based Power Consumption Model by Univarent Analysis

Input	Optimization for the Minimum Power Consumption	
	Network	Optimum Value
Π_1(M/C Operator)	6,5,1	0.688660
Π_2(Cutting Tool)	6,5,1	11839.84
Π_3(Work Piece)	6,5,1	8147567.74
Π_4(Cutting Process)	6,5,1	1.121456
Π_5(Lathe Machine)	6,5,1	0.0982288
Π_6(Environment)	6,5,1	101.40652
ΠD_1(Power Consumption)	Minimum	0.937383

Table-4: Sensitivity for the ANN Based Power Consumption Model by Univarent Analysis

Sr. No	Optimization for the Minimum Power Consumption	
	Length of Influence	Most influencing Variable
1	87	4
2	148	2

Following figure 7 shows the comparison between actual and the ANN response. The result shows that the actual data is more than 0.90 correlation with the ANN.

ISSN 2394 - 7780

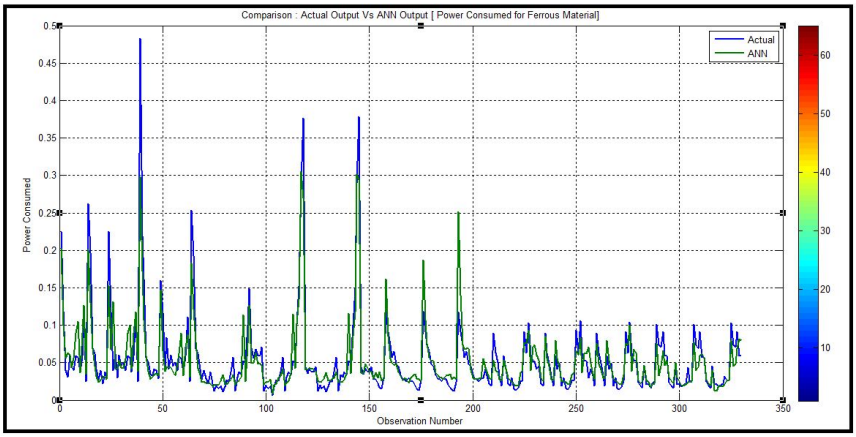


Fig-7: Comparison between actual and the ANN Power Consumption.

4.2 Sensitivity Analysis of ANN Model

Univarent analysis shows that for the model related with the **ferrous material** considering all pi terms, the input pi term related to the tool and cutting process are influential pi term for power consumption.

5. CONCLUSION

According to the present study and investigation in the turning of ferrous material, the following conclusions can be drawn.

(1) Feed forward Back propagation neural network is the most important and useful artificial neural network applied in the various researches to find out the complex behaviour of the system.

(2) The ANN model obtain has showed the higher accuracy than any other traditional approaches of model formulation.

(3) Univarent algorithms coupled with ANN are widely used for analyzing the sensitivity and optimization of the various process parameters.

(4) Most of the studies concentrated on surface roughness prediction compared with power consumption.

ACKNOWLEDGEMENT

Authors acknowledged the Machine shop, Shivne, Pune, Maharashtra, India for the cooperation and permission for carry out the research work.

REFERENCES

1. Iwona, P.,Christina, B.,Hamid, R. K., & Peter, M.(2009). Mathematical model of micro turning process. *International Journal of Advanced Manufacturing Technology*,45(1), 33–40.
2. Kahraman,S.,(2009).The use of response surface methodology for the prediction and analysis of surface roughness of AISI 4140 steel. *Materials and technology*,13(6), 267–270.
3. Kumar,A., Kumar,S., & Garg,R.,(2011).Statistical Modeling of surface roughness in turning process. *International Journal of Engineering Science and Technology (IJEST*), 3(5), 4246-4252.
4. ,Jeffrey B., Dahmus,S., and Timothy, G.,(2004). An environmental analysis of machining, *ASME International Mechanical Engineering Congress and RD&D Expo*,13-19.
5. Soleimanimehr,H., Nategh,M.J., Amini,S.,(2009).Modeling of Surface Roughness in Vibration Cutting by Artificial Neural Network,*World Academy of Science, Engineering and Technology,52,* 386-391.
6. Neelakanth,V., Gaitonde,S. R., Karnik,L. F.,&Davim,J.P.,(2011).Performance comparison of conventional and wiper ceramic inserts in hard turning through artificial neural network modeling, *International Journal of Advanced manufacturing Technology,* 52,101–114.
7. Petropoulos G., Ntziantzias I., & Anghel, C.,(2005)*International Conference on Experiments/ Process/ System Modelling/ Simulation/Optimization,* Athens,25-34.
8. H. Schenck Jr., *Theories of Engineering a experimentation,McGraw Hill Book* Co ,New York,1954,40-50.
9. Sundaram, R.M., (1978)An application of goal programming technique in metal cutting, *International Journal of Production Research*, 375-382.

ISSN 2394 - 7780

10. Agapiou, J.S., (1992),The optimization of machining operations based on a combined criterion, Part 1 The use of combined objectives in single-pass operations, Part 2: Multi-pass operations. *J. Eng Ind., Trans. ASME, 1(14),*500–513.
11. Brewer, R.C,. & Rueda, R.,(1963),A simplified approach to the optimum selection of machining parameters, *Eng Dig,*133–150.
12. Petropoulos, P.G.,(1973), Optimal selection of machining rate Variable by geometric programming. *J Prod. Res.,1973,*305–314.
13. Phate, M.R., Tatwawadi V.H., Modak J.P.,(2012), Formulation of A Generalized Field Data Based Model For The Surface Roughness of Aluminum 6063 In Dry Turning Operation, *New York Science Journal*, 5(7),38-46 .
14. Tatwawadi, V.H., Modak, J.P., & Chibule, S.G.,(2010). Mathematical Modeling and simulation of working of enterprise manufacturing electric motor, *International Journal of Industrial Engineering,*341-351.
15. Walvekar, A.G., & ,Lambert B.K., (1970),An application of geometric programming to machining variable selection. *Int. J.Prod. Res*.,38-45.
16. Gilbert W.W., Economics of machining. In Machinin – Theory and practice. *Am. Soc. M1950,*476–480.
17. Muwell K.F.H., Nature of Ergonomics, Ergonomics (Man In His Working Environment), *Chapman and Hall, London, New York*, 1956,PP.69-85.
18. Phate, M., Toney, S., (2016). Formulation of artificial neural network (ANN) based model for the dry machining of ferrous & non-ferrous material used in Indian small scale industries. *International Journal of Materials Science and Engineering,* 4(3),145-160. doi: 10.17706/ijmse.2016.4.3.145-160.
19. Phate, M., Tatwawadi, V., & Modak, J., (2013) Modeling and simulation of productivity in the turning of ferrous and nonferrous material using artificial neural network and response surface methodology. *Research Journal of Engineering Sciences*, 2 (3),37-44. http://www.isca.in/IJES/Archive/v2/i3/8.ISCA-RJEngS-2013-027.pdf.
20. Phate, M., Tatwawadi, V., (2014). ANN based model development for material removal rate in dry turning in Indian context. *World academy of Science, Engineering and Technology International Journal of Mechanical, Aerospace, Industrial, Mechatronic and Manufacturing Engineering,* 8 (1),130-135. http://waset.org/publications/9997427.
21. Phate, M., Tatwawadi, V., (2015). Mathematical Model of Material Removal rate and Power Consumption for Dry Turning of Ferrous Material using Dimensional Analysis in Indian Prospective. *Jordon Journal of Mechanical and Industrial Engineering*, 9 (1),351-362.jjmie.hu.edu.jo/vol9-1/JJMIE_-25-14-01.
22. Phate, M., Toney, S., (2019). Modeling and prediction of WEDM performance parameters for Al/SiCp MMC using dimensional analysis and artificial neural network. *Engineering Science and Technology, an International Journal,* 22 (2),468-476.https://doi.org/10.1016/j.jestch.2018.12.002.
23. Phate ,M., Toney, S., & Phate ,V., (2019). Analysis of machining parameters in WEDM of Al/Sicp20 MMC using Taguchi –based Grey –Fuzzy Approach. *Hindawi's, Modelling and Simulation in Engineering*, Article ID 1483169, 13 pages, 2019. https://doi.org/10.1155/2019/1483169.
24. Phate ,M., Toney, S., & Phate ,V., (2019). Optimization Performance Parameters of OHNS Die Steel using Dimensional Analysis Integrated with Desirability Function. *International Journal of Industrial Engineering and Production Research*, 30 (1),11-23. http://ijiepr.iust.ac.ir/article-1-877-en.html.

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

EMOTIONAL INTELLIGENCE IN RELATION TO ORGANIZATIONAL COMMITMENT & WORK ENGAGEMENT AMONG NURSES OF GOVERNMENT AND PRIVATE HOSPITALS

Priyanka[1] and Dr. Akanksha Tripathi[2]
Research Scholar[1], Panjab University, Chandigarh
Assistant Professor[2], Department of Psychology, MCM DAV College for Women, Chandigarh

ABSTRACT
The aim of the study was to investigate Emotional Intelligence in relation to Organizational Commitment and Work Engagement. The study was conducted on 200 female nurses (100 from government hospitals and 100 from private hospitals) in the age range of 24-30 years from the cities of Chandigarh, Panchkula and Mohali. The Emotional Intelligence Scale (Schutte et al., 1998), Organisational Commitment Scale (Meyer et al. 1993) & Work Engagement Scale (Schaufeli and Bakker, 2003) were used. The results of the study revealed that emotional intelligence has a significant and positive correlation with work engagement and organizational commitment. It was also found that nurses of government hospitals scored higher on emotional intelligence and its dimensions (i.e. perception of emotions, managing one's own emotion, managing others emotion and utilization of emotions), organizational commitment and its two dimensions (i.e. affective commitment and continuance commitment), whereas nurses of private hospitals scored higher on work engagement and its dimensions (i.e. vigor, dedication and absorption) and one of the dimensions of organizational commitment (i.e. normative commitment). Results also revealed that there is a significant difference on work engagement in terms of groups (i.e. nurses of government and private hospitals) and levels of emotional intelligence (nurses with high emotional intelligence and nurses with low emotional intelligence), whereas, there is significant difference on organizational commitment in terms of levels of emotional intelligence only (i.e. nurses with high emotional intelligence and nurses with low emotional intelligence).

Keywords: Emotional intelligence, organizational commitment and work engagement.

INTRODUCTION
Since hospitals are a major pillar of an effective health care system and nurses provide a crucial primary-care-giver function within hospital environments, nursing remain a crucial research issue (Tallman and Bruning, 2008). The importance of Emotional Intelligence in nursing work in the field of health-care has been well documented and acknowledged (Kooker et al., 2007). All employees in a hospital are required to participate daily in events like birth, death and disease which are connected with profound and intense emotions. Thus, nurses are expected to act and work appropriately and efficiently while at the same time negotiating through stressful circumstances thrown up regularly by their work environment. Since even a slight negligence or absence on their part may cost a patient's life, they are expected to bear heavy responsibility with regard to the treatment they provide (Kooker et al., 2007). So, nurses have to work in a highly stressful environment.

It is well documented that nurses work in highly stress environments (Humpel and Caputi, 2001). On a daily basis, nurses must confront a variety of daily hassles (e.g., personal, interpersonal, or organizational) and emotion-eliciting events. A nurse's emotional intelligence is likely to have a profound effect on outcomes related to his or her personal and professional life (Farmer, 2004). In traditional training programs, nurses were encouraged to conceal their emotions and to maintain a professional barrier. In recent decades, however, there has been a shift from maintaining distance and detachment towards an appreciation of involvement and commitment (Williams, 2000). People who possess such skills can form connecting relationships with others easily, read other people's feelings and responses accurately, lead and organize other people and handle disputes successfully (McQueen, 2003). It seems appropriate, therefore, to foster interpersonal intelligence in nursing, where it is advantageous to form good rapport, and indeed form connected relationships with patients (Morse, 1991) and this form of intelligence is known as emotional intelligence.

According to Jacqueline (2011), emotional intelligence is the capacity to interpret correctly, assess and convey emotions. In the words of Huy (1999), "Emotional intelligence refers to the ability to regulate feelings and emotions of one's own self and of others, to distinguish among these emotions and to utilize the knowledge thus obtained in order to direct one's thoughts and behavior".

The literature showed that the emotional intelligence has emerged to be a positive correlate of organizational commitment. **Singh (2016)** studied the effect of emotional intelligence on organizational commitment and found that higher the emotional intelligence, more the organizational commitment. **Aghabozorgi et al. (2014)** investigated the impact of emotional intelligence on organizational commitment in nurses of the public hospitals

ISSN 2394 - 7780

of Sanandajand, wherein the results showed the meaningful and positive relationship between the dimension of emotional intelligence and organizational commitment in nurses of the public hospitals of Sanandajand. Similarly, **Vakola et al, (2004)** claimed in most of the research, that emotional intelligence is associated with job satisfaction, high ability to solve problem and pressure, and organizational commitment.

Emotional intelligence influence nurses' engagement, and therefore, it also has an impact on health-care outcomes. An interrelation between emotional intelligence and work engagement among employees was studied and identified by **Devi (2016)** and found that the two aspects are closely related and a worker with optimistic feelings and a positive frame of mind was much more likely to make full utilization of his strengths and capacities, thereby higher employee engagement. There are few studies that revealed a weaker positive correlation between nurses' emotional intelligence and work engagement. The knowledge of the relationship between emotional intelligence and work engagement was further enhanced by **Ravichandran et al., (2011)**, who suggested a positive weaker relationship between the emotional intelligence and work engagement which stated that emotional intelligence behavior may not influence work engagement behavior independently.

Research on emotional intelligence in nursing has emerged, only over the past decade, but the work is still in its infancy. Therefore, it is reasonable to propose that EI might be an important vehicle for improving well-being among health professionals and nurses. Keeping this in mind, the present investigation aimed at assessing the correlation of emotional intelligence with organizational commitment and work engagement.

METHODOLOGY

Sample

The sample for the study included 200 nurses (100 from government hospitals and 100 from private hospitals) in the age range of 24-30 years. Sample was derived through random sampling technique from various hospitals from the cities of Chandigarh, Panchkula and Mohali. Informed consent was taken from all the participants before collecting data.

HYPOTHESES

It was expected that,

1. Emotional intelligence and its dimensions will be positively correlated with work engagement.
2. Emotional intelligence and its dimensions will be positively correlated with organizational commitment.
3. There will be no significant difference between the nurses in government and private hospitals on work engagement and organizational commitment.
4. There will be significant difference between the nurses with high emotional intelligence and nurses with low emotional intelligence on work engagement and organizational commitment.

TESTS AND TOOLS

1. **Emotional Intelligence Scale (Schutte et al., 1998):** The scale includes 33 items selected from an original 62-item scale and the response to each item is given based on a Likert scale, where 1 represents total disagreement and 5 represents total agreement. The total score ranges from 33 to 165. Minimum and maximum scores of all the four dimensions of emotional intelligence (perception of emotions, managing own emotions, managing other's emotions and utilization of emotions) were 1 and 5 respectively.
2. **Work Engagement Scale (Schaufeli and Bakker, 2003):** It is a 17 item survey designed to measure work engagement based on three key elements that include vigor, dedication, and absorption (Schaufeli & Bakker, 2004). Vigor measures a respondent's energy level; dedication centers on measuring how inspired and proud one is of their work; and absorption seeks to understand how immersed a person is in their work (Schaufeli & Bakker, 2004). Minimum and maximum scores of work engagement and its dimensions were 0 and 6 respectively. The instrument demonstrated good reliability with a Cronbach alpha of .80 to .90 (Schaufeli, Bakker, & Salanova, 2006). The higher score indicates higher emotional intelligence.
3. **Organizational Commitment Scale (Meyer et al. 1993):** It is a eighteen-item measure of organizational commitment. It consists of three sub-scales i.e. affective commitment, continuance commitment and normative commitment. The scale provides the 'commitment profile' of individuals in total and on normative, continuance and affective bases separately. Minimum and maximum scores of organizational commitment and its dimensions were 1 and 7 respectively. Coefficient alphas for the scale as obtained by Allen and Meyer were 0.87 and 0.84**.**

ISSN 2394 - 7780

STATISTICAL ANALYSIS

Keeping in view the hypotheses of the study, descriptive statistics, 2 X 2 ANOVA and Pearson correlations were computed.

RESULTS & DISCUSSION

Table 1 shows descriptive statistics to show the level of emotional intelligence and its dimensions (i.e. perception of emotions, managing own emotions, managing other's emotions and utilization of emotions), work engagement and its dimensions (i.e. vigor, dedication and absorption) and organizational commitment and its dimensions (i.e. affective commitment, continuance commitment and normative commitment) of nurses in government hospitals and private hospitals. In Table 1, results clearly revealed that nurses of government hospitals scored higher on emotional intelligence and its dimensions (i.e. perception of emotions, managing one's own emotion, managing others emotion and utilization of emotions), organizational commitment and its two dimensions (i.e. affective commitment and continuance commitment), whereas nurses of private hospitals scored higher on work engagement and its dimensions (i.e. vigor, dedication and absorption) and one of the dimensions of organizational commitment (i.e. normative commitment).

Table-1: Descriptive statistics of Emotional Intelligence and its dimensions (i.e. perception of emotions, managing own emotions, managing other's emotions and utilization of emotions), Work Engagement and its dimensions (i.e. vigor, dedication and absorption) and Organizational Commitment and its dimensions (i.e. affective commitment, continuance commitment and normative commitment) among nurses of Government and Private Hospitals (N= 200)

S. no	Variables	Government n=100		Private n=100	
		mean	Sd	mean	Sd
1.	Emotional Intelligence	125.53	20.91	120.81	9.02
2.	Perception of Emotions	35.51	6.43	35.01	1.81
3.	Managing Own Emotions	35.13	6.86	33.01	4.64
4.	Managing Other's Emotions	30.70	5.22	29.74	2.41
5.	Utilization of Emotions	24.19	5.46	23.05	2.49
8.	Work Engagement	65.92	17.35	70.27	16.80
9.	Vigor	22.03	5.75	25.61	6.67
10.	Dedication	19.08	9.61	19.43	5.70
11.	Absorption	24.82	8.16	25.24	9.29
12.	Organisational Commitment	58.78	11.85	57.59	9.72
13.	Affective Commitment	20.48	6.11	19.08	4.36
14.	Continuance Commitment	19.50	4.00	19.19	5.64
15.	Normative Commitment	18.80	6.51	19.31	4.10

In Table 2.1, the F-ratios for group comparison (i.e. nurses of government and private. hospitals) on work engagement ($F= 9.52$, $p < .01$) emerged to be significant, which indicates that there is a significant difference between nurses of government and private hospitals on work engagement. Furthermore, F-ratios for the levels of emotional intelligence (i.e. high and low on emotional intelligence) ($F= 12.62$, $p < .01$) were also found to be significant, which indicates that there is significant difference between nurses with high emotional intelligence and nurses with low emotional intelligence on work engagement. Also, the interaction effect came out to be significant ($F= 5.31$, $p < .05$).

Table-2.1: Analysis of Variance of Work Engagement

Dependent Variable: Work Engagement					
Source	Type III Sum of Squares	df	Mean Square	F-value	p-value
Group (Govt. and Pvt. hospitals)	2587.876	1	2587.876	9.52	.002**
Emotional Intelligence (High and Low)	3429.087	1	3429.087	12.62	.0001**
Group * Emotional intelligence (Interaction)	1443.017	1	1443.017	5.31	.022*
Error	53279.788	196	271.836		
Total	986089.900	200			
Corrected Total	58676.857	199			

ISSN 2394 - 7780

In Table 2.2, the F-ratios for the levels of EI (F= 16.73, p < .01) comparison were found to be significant, which indicates that there is significant difference between nurses with high emotional intelligence and nurses with low emotional intelligence on organizational commitment. Furthermore, the F-ratios for group comparison and interaction effect on organizational commitment emerged to be insignificant.

Table-2.2: Analysis of Variance of Organizational Commitment

Dependent Variable: Organizational Commitment					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F-value**	**p-value**
Group (Govt. and Pvt. hospitals)	29.484	1	29.484	.27	.603
Emotional Intelligence (High and Low)	1821.071	1	1821.071	16.73	.0001**
Group * Emotional intelligence (Interaction)	206.848	1	206.848	1.90	.170
Error	21337.877	196	108.867		
Total	700427.880	200			
Corrected Total	23329.035	199			

A glance at the Inter-correlation matrix (Table 3) for the total sample (200 nurses from both government and private hospitals) revealed that emotional intelligence is significantly and positively related with work engagement (r = .311, p< .01) and its two dimensions i.e. dedication (r = .321, p< .01) and absorption (r = .265, p< .01), organizational commitment (r = .306, p< .01) and its two dimensions i.e. affective commitment (r = .309, p< .01) and normative commitment (r = .208, p< .01). Results also revealed that the dimensions of emotional intelligence, i.e. (a) perception of emotions is significantly and positively related with work engagement (r = .314, p< .01) and its two dimensions, i.e. dedication (r = .344, p< .01) and absorption (r = .258, p< .01), organizational commitment (r = .239, p< .01) and its dimensions, i.e. affective commitment (r = .254, p< .01) and normative commitment (r = .152, p< .05), (b) managing one's own emotions is significantly and positively related with work engagement (r = .234, p< .01) and its two dimensions, i.e. dedication (r = .254, p< .01) and absorption (r = .206, p< .01), organizational commitment (r = .278, p< .01) and its two dimensions i.e. affective commitment (r = .291, p< .01) and normative commitment (r = .177, p< .01), (c) managing other's emotions is significantly and positively related with work engagement (r = .240, p< .01) and its two dimensions, i.e. dedication (r = .237, p< .01) and absorption (r = .183, p< .01), organizational commitment (r = .232, p< .01) and one of its dimensions i.e. affective commitment (r = .261, p< .01) and (d) utilization of emotions is significantly and positively related with work engagement (r = .283, p< .01) and its two dimensions, i.e. dedication (r = .262, p< .01) and absorption (r = .261, p< .01), organizational commitment (r = .291, p< .01) and its two dimensions i.e. affective commitment (r = .242, p< .01), and normative commitment (r = .247, p< .01).

Table-3: Correlation of emotional intelligence and its dimensions (i.e. perception of emotions, managing own emotions, managing other's emotions and utilization of emotions) with work engagement and its dimensions (i.e. vigor, dedication and absorption) and organizational commitment and its dimensions (i.e. affective commitment, continuance commitment and normative commitment) in nurses of government hospitals and private hospitals.

	WE	**V**	**Dedi.**	**A**	**OC**	**AC**	**CC**	**NC**
1. EI	.311**	.078	.321**	.265**	.306**	.309**	.109	.208**
2. POE	.314**	.067	.344**	.258**	.239**	.254**	.084	.152*
3. M OWN E	.234**	.034	.254**	.206**	.278**	.291**	.102	.177*
4. MOE	.240**	.102	.237**	.183**	.232**	.261**	.078	.137
5. UOE	.283**	.080	.262**	.261**	.291**	.242**	.106	.247**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

*EI= Emotional Intelligence, POE= Perception of Emotions, M OWN E= Managing Own Emotions, MOE= Managing Others Emotions, UOE= Utilization of Emotion, WE= Work Engagement, V= Vigor, Dedi.= Dedication, A= Absorption, OC= Organizational Commitment, AC= Affective Commitment, CC= Continuance Commitment, NC= Normative Commitment

There are few studies which corroborate the results, i.e. there is a significant positive correlation between emotional intelligence and work engagement. Scott (2012) sought to better understand the relationship between

ISSN 2394 - 7780

emotional intelligence and work engagement and indicated a moderately significant relationship (r = .416) and emotional intelligence predicted 17.3% of the variability in work engagement. Brunetto et al. (2012) examined the effects of emotional intelligence on the job satisfaction and engagement of police officers in explaining their organizational commitment and identified that emotional intelligence affects their job satisfaction, which further affects their engagement. Saloni (2016) explored and established a relationship between emotional intelligence and employee engagement and stated that emotional intelligence significantly affects employee engagement and the employee with positive emotions had improved and mastered their skills and abilities, which positively affect engagement.

Few studies have shown that emotional intelligence is positively related to organizational commitment. Findings of a research by Koshtegar & Rezayian (2008) showed that emotional intelligence has a significant relationship with organizational commitment. Similarly, the **r**esearch findings of Khashi & Sorjani (2010) showed a significant relationship of emotional intelligence with organizational commitment and results of regression analysis showed that emotional intelligence in a positive and meaningful way can predict employed organizational commitment. Tisha (2016) explored the direct and indirect effect of emotional intelligence on organizational commitment and the results showed that emotional intelligence leads to organizational commitment.

The present research concludes that emotional intelligence has a significant and positive correlation with work engagement and organizational commitment. It was also found that nurses of government hospitals scored higher on emotional intelligence and its dimensions (i.e. perception of emotions, managing one's own emotion, managing others emotion and utilization of emotions), organizational commitment and its two dimensions (i.e. affective commitment and continuance commitment), whereas nurses of private hospitals scored higher on work engagement and its dimensions (i.e. vigor, dedication and absorption) and one of the dimensions of organizational commitment (i.e. normative commitment). Results also indicated that there is a significant difference on work engagement in terms of groups (i.e. nurses of government and private hospitals) and levels of emotional intelligence (nurses with high emotional intelligence and nurses with low emotional intelligence), whereas, there is significant difference on organizational commitment in terms of levels of emotional intelligence (i.e. nurses with high emotional intelligence and nurses with low emotional intelligence).

CONCLUSION

In this context of present research, the contemporary demands of nursing require high levels of emotional intelligence to keep up with the work demands and patient care delivery. The nurses should have high emotional intelligence to maintain and develop their commitment. This proactive approach can be generated by providing adequate knowledge about emotional intelligence by providing them training programs to improve their emotional intelligence. Nurses' organizational commitment may also be increased by fostering a favorable and supportive climate for nurses in the hospitals in which they can utilize their skill of emotional intelligence. So, it is required to put continuous efforts on nurses to enhance their emotional intelligence because high emotional intelligence can facilitate behaviour change that leads to high organizational commitment and engagement in work.

REFERENCES

1. Aghabozorgi, A., Mehni, A. K., Alipour, O., & Azizi, B. (2014). Impact of emotional intelligence on organizational commitment of nurses in the public hospitals of Sanandaj, *Indian Journal of Fundamental and Applied Life Sciences*, 14(4), 120-127.
2. Brunetto, Yvonne, T.T. Teo, Stephen, Shacklock, Kate, Farr-Wharton, Rod. (2012). Emotional intelligence, job satisfaction, well-being and engagement: explaining organisational commitment and turnover intentions in policing. *Human Resource Management Journal*, 1748-8583.
3. Codier, E., Kooker, B. M., and Shoultz, J. (2009). Emotional Intelligence, Performance, and Retention in Clinical Staff Nurses. University of Hawaii at Manoa, Honolulu.
4. Devi, S. (2016). Impact of spirituality and emotional intelligence on employee engagement, *International Journal of Applied Research*, 2(4), 321-325.
5. Farmer, S. (2004). The relationship of emotional intelligence to burnout and job satisfaction among nurses in early nursing practice. *Doctoral Dissertation, The University of Utah Graduate School.*
6. Humpel, N., & Caputi, P. (2001). Exploring the relationship between work stress, years of experience and emotional competency using a sample of Australian mental health nurses. Department of Psychology, University of Wollongong, Wollongong NSW 2522, Australia.

ISSN 2394 - 7780

7. Huy, Q. N. (1999). Emotional Capability, Emotional Intelligence, and Radical Change, *The Academy of Management Review*, 24(2), 325-345.
8. Jacqueline, M. C. (2011). Nurse Manager Emotional Intelligence as a Predictor to Registered Nurse Job Satisfaction and RN Perceptions of the Practice Environment and the Relationship to Patient, Nursing and Hospital Outcomes. *Graduate Theses and Dissertations*. https://scholarcommons.usf.edu/etd/3259.
9. Kooker, B. M., Shoultz, J., & Codier, E. (2007). Identifying emotional intelligence in professional nursing practice. *Journal of Professional Nursing*, 23, 30–36.
10. Morse, J. M. (1991). Negotiating commitment and involvement in the nurse-patient relationship. *Journal of Advanced Nursing*, 16(4), 1365-2648.
11. Ravichandran, K., Arasu, R., & Kumar, S. A. (2011). The Impact of Emotional Intelligence on Employee Work Engagement Behavior: An Empirical Study, *International Journal of Business and Management*, 6(11), 157.
12. Schaufeli W., Salanova M., Gonzalez-Roma, V., & Bakker A. (2002) The measurement of engagement and burnout: a two sample confirmatory factor analytic approach. *Journal of Happiness Studies*. 3, 71–92.
13. Schaufeli, W., & Bakker, A. (2004). UWES: Utrecht work engagement scale. Retrieved from http://www.schaufeli.com
14. Schaufeli, W., Bakker, A., & Salanova, M. (2006). The measurement of work engagement with a short questionnaire: A cross-national study. *Educational and Psychological Measurement*, 66(4), 701-716.
15. Schutte, N. S., Malouff, J. M., Hall, L. E., Haggerty, D. J., Cooper, J. T., Golden, C. J., & Dornheim, L. (1998). Development and validation of a measure of emotional intelligence. *Personality and Individual Differences*, 25, 167-177.
16. Singh, T. (2016). Relating Emotional Intelligence and Organisational Commitment Though Moderated Mediation of Psychological Well being and Work Life Balance: A Study on Teachers of NGOs, *Rupkatha Journal on Interdisciplinary Studies in Humanities*, VIII(2), 0975-2935.
17. Tallman, R., & Bruning, N. (2008). Relating employees' psychological contracts to their personality. *Journal of Managerial Psychology*, 23(6), 688-712.
18. Thor, S. (2012). Organizational Excellence: A Study of the Relationship Between Emotional Intelligence and Work Engagement in Process Improvement Experts. *Doctoral Dissertation, Doctor of Management degree, George Fox University School of Business.*
19. Vakola, M., Tsaousis, I., & Nikolaou, I. (2004). The role of emotional intelligence and personality variables on attitudes toward organizational change. *Journal of Managerial Psychology*, 19, 88-110.

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

ENTHALPY OF TRANSFER OF SOME ALKALI-METAL HALIDES FROM WATER TO 5 WEIGHT % DIOXANE-WATER SYSTEM AT 25 °C.

Raghvendu Pathak
Department of Chemistry, Pachhunga University College, Aizawl, Mizoram University, Mizoram

ABSTRACT
The present communication deals with the calculation of standard enthalpies of solution of nine alkali metal halides solution-calorimetrically as a function of concentration and then computing enthalpies of transfer ($\Delta_t H°$) of lithium chloride, sodium chloride, potassium chloride, lithium bromide, sodium bromide, potassium bromide, lithium iodide, sodium iodide, and potassium iodide from water to 5 weight % dioxane-water system at 25 °C. The difference in standard enthalpies of transfer ($\Delta_t H°$) between Cl^- and Br^-, Cl^- and I^-, Li^+ and Na^+ and Li^+ and K^+ have also been evaluated. The values of enthalpies of transfer ($\Delta_t H°$) of all the nine alkali metal halides were all found to be negative.

Keywords: Alkali metal halides, calorimeter, dioxane-water, enthalpy of transfer, solution enthalpy.

1. INTRODUCTION

Thermochemical studies of metal and organo-metallic compounds have been the subject of long standing interest among the researchers as they play vital role in many physico-chemical and thermal engineering process as well as in pharmaceutical and biopharmaceutical research [1]. When a salt or an electrolyte passes from crystalline state into the solution state in presence of a solvent, a host of thermodynamic processes come into play and there is a change in free energy, enthalpy and entropy of the system due to interionic effects between solute and solvent molecules. The exact measurement of heat transfer from one solution-concentration to the other is a cumbersome process, yet several investigators tried to measure the same using different media with good effect. But the data on enthalpy transfer of alkali metal halides from water to dioxane-water system at room temperature have been scantly reported. The present paper deals with the calculation of standard enthalpies of solution of nine alkali metal halides in 5 weight % dioxane-water system solution-calorimetrically at infinite dilution at 25 °C and then computing enthalpies of transfer ($\Delta_t H°$) of lithium chloride, sodium chloride, potassium chloride, lithium bromide, sodium bromide, potassium bromide, lithium iodide, sodium iodide, and potassium iodide from water to 5 weight % dioxane-water system at 25 °C.

Although various investigators have calculated solution enthalpies of various compounds in various solvents/solvent mixtures under various conditions and thereby evaluated various thermodynamic parameters including enthalpy of transfer of certain compounds by adopting various means [2-11], yet the data on enthalpy of transfer of alkali metal halides from water to dioxane-water system seems to be very limited and very few and far between.

2. EXPERIMENTAL

2.1. Alkali metal halides

Chemicals of reagent grade were used. Dried and purified alkali metal halides, viz., LiCl, NaCl, KCl, LiBr, NaBr, KBr, LiI, NaI and KI were used. LiCl, being hygroscopic, was recrystallised from distilled water and then dried at about 150 °C under dry N_2 atmosphere for 12 hours. NaCl was purified by passing pure dry HCl gas through a saturated solution of the salt. The precipitated NaCl was decanted, washed (with ice cold water) and dried at about 110 °C for 8 hours and stored in a desiccator under low-pressured dry N_2 gas. KI, KCl and KBr were repeatedly recrystallised from distilled water and dried at about 110 °C for 6 to 8 hours. LiBr and LiI were recrystallised and dried at 250 °C and 350 °C respectively under dry N_2. NaB and NaI were recrystallised from distilled water at 60 °C and dried under N_2 gas.

2.2. Dioxane-water mixtures

The 5 wt % dioxane-water mixtures were prepared from freshly distilled dioxane and conductivity water.

2.3. Conductivity water

Conductivity water was obtained by redistilling ordinary distilled water thrice with $KMnO_4$ and collected in a pyrex glass receiver. All the electrolytes dissolved within a minute or two.

2.4. Apparatus

Measurements of solution enthalpies of alkali metal halides were done by using isothermal or constant temperature bath solution calorimeter (200 ml 'pyrex' high vacuum silvered Dewar flask). Standardization or calibration of calorimeter was done using doubly recrystallized 'BDH AnalaR' grade KCl in conductivity water.

ISSN 2394 - 7780

The value found was 17·01 kJ mol^{-1} whereas literature value is 17·5 kJ mol^{-1} [12]. Each run required for about 4-5 hours to complete starting from loading the sample into the calorimeter. The enthalpy of solution was computed using the following relationship:

$\Delta_s H = C^2 Rt\, r_m / n\, r_h = (V_s / 10)^2 = Rt\, r_m / n\, r_h$

where,

t = time in seconds,

R = resistance of calibration heater in ohms,

C = current in amperes passing through the calibration heater,

n = number of g mole of the solute under investigation,

V_s = potential drop across 10 ohm standard resistance,

r_m = resistance change in ohm due to chemical reaction in calorimeter, and

r_h = average resistance change in ohm of the thermistor during heating.

In the present work, the resistance of the heater was taken to be 19·8 ohms. All the measurements were carried out at constant temperature and pressure.

3. RESULTS AND DISCUSSION

At infinite dilution, all the electrolytes were assumed to be fully dissociated in dioxane-water mixture and the ions of the binary salts, being at infinite distance from each other, do not interact with each other except with the solvent, i.e., dioxane-water mixture. Standard enthalpies of solution ($\Delta_S H°$) of all the nine alkali metal halides were determined solution-calorimetrically as a function of concentration and then the data so obtained were extrapolated to zero concentration or infinite dilution following the extended Debye-Huckel treatment on dilute solutions [13]. After substituting the auxiliary thermochemical data from the standard reference sources [14], molar enthalpy of transfer ($\Delta_t H°$) of these compounds have been computed using the following relationship,

$\Delta_t H° = \Delta_S H\ (D\text{-}W)° - \Delta_S H°\ (water)$

or, $\Delta_t H° = \Delta_S H\ (D\text{-}W)° - \Delta_S H_W°$

where, $\Delta_t H°$ = standard molar enthalpy of transfer of alkali metal halides at infinite dilution,

$\Delta_S H\ (D\text{-}W)°$ = standard molar enthalpy of solution of alkali metal halides in 5% dioxane-water system at infinite dilution, and $\Delta_S H_W°$ = molar enthalpy of solution of water at infinite dilution.

Then the difference in standard enthalpies of transfer ($\Delta_t H°$) between Cl^- and Br^-, Cl^- and I^-, Li^+ and Na^+ and Li^+ and K^+ have been evaluated for the same composition. The mean value of a group of $\Delta_t H°$ values gives the difference in standard enthalpies of transfer ($\Delta_t H°$) between Cl^- and Br^-, Cl^- and I^-, Li^+ and Na^+ and Li^+ and K^+. The results of $\Delta_S H\ (D\text{-}W)°$ and $\Delta_t H°$ have been tabulated in Table-1 whereas those of differential enthalpies of transfer values for the same composition have been given in Table-2. Moreover the values of enthalpies of solution as well as those of enthalpies of transfer of certain compounds have been compared wherever felt necessary.

S. Taniewski-Osinska et al., (1980) [15] while investigating the enthalpy of solution of NaI, NaCl, $NaClO_4$ and urea (NH_2CONH_2) in water-tetrahydrofuran mixtures at 298.15 K, have reported the ΔH° values of NaCl in water to be 3·79 kJ mol^{-1}, whereas the literature values varied from 3·80 to 3·88 kJ mol^{-1} [16-19]. On the other hand, H. Iekarski (1986) [20] reported the standard solution enthalpy of NaCl in water at 298.15 K ($\Delta_{sol}H^{\infty}$) to be 3875 J mol^{-1}, whereas the same ΔH° (NaCl) at 25 °C has been calculated in this work is said to be 3·567 kJ mol^{-1}, which is almost compatible with the literature value {e.g. 3.82 kJ mol^{-1} (Criss & Cobble 1961) [16], 3.88 kJ mol^{-1} (Parker 1965) [19]}. The low differential value of about 0·32 kJ mol^{-1} from the literature value of 3·88 kJ mol^{-1} [19] seems to indicate that the lower amount of heat is required to break the NaCl bonds by dioxan-water system and therefore the dioxan-water system plays a destabilizing effect on the structure of the said salt solution. On the other hand, the same group of authors viz., S. Taniewski-Osinska et al., (1980) [15] have reported ΔH° value of NaI (c) to be + 7·54 kJ mol^{-1}, whereas literature value of molar enthalpy (heat) of solution of NaI (c) at infinite dilution at 25 °C is - 07·53 kJ mol^{-1} [19] and our calculated value is supposed to be - 08·732 kJ mol^{-1}. The negative value of ΔH° in this case indicates the exothermicity of the reaction.

ISSN 2394 - 7780

Table-1: Standard enthalpies of transfer ($\Delta_t H°$) of alkali metal halides from water to 5 weight % dioxan – water system at 25 °C

Compds	$\Delta_S H$ (D-W)°	$\Delta_S H_W$° *	$\Delta_t H°$
(kJ mol^{-1})	(kJ mol^{-1})	(J mol^{-1})	
LiCl	- 37·146	- 37·028	- 118
NaCl	03·567	03·891	- 324
KCl	16·901	17·218	- 317
LiBr	- 49·611	- 48·928	- 683
NaBr	- 01·412	- 00·628	- 784
KBr	19·251	19·874	- 623
LiI	- 62·912	- 61·737	- 1175
NaI	- 08·732	- 07·531	- 1201
KI	19·313	20·502	- 1189

Where $\Delta_S H$(D-W)° (solvent) and $\Delta_S H_W$° are standard enthalpies of solution of alkali metal halides in 5 weight % dioxan-water system and pure water respectively at infinite dilution at 25 °C.

* Ref. 21.

Table-2: Single-ion enthalpies of transfer of alkali metal halides from water to 5 weight % dioxan – water system at 25 °C

Compounds	$\Delta_t H°$	$\Delta_{trf\ (ion)} H°$	Mean diff. 5 wt. % D-W system
(J mol^{-1})	(J mol^{-1})	(J mol^{-1})	
LiCl - LiBr	565		
NaCl - NaBr	460	Cl^- - Br^-	443 ± 106
KCl - KBr	306		
LiCl - LiI	1057		
NaCl - NaI	877	Cl^- - I^-	935 ± 860
KCl - KI	872		
LiCl - NaCl	206		
LiBr - NaBr	101	Li^+ - Na^+	111 ± 730
LiI - NaI	026		
LiCl - KCl	199		
LiBr - KBr	- 60	Li^+ - K^+	051 ± 108
LiI - KI	014		

These figures are satisfactory and additive within the limits of experimental error.

Although interactions of dioxane-water in water is still debatable, yet there are enough proofs that dioxane actually intensifies the water structure in the water-rich region. This has been buttressed by nuclear magnetic resonance [22], self-diffusion coefficients [23], and heat capacities [24] studies of water in in different solvents. However, there are other investigators too who completely differ from this verdict [25-26]. In the light of above dispute or disagreement, alkali metals and halide ions are generally supposed to be water-structure breaker (Dunn 1968; Hepler 1969; Millero 1972) [27-29].

4. CONCLUSION

Actually if the solvent molecules are less bulky and fit in the cavities of 3D water structure then they might enhance the water structure, otherwise not. It also depends upon whether the solvent molecules are proton donors or proton acceptors. From table-1, it is obvious that enthalpies of transfer ($\Delta_t H°$) of all the nine alkali metal halides from water to 5 weight % dioxane-water system at 25 °C is negative which indicates dioxane to be structure breaker at all concentrations. Also the exothermic enthalpies of transfer from water to 5 weight % dioxane-water system increases with increasing ionic radius.

ISSN 2394 - 7780

REFERENCES

1. Royall**,** P**.** G**.** and Gaisford**,** S. (2005). Application of solution calorimetry in pharmaceutical and biopharmaceutical research, Current Pharmaceutical Biotechnology, 6 (3): 215-22.
2. Stern, J. H. and Kulluk, J. D. (1969). Thermodynamics of aqueous mixtures of electrolytes and nonelectrolytes. VIII. Transfer of sodium chloride from water to aqueous urea at 25, Journal of Physical Chem., 73 (9): 2795-2797.
3. Stern, J. H. and Bottenberg Jr., W. R. (1971). Enthalpy of transfer of sodium chloride from water to aqueous hydrogen peroxide at 25.deg., Journal of Physical Chem., 75 (14): 2229–2230.
4. Stern, J. H., Lowe, E. and O' Connor, M. E. (1974). Thermodynamics of transfer of sodium chloride from water to aqueous sucrose at 25°C, Journal Solution Chem., 3 (11): 823-826.
5. Stern, J. H., Stoner, S. J. and Doyle, G. L. (1981). Enthalpies of transfer of amino acids and sodium chloride from water to aqueous fructose at 25°C, Journal Solution Chem., 10(4): 263.
6. Woldan, M. (1987). Enthalpies of transfer of alkali metal halides from water to water-acetamide mixtures, Thermochimica Acta, 111: 175-183.
7. Carthy, G., Feakins, D. and Waghorne, W. E. (1987). Enthalpies of transfer of tetra-alkylammonium halides from water to water–propan-1-ol mixtures at 25 °C. **Journal of the Chemical Society, Faraday Transaction 1, 83 (8)**: 2585-2592.
8. Jellema, R., Bulthuis, J., Zwan, Gert van der and Somsen, G. (1996). Prediction of the enthalpy of transfer of alkali-metal halides in binary mixtures, **Journal of the Chemical Society, Faraday Transaction,** 92 (14): 2563-2568.
9. Waghorne, W. E., Hefter, G. and Marcus, Y. (2002). Enthalpies and Entropies of Transfer of Electrolytes and Ions from Water to Mixed Aqueous Organic Solvents, Chemical Reviews, 102 (8): 2773-836.
10. Hakin, A. W. and Beswick, C. L. (2011). Single-ion enthalpies and entropies of transfer from water to aqueous urea solutions at 298.15 K, Canadian Journal of Chemistry, 70 (6): 1666-1670.
11. Kamieńska-Piotrowicz, E and Inerowicz , H (1990). Ionic enthalpies of transfer in acetonitrile–water mixtures, Journal of the **Chemical Society, Faraday Transaction, 86,** 3391-3394.
12. Weast, R. C., ed. "Handbook of Chemistry and Physics", 59th edn., CRC Press, Florida, US, 1978-79.
13. Harned, H. S. and Owen, B. B., (1958).The Physical Chemistry of Electrolytic Solutions, 3rd ed., Reinhold Publication Corporation, New York, pp. 334.
14. Rossini, F. D., Wagman, D. D., Evans, W. H., Levine, S. and Jaffe, I., (1952). "Selected values of chemical thermodynamic properties Circular of the National Bureau of Standards 500", U.S. Govt. Printing, Washington D.C., pp. 1268.
15. Taniewska-Osinska, S., Piestrzynska, B. and Logwinienko, R. (1980). The enthalpy of solution of NaI, NaCl, $NaClO_4$, and urea in water-tetrahydrofuran mixtures at 298.15 K, Canadian Journal of Chemistry, 58: 1584-1588.
16. Criss, C. M. and Cobble, J. W. (1961). The Thermodynamic Properties of High Temperature Aqueous Solutions. I. Standard Partial Molal Heat Capacities of Sodium Chloride and Barium Chloride from 0 to 100°, Journal of the American Chemical Society, 83 (15): 3223-3228.
17. Bury, R., Mayaffre, A. and Chemla, M. (1976). Application of the calvet micro-calorimeter for precise heat of solution measurement-study of NaCl in water tetrahydrofuran mixture at 25 °C, **Journal de chimie physique et de physico-chimie biologique,** 73: 935-939.
18. Coulter, L. V. (1953). The Thermochemistry of the Alkali and Alkaline Earth Metals and Halides in Liquid Ammonia at − 33°, The Journal of Physical Chemistry, 57 (6): 553-558.
19. Parker, V. B. (1965). Thermal Properties of Aqueous Uni- univalent Electrolytes, National Standard Reference Data Series (NSRDS) – NBS 2, (Category 5 – Thermodynamic & Transport Properties)", Issued April 1, 1965, U. S. Dept. of Commerce, NBS Publications, U. S. Govt. Printing Office, Washington D.C., pp 1-76.

ISSN 2394 - 7780

20. Iekarski, H. (1986). Dissolution enthalpy of NaCl in aqueous nonelectrolyte solutions at 298.15 K. Analysis of electrolyte–nonelectrolyte enthalpic pair interaction coefficients in aqueous solution, Canadian Journal of Chemistry, 64 (11): 2127-2131.
21. Rossini, et al. (1952). "Selected values of Chemical Thermodynamic Properties, Circular of the N.B.S. 500", U.S. Govt. Printing, Washington D. C., (iv): pp 1268.
22. Clemett, C. J., (1969), Nuclear magnetic resonance (NMR) study of water dissolved in some cyclic ethers, **Journal of the Chemical Society A,** Inorganic, Physical, Theoretical, **0**: 455-458.
23. Clemett, C. J. (1969). The self-diffusion coefficients of water and dioxan in the water–dioxan system, **Journal of the Chemical Society A**, Inorganic, Physical, Theoretical, **0**: 458-460.
24. Kiyohara, O., Perron, G. and Desnoyers, J. E. (1975). Volumes and Heat Capacities of Cyclic Ethers and Amines in Water and of some Electrolytes in these Mixed Aqueous Solvents, Canadian Journal of Chemistry, 53: 2591-2597.
25. Ben-Naim, A. and Moran, G. (1965). Solubility and thermodynamics of solution of argon in water + p-dioxane system:, **Transactions of the Faraday Society, 61**: 821-825.
26. Sarma, T. S., Mohanty, R. K. and Ahluwalia, J. C. (1969). Heat capacity changes and standard partial molal heat capacities of aqueous solutions of some tetra-alkyl ammonium halides at 30°C and the effect on water structure , **Transactions of the Faraday Society, 65:** 2333-2338.
27. Dunn, L. A. (1968). Apparent molar volumes of electrolytes. Part 3.-Some 1-1 and 2-1 electrolytes in aqueous solution at 0, 5, 15, 35, 45, 55 and 65 °C, **Transactions of the Faraday Society, 64**: 2951-2961.
28. Hepler, L. G., (1969). Thermal expansion and structure in water and aqueous solutions, Canadian Journal of Chemistry, 47(24): 4613-4617.
29. Millero, F. J. (1972). Water and aqueous solutions, Ed. by R. A. Horne. Wiley-Interscience, New York, pp. 519.

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

PRELIMINARY PHYTOCHEMICAL ANALYSIS OF ETHNOMEDICINALLY IMPORTANT PLANT SPECIES *VITEX NEGUNDO* FROM CENTRAL M.P. AGAINST RESPIRATORY DISORDER

Sapan Patel and Sameer Ahmad Thoker
Ethnobotany Lab, School of Studies in Botany, Jiwaji University, Gwalior

ABSTRACT
In the present study, the main emphasis was laid on respiratory disorder (asthma) and some other allergic ailments only. The main allergic respiratory disorder is "Asthma" which is a chronic disease associated with allergic reaction in the body. The allergic reaction is due to the production of histamine secreted by the mast cells of body. Histamine is proteinous in nature, chemically it is β imidazolyl ethylamine. The study showed the effect of some Ethnomedicinal plant's crude extracts can control the secretion of histamine in the body. In some of the plants extract saponin was found, which is effective for the inhibition of mast cells degranulation and control the secretion of histamine in the body. An attempt has been made to search for new or less known herbal remedies popular among the people of Madhya Pradesh. Data on ethnomedicinal survey was complied and reported for some less known and important plant species, Vitex negundo is one of them. Vitex. negundo plant belongs to a family-Verbenaceae is mostly found in the hilly areas under shrub category. The present paper deals with Vitex negundo plant species used by the tribes of Betul district of Madhya Pradesh in India. This plant is useful for the treatment of asthma as well as other diseases.

Keywords: Bronchial asthma, Ethnomedicine, Histamine, Mast cell, Tribes.

INTRODUCTION
Ethnobotany is the study of medicinal plants on ancient knowledge and belief of man since time immoral using herbs or plant products as medicine for the treatment of disease or developing immunity or resistance against biotic factors like causal organisms or abiotic stresses like environmental pressure. The ethnomedicinal system is mainly based on the knowledge, experience and belief of thousands of year of ancient people living in remote areas, the system makes use of plant product in eradication of common diseases. Tribal societies of India use a large number of plant species for curing various ailments. These people are the treasure of ethnobotanical knowledge. Information from various states of the country indicates that, a good number of species possess miraculous properties against various diseases. A vast majority of our population particularly those living in village, mainly depends on herbal remedies this knowledge has been acquired and passed from one generation to another. A good number of herbal remedies have been acquired from their knowledge particularly from the treatment of asthma and allergy. Madhya Pradesh being the tribal dominated state also shelter many tribes like Gond (Adiwasi), Korku, Bheel, Bhilal, Sahariya etc. A survey of these tribes inhabited localities provided very enthusiastic and interesting information. Asthma is a allergic reaction, which is caused by various agents like dust particles, insects, pollen grains, smoke, animal hairs fungal spores, mucilaginous substances and change in the climatic conditions, which are known as allergens. Allergens and external factors cause extrinsic asthma, while intrinsic asthma is caused by congenital and physiological factors. When any foreign particle comes in contact with the skin of soft tissue of respiratory track the histamine is secreted by mast cell, causing not only the allergic reaction but also the bronchial asthma. There are herbal formulations, which are used against bronchial asthma, cough and cold. Negi et. al. (1993) explored several medicinal plants from Garwal Himalayas and mentioned dozens of plants for various ailments including bronchial asthma. Ghosh et. al. (2005) noticed the anti inflammatory and analgesic activity of methanolic extract from the seed of *Swietenia mahagoni*. Jha et. al. (2001) has made an Ethnobotanical survey of the Chhotanagpur area of Jharkhand and collected the information from herbal practitioners. They collected the information regarding plant product used in the remedies diseases mode of preparation of the drugs and the method administration of 19 species of medicinal plants. Christian et. al. (2003) reported the phytochemical screening of some Ethnobotanical plants of endangered species. Mitra et. al. (1999) made a study of *Albizia lebbek* as an anti aromatic drug they reported mast cell degranulation property of the plant *Vitex nigundo* is an aromatic shrub found widely along the river bank in marshy land, open wasteland and deciduous and forest. Ammar et. al. (1997) isolated bioactive fraction from the seed of *Glycyrrhiza glabra* for the treatment of inflammatory disease asthma and allergy.

MATERIALS AND METHODS
Plant *Vitex negundo* (Family: Verbenaceae) was collected from Satpura Hills of Betul district. The survey of folklore medicinal plant was carried out from Dec. 2006 to June 2007. During the survey information was collected from villagers, Vaidyas, local Hakeem and Ayurvedic practitioner religious people of Betul district regarding various aspects of the plants like collection method, time of collection, plant part used as traditional

ISSN 2394 - 7780

and medicinal purpose. The plants were collected from the places where the local people have been using them for recovering diseases. The availability of plants were recorded only when more than one conformation got. Then the plants were collected and shade dried at room temperature.

Phytochemical study: (Harborne, 1984)

Extraction

The powdered plant material depends on the texture and the water content of plant substance was extracted. It can be done by cold-percolation and soxhlet Method. Since saponin is a polar compound, they are extracted with polar solvent such as methanol, ethanol and water.

Cold-percolation method

250 gm powdered plant material was taken in a conical flask. The percolation was stirred thoroughly over magnetic stirrer in methanol and water respectively for 24 hours. The extract was filtered by whatman filter paper no.1 and evaporated under vacuum evaporator with low temperature and pressure.

Soxhlet method

The powdered material was extracted by soxhlet apparatus using methanol, ethanol and water as solvent. The extraction was done for 48 hours duration and up to 8 cycles. The crude Extract was concentrated in rotavapour below 40˚C. After that crude extract evaporated on water bath to get dry. The extract obtained with solvent was weighed. The percentage value was calculated and compared with the initial weight of the plant material.

Calculation of extraction Yield in %

Yield (%) = $(W_1 \text{ X } 100)$

W_2

W_1 is weight of Crude

W_2 is weight of Powered Material

Table-1: Percentage yield of *Vitex negundo* by cold percolation:

S.No.	Solvent	Weight of Powered plant Material	Volume of solvent	Weight of plant extract	Yield (%)
01.	Petroleum Ether	25 gm.	250 ml.	3.83gm.	15.32%
02.	Methanol	25gm.	250 ml.	4.40gm	17.6%
03.	Water	25gm.	250 ml.	1.53gm	6.12%

Table-2: Percentage yield of *Vitex negundo* by soxhlet method:

S.No.	Solvent	Weight of Powered plant Material	Volume of solvent	Weight of plant extract	Yield (%)
01.	Petroleum Ether	30 gm.	500 ml.	7.16gm.	23.86%
02.	Methanol	30gm.	500 ml.	8.31gm.	27.7%
03.	Water	30gm.	500 ml.	4.60gm.	15.33%

Preliminary phytochemical analysis

Frothing test for saponin

Preliminary phytochemical screening for the presence of saponin was carried out using Standard test procedure.0.5 ml filtrate sample was taken in test-tube, added 5 ml distilled water and shaken. Presence of persistent foams above the liquid surface confirms the presence of saponin.

Table-3: Preliminary phytochemical screening of secondary metabolites in *Vitex negundo*:

	Alkaloid	Flavonoid	Glycoside	Saponin	Steroid
Presence / absence	-	+	+	+	+
Name of Test	Mayer Test	Ammonium Test	Fehlings Solution	Frothing test	Liebermann Burchard reaction
Color Observation	Cream precipitate	Yellow coloration	Dark red Precipitate	Persistent foam	Blue green Ring

Isolation and purification of the crude extract

The crude extracts obtained from the plants of selected species were analyzed through column chromatography and thin layer chromatography.

ISSN 2394 - 7780

Column chromatography
In column chromatography, the packing material used was silica gel. The different fractions were collected in small glass vials using four solvent system 1, 2, 3, and 4 at the ratio of chloroform: methanol: water (2:1:0:2), chloroform: methanol: water (2:1:0.5) and chloroform: methanol: water (2:1:0.6) and chloroform; carbon tetra chloride: acetone (2:2:1).

5.11 Fraction obtained by column chromatography of crude extract of *Vitex negundo*
Table (4) showed the column chromatographic separation of the crude of *Vitex negundo* using four different systems $CHCl_3$: $MeOH:H_2O$ (2:1:.2), $CHCl_3:CCl_4:CH_3COCH_3$ (2:2:1), $CHCl_3:MeOH:H_2O$ (2:1:.5), $CHCl_3:MeOH:H_2O$ (2:1:.6) which gave four fractions are obtained which were collected in the conical flask of 50-ml capacity each. The fractions were evaporated to dryness on vacuum evaporator. The fractions obtained and the colour characteristic of each has been given in the table (3).

Table-4: Fractions obtain by column chromatography of crude extract of *Vitex negundo*.

S. No.	Solvent Used	Fractions	Weight of the fractions (in mg)	Color of fractions
01.	(I). $CHCl_3:MeOH:H_2O$(2:1:0.2)	VF_1	0.39	Dark Yellowish
02.		VF_2	0.78	Brown
03.		VF_3	0.75	Light Green
04.		VF_4	0.29	Yellowish Green
05.	(II). $CHCl_3:CCl_4:CH_3COCH_3$ (2:2:1)	VF_1	0.84	Light Reddish
06.		VF_2	0.18	Brown
07.		VF_3	0.62	Dark Greenish
08.		VF_4	0.12	Reddish Brown
09.	(III). $CHCl_3:MeOH:H_2O$ (2:1:0.5)	VF_1	0.86	Reddish
10.		VF_2	0.11	Orange Brown
11.		VF_3	0.78	Shiny Brown
12.		VF_4	0.68	Dark Green
13.	(IV). $CHCl_3:MeOH:H_2O$(2:1:0.6)	VF_1	0.79	Dark Brown
14.		VF_2	0.18	Light Greenish
15.		VF_3	0.69	Yellow Green
16.		VF_4	0.57	Green Brown

THIN LAYER CHROMATOGRAPHY
5.6 Cold percolation and its ratio:
For any phytochemical investigation especially for medicinal chemistry of the plant for herbal formulation, it is very essential to see the different parameters pertaining loss in weight after drying, percentage of yield of the crude material as well as water soluble and acid soluble ash content. Table (5) shows the cold percolation yield of the crude of *Vitex negundo*.7.73%.

5.7 Percentage of yield of crude extract by soxhlet method:
Table (6) shows the percentage yield of the crude material, when soxhlet method was used. Maximum yield was found in *Vitex negundo* 3.84% followed by *Annona squamosa* 3.76% and *Glycyrrhiza glabra* giving 3.12%.

The minimum yield was noticed in case of *Mimosa pudica*, which are about 2.72%. This yield was recorded by evaporating the extract obtained by soxhletion in rotavapour (R.E.-100).

5.8 TLC of crude extract of *Vitex negundo:*
The table (7) shows the TLC of *Annona squamosa* and *Vitex negundo* different fractions. It has been observed that in both the plants four different fractions were obtained using the solvent systems $CHCl_3:MeOH:H_2O$ (2:1:.2), $CHCl_3:CCl_4:CH_3COCH_3$ (2:2:1), $CHCl_3:MeOH:H_2O$ (2:1:2), $CHCl_3:MeOH:H_2O$ (2:1:2).

The spots obtained on the TLC plate were observed in visible light, Iodine chamber as well as in UV light. The different characteristics of the spots as well as their R_f value have been mentioned in the table (7).

The fractions obtained from plant extract were tested for their purity by using thin layer chromatography method. The column purified fractions were assessed on thin layer chromatography. The TLC plates were made of silica gel 'G' and activated by heating in the Chromatographic oven at 100˚C for 5 min. The purified samples were applied with the Help of a capillary tube as a minute spot at the start line marked at 1 cm from the edge of the plate. The spot were allowed to dry and kept carefully in large glass bottles containing the solvent system. After the run of the solvent on the plates up to the marked line, /they were taken out from the bottle and the

ISSN 2394 - 7780

plates were exposed in u.v. chambers and Measured the run of solvent with a centimeter scale to determine the Rf values.

$$Rf = \frac{\text{Distance travelled by solute}}{\text{Distance travelled by solvent}}$$

The fraction collected from column chromatography was subjected to acid hydrolysis and methylation for further analysis.

Spectral analysis
For characterization of biological active principle, the plant extract was sent to Central Drug Research Institute, Lucknow for spectral analysis by mass spectroscopy and nuclear Magnetic resonance spectroscopy. The spectrums obtained from CDRI, Lucknow were analyzed for various functional groups by organic chemist of Govt. P.G. College, Betul and Govt. M.V.M. College, Bhopal

Anti-asthmatic study of *Vitex negundo* extract on albino rat
Swiss variety of albino rats had been reared at Pest Control and Ayurvedic Drug Research Laboratory, S.S.L. Jain College Vidisha, India. The rats were given asthmatic drug intraperitonially for 15 days period to induce asthma. That rat was scarified to get the mast cells for histological preparation. The experiment was conducted mainly on the albino rat's connective tissue. Mast cells of experimental rats were taken out from the mesenteries and areolor connective tissues of the scarified rats. They were fixed in the fixative used for general histological preparation (aqueous bouins) and sections were cut of paraffin block at 8 mm thickness over rotary microtome.

The herbal extract isolated and purified from *Vitex negundo* has been tested for it's detailed pharmacological properties on anaphylactic albino rats. The herbal extract was injected intraperitonially to albino rats. The amount of plant extract actually needed in experiment is quite small often as little as 10 mg or less. For albino rats, 100mg/kg body weight of the extract was injected for 15 days period. The areloar connective tissues were taken out from the experimental animals for histological observation of mast cells degranulation.

5.17 Preparation of drug solution
The amounts of drug actually needed in experiment are quite small often as little as 10 mg. or less. For albino rat 100 mg / kg body weight of the extract were injected in to the experimental rats for 14 days period.

5.18 Effects of herbal drugs on mast-cell degranulation in sensitized albino rats
Mast cells play an important role in anaphylaxis and inflammation. It has been used to test against allergic disorders and chronic bronchial asthma (Barnes, 1993). Inhibition of mast cell degranulation, which in turn inhibits release of mast-cell mediators, also considered one good way of treating asthma.

In this study, mast-cell degranulation was observed in the time containing these cells. In order to explore the mast cells stabilizing, all the herbal drugs were tried on in *vivo* albino rats. The effect of herbal drugs on mast cell stabilizing activities was studied.

5.19 Effect of herbal drugs on mast cell degranulation in actively sensitized rat
Two weeks after sensitization, the antigen challenged degranulated about 75 % of the mast cell. When the sensitized animals were treated with herbal drugs (25, 50, 75, & 100-mg / kg. p.o.) for two weeks and then challenged with an antigen. There was the significant reduction in the number of disrupted mast cells. The effect of herbal drugs at 100 mg/kg was comparable with that of Prednisolone (table 4). In the control group of sensitized rats, 74% disruption of mast cells was noticed whereas it comes down to 27% in the treatment with 100 mg/kg. body weight of herbal drug of *Vitex negundo.*

Similarly, inhibitory effect on the release of histamine from the mast cells have also been noticed by Yano *et al.* (2000), when *Curcuma longa* extract was applied to the albino rats. Anti inflammatory drug were also found to be equally effective causing inhibitory action on mast cells as shown in the present study.

Bani *et al.* (2000) have reported such activity of the hydro soluble fraction of *Euphorbia royleana* latex as anti inflammatory drug. They have noticed the inhibition in the degranulation of mast cells up to 70.69% against Prednisolone effect of 31.21% this shows higher inhibitory effect of the plant extract.

ISSN 2394 - 7780

Table-5: Effect of herbal drug of *Vitex negundo* on mast cell degranulation on sensitized rat.

S. No.	Treatment	Dose (Mg/Kg p.o) for 15 days	Mast cells Intact %	Mast cells Disrupt %
1.	Control	-	26	74
2.	V-1	25	30	61
3.	V-2	50	57	43
4.	V-3	75	69	31
5.	V-4	100	72	28
6.	Standard drug (Prednisolone)	10	75	25

5.16 Anti-asthmatic activity in experimental animal (Albino rat):

The herbal extract isolated and purified from *Vitex negundo* has been tested for its detail pharmacological properties on anaphylactic albino rat. The effect of herbal extract was manifested orally, mixing with the diet as well as by injecting intraparietonially to the albino rat. The areolor connective tissue was taken out from the experimental animal for histological observation of mast cells degranulation.

RESULTS

The present paper reports *Vitex negundo* important plant species of ethnomedicinal value used by the tribes of Betul district of Madhya Pradesh in India. Betul is predominantly tribal area where tribe communities living in remote places still make use of local flora for their day to day activities for various aliment including asthma, cold and cough. During the survey, it was observe that primary health facilities are still meager hence they depend on local flora for various treatments. The knowledge of ethnomedicinal plant based on folklore ethnic culture goes from generation to generation. Ethnomedicinal study of various part of the country has been surveyed by different workers. Saxena (2001) have made such study of Hamirpur district of Bundelkhand region, where he has listed more than 70 genera used by the villagers for gastro intestinal trouble, skin and wound healing snake bite and other disease. Similarly, Malviya et. al. (2008) have reported more than 10 plants from Udaipura tahseel of Raisen district used in wound healing and skin disease. Chandra et. al. (2005) have demonstrated exhaustive ethnobotanical study in tribal community of Baghmundi and Purvlia district of west Bengal. They reported 143 species of the plants belonging to 65 families from various habitats of this area. Abbas et. al. (2009) from this laboratory have reported 20 plants of Lolab Vally of Kashmir based on Gujar and Bakarval communities living in high slope area of Kashmir Valley for skin disease. From the forgoing discussion, it may concluding that ethno medicinal studies are still considered important because there are some hidden facts which has been exposed by such studies and as such the present paper is quite important which revealed the information's gathered from the survey carried out by the tribal area of Betul district of Madhya Pradesh in India.

DISCUSSION

Asthma is a disease or condition in which the bronchial air ways temporarily constructed so that it becomes difficult to breathe. Such difficulty may arise due to muscles-spasm in the bronchi of the lungs because of narrow space available for the air. It becomes difficult to breath. The spasm is produced by the mast cell.

Herbal Medicines are widely protected from ancient period through the world. Ethnomedicine is a modern branch of Ethnobotany, which is mainly based on the ancient knowledge of the plants in the traditional medicine for different ailments in the modern world. In this study it has been found that highest yield of *Vitex negundo* during isolation is obtain using soxhlet method with methanol as solvent. Frothing test confirmed the presence of saponin in the extract. The stricture of saponins was investigated using spectral analysis techniques.

Finally the effect of *Vitex negundo* on mast cells degranulation in sensitized albino rat was studied and it was conformed that plant extract of *Vitex negundo* is effective against the respiratory diseases like asthma and in higher concentration it is comparable to the standard drug Prednisolone. In control group of the sensitized rats 79% disruption of mast cell was noticed, which comes to be 28% after the drug administration of *vitex negundo* as shown in Table 4

This study highlights the potential capability of the *Vitex negundo* for the treatment of respiratory diseases like asthma detailed study on the possible side effects scope of mass production, comparison with other standard drugs and cost benefit analysis may be carried out in future ascertain in the commercial viability in establishing vitex negundo as a practical medicine for treating asthma.

ISSN 2394 - 7780

ACKNOWLEDGEMENT
Author is very great full to the entire Villagers local Ayurvedic practitioner, Vaidyas, taxonomists and people of Betul district for sharing their knowledge on herbal medicine.

REFRENCES

1. Ahmadiani A., Javan, M., Semnanian S., Barat, E., Kamalinjad, M. (2001) Anti-inflammatory and anti pyretic effects of *Trigonella foenum-graecum* leaves extract in the rat. *J. Ethnopharmacol.* 75: 283-286.
2. Anish, M., Sharma, M. P. and Iqbal, M. (2000). Herbal ethnomedicine of the Gwalior forest division in Madhya Pradesh, *India Pharmaceutical Biology*. 38 (4): 241-253.
3. Ammar, N. M., Alokbi, S. Y., Mohammed, D. A., (1997) Study of the anti-inflammatory activity of some medicinal, edible plants growing in Egypt. *J. Islamic Acad. Sci* 10 (4): 35-41.
4. Banerjee S., Sur T. K., Mandal P. S., Das S. C. (2000) Assessment of the anti inflammatory effect of Swertia chirata in acute and chronic experimental models in male albino rate. *Ind. J. Pharmacol.* 32 : 21-24.
5. Baruah C. C., Gupta P. P., Amarnath, Goel R. K. and Dhawan B. N. (2001). *Albizia lebbek* a traditional anti allergic medicinal plant. Proceedings of Ethnomedicine of North-East India organized by national institute of science communication and information resources, CSIR, New Delhi. 72-73.
6. Chandra R., Kuiri N. I. and Kumar J. (2005) Ethnomedicinal plants of Baghmundi, Purulia district (W.B.) India Proc: International Conference on Botanicals, Kolkata India. 262-265
7. Chopra R. N., Nayar S. L., Chopra I. C. (1996) Glossary of Indian medicinal plants: CSIR : New Delhi, 256-257.
8. Christen G. L., D'Cruz L. S. J., Saxena O. P., Braganza V. J. S. J. (2003) Phytochemical screening of some ethnomedicinal plants of endangered status. National convention on convention on current trend in Herbal Drugs. 21-94.
9. Deepak M., and Honda S. S. (2000) Anti-inflammatory activity and chemical composition of extract of *Verbena officinalis* Phytothex. Res. 14: 463-465.
10. Dixit R. S. and Pandey H. J. (1984). Plant used as folk medicine in Jhansi and Lalitpur section of Bundelkhand, Uttar Pradesh. *Int. J. Crude Drug. Res.* 22: 47-51.
11. Negi, K. S., Tiwari, J. K., Gaur, R. D. and Pant, K. S. (1993) Notes on ethnobotany of five district of Garhwal Himalaya, Uttar Pradesh India ethnobotany. 5: 73-81.
12. Ghosh S., Besra S. E., Roy K., Vedasiromoni J. R. and Gupta J. K. (2005). Anti inflammatory activity of methanolic extract of seeds of *Swietenia mahagoni Jacq* (Meliacaea) International conference on promotion and development of Botanicals, Kolkata, India. 103-SNPS/CB/55-072.
13. Harbornae, J.B. (1984) Phytochemical methods-A guide to modern techniques of plant analysis. 2nd ed. Chapmens Hall publication, London 238
14. Jain, S. K. (1999). Dictionary of Indian folk medicine and ethnobotany, Deep Publication, New Delhi.
15. Jain, S. K. (1991). Dictionary of Indian folk medicine and ethnobotany, Deep Publication, New Delhi India 116.
16. Jha, R. K. (2001). Ethnomedicinal plants used against asthma at Chhotanagpur, Jharkhand, India Adv. pl. Sci. 14 (1): 95-97.
17. Lone, M. A., Shrivastava, P. N., Saxena, R. C. and Lone, M. A. (2009) Survey of ethnomedicinal plant of Lolab valley of Kashmir for skin diseases. Biosciences, Biotechnology Research Asia 6 (1): 355-358.
18. Malviya D., Shrivastava P. N. and Saxena R. C. (2008) Medicinal plants used in traditional system of medicine tribal area of Udaipura Tehsil of Raisen district of M. P. specially for wound healing and skin diseases, *Biosciences Biotechnology Research Asia*, 5 (1): 417-420.
19. Mitra, S. K., Gopumadhavan, S., Venkateranganna, M. V. and Anturlikar, S. D. (1999) Anti asthmatic and anti anaphylactic effect of E-721 B herbal formulation. *Ind. J. Pharmacology. 31(5): 133-337.*
20. Saxena B. R. (2001) ethnobotanical and pharmacological studies of Medicinal plants of Hamirpur district of Bundelkhand region Ph. D. Thesis in Botany Barkatullah University Bhopal.

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

VARIATION IN PHYSICAL AND PHYSICOCHEMICAL PROPERTIES OF DIFFERENT CULTIVARS OF JACKFRUIT SEEDS HARVESTED FROM THE NORTHERN REGION OF INDIA

Radha Kushwaha, Vinti Singh, Monika Singh, Devinder Kaur
Centre of Food Technology, University of Allahabad, Allahabad

ABSTRACT
The jackfruit belongs to family Moraceae, composed of pulp, seed, and rind. In this study, the physical and nutritional properties of jackfruit seeds were analyzed. Five different cultivars were used in study viz. Hadiyava, Bhadaiyan, Khaja, Safeda, and Katahri. The average moisture content of seeds was 48.62 to 67.84% (wet basis). The average for the three characteristic dimensions, length, width, and thickness was 2.30 to 2.77 cm, 1.45 to 1.93 cm and 1.22 to 1.64 cm among the seeds from different cultivars, respectively. The bulk density of seeds ranges from 0.44 to 0.53gcm^{-3}. Jackfruit seed contains 13.30 to 16.60% of protein content in which 'Safeda' has the highest protein (16.60%). The present study reveals the size and shape of seeds which is important for the development of equipments. Seeds of jackfruit can be used as the production of flour and starch for the production of various foods.

Keywords: Jackfruit; Moraceae; dimensions; geometric mean; Bulk density; Seed.

1. INTRODUCTION
Jackfruit (*Artocarpus heterophyllus L.*) an evergreen tree belongs to family *Moraceae* and being grown in tropical regions, broadly in Asia including India. It is mainly grown as a shade crop and is available throughout the country (Ghosh and Venkatachalapathy, 2014). In India total jackfruit production was about 1852 thousand tonnes from an area of 156 thousand hectares in 2016-2017 NHB, database. In the southern part of Asia and other countries, it is also known as poor man's fruit. The fruit contains palatable sweet yellow bulbs and seeds. A single fruit may contain about 500 seeds (Menaka *et al.,* 2011). Total percent of seeds in fruit is 10 to 20% of the total fruit weight (Tulyathan *et al.,* 2002). Seeds are rich in protein and carbohydrate. Naturally, Jackfruit occurs in two textural varieties at ripening phase soft fleshed (with soft and pulpy perianth) while firm-fleshed has firm perianth (Odoemelam, 2005). The jackfruit seed contains 61.8% (w.b.) moisture content, protein (11.85%), fiber (3.19%), carbohydrate (26.20%) and 382.79 kcal/100g energy. Jackfruit seeds not being used industrially. Generally, the seeds are discarded or steamed and eaten as a snack (Tulyathan *et al.,* 2002). Jackfruit seeds are recalcitrant; they sprout instantaneously after maturity so they cannot be stock up for a long time period without any processing. Consequently, vast quantities of the total seed left unexploited. For the storage of these seed proper handling and postharvest techniques should be used. Proper moisture content and storage apparatus make them safe for a longer duration which can be used further for the production of flour and starch. The recent study was an attempt to determine the physical and nutritional properties of jackfruit seeds from different cultivars. These properties are useful in the design and development of equipment, handling, processing like cleaning, washing, peeling, cutting and drying, storage, value addition of products from jackfruit seeds. Due to the absence of this basic information on properties, there is no technology or equipment available for post-harvest processing of jackfruit seeds. The traditionally all the processing of seeds are done by manual methods which are tiresome and time-consuming process.

The seeds properties like bulk density, porosity, true density and angle of repose are helpful for deciding the size of seed hoppers and storage apparatus. These properties can be influenced by the mass rate and heat transfer of moisture in the duration of various processing techniques like aeration and drying. Shape and size of seeds are essential for designing of various types of equipment viz. separating, harvesting, sizing and grinding machines. Many researchers (Aydin, 2003; Altuntas, 2005; Milani *et al.,* 2007; Altuntaş and Yiliz, 2007) have studied the physical properties of various seeds, grains, and nuts.

2. MATERIALS AND METHODS
Jackfruit seed used in the present study was obtained from Khushrobagh, Allahabad (U.P.) India. Three cultivars were selected for the further study viz. Khaja, Safeda, and Katahri. The seeds were separated manually from fruits (Figure 1). The moisture content of the seeds was 49.97 to 67.84% on the wet basis.

Physical Properties
Twenty seeds were selected randomly and the three linear dimensions namely length, width, and thickness and other properties were measured.

The geometric mean diameter was calculated by using the three principal dimensions and formula given by Milani *et al.,* (2007). The geometric mean diameter was denoted by D_g

ISSN 2394 - 7780

$$\text{Geometricm ean Diameter } (D_g) = (LWT)^{1/3}$$

Where **L** is the length (cm), **W** is the width (cm), and **T** is the thickness (cm).

The shapes of seeds are generally expressed in terms of its sphericity. It is an essential parameter to know the fluid flow, heat and mass transfer calculations. The sphericity (ϕ) was determined by the following formula.

$$\text{Sphericity } (\phi) = \frac{W \times T}{L^2}$$

The surface area (S) of the seed sample was calculated by the following equation given by McCabe *et al.,* (1986)

$$\text{Surface area } (S) = \Pi D_g^2$$

The aspect ratio (R) of the jackfruit seeds were calculated by Maduako and Faborode, (1996) the equation 4.

$$\text{Aspect ratio } (R) = \frac{\text{Width of seed}}{\text{Length of seed}} \times 100$$

The bulk density of the sample was determined by the method given by Singh and Goswami, (1996). Seeds were filled in a 100 ml container up to the mark then the content was weighed. No additional manual compaction of seeds was done. The bulk density was calculated by the ratio of the weight of the seeds and the volume of the container.

$$\text{Bulk Density } (g/cm^3) = \frac{\text{Weight of Sample}}{\text{Volume of Sample}}$$

Physicochemical properties

The proximate composition viz. moisture, fat, protein, ash, the crude fiber was done by using standard methods of analysis AOAC (2016) for all the samples. Protein content was calculated by multiplying a factor of 6.25 to the percent of nitrogen found in the sample. Carbohydrate content was determined by subtracting with the sum of moisture, protein, ash fiber and fat content of the sample. All the experiments were done in triplicate and analyzed statistically.

Statistical analysis

Results were analyzed for statistical significance at $p \leq 0.05$ by one-way analysis of variance (ANOVA) followed by Dunken test, by using software IBM SPSS statistics 20.

3. RESULTS

Linear dimensions and Geometric mean diameter

The seed size distribution was carried out by random sampling of jackfruit seeds. The size of the seeds was ranged from (2.30-2.86 cm) given in Table 1. Safeda has the highest length (2.93cm) with lowest width (1.45cm) and thickness (1.22), followed by Safeda that was having (2.86 cm), (1.48cm) and (1.28cm) length, width and thickness, respectively. These values are higher than those of Jetropa seeds, wild pistachio and African nutmeg (Burubai *et al.,* 2007; Garnayak *et al.,* 2008; Heidarbeigi *et al.,* 2008). The geometric mean diameter of jackfruit seeds was 1.72 to 2.04 cm, being these values lower than the length, and higher than width and thickness (Table 1). Geometric mean diameters were analyzed statistically and found no significant differences ($p \geq 0.05$) among the cultivars. The geometric mean diameter can be used for the determination of volume and sphericity of seeds. Present findings agreed with the result of Deshmukh, (2014) he reported that the geometric mean diameter was 14.01 to 17.84 mm and 14.73 to 19.86 mm for the firm and soft flesh seeds,

ISSN 2394 - 7780

respectively at moisture content ranged from 9.43 to 130.68 % (db). The D_g values of Jackfruit seeds were found higher compare to Ipoli fruits (Burubai and Amber, 2014).

Surface area, Sphericity, Aspect ratio, and Bulk density

The data presented in table 2 show that the surface area of seeds ranged from 9.26 to 13.19cm^2, having significant differences ($p \leq 0.05$) among the cultivars. Deshmukh, (2014) found the surface area raises linearly from 662.00 to 1014.17 mm^2 and 620.00 to 1140.82 mm^2 in the firm and soft flesh seeds, respectively as moisture content increases.

The sphericity of seeds found higher value in cultivar Katahri (84.06%) followed by Hadiyava (74.89%) and Khaja (70.15%) respectively (Table 2). The sphericity of seeds was different from variety to variety in the present study. Above results indicate that the shape of the jackfruit seeds makes them easier to spin on the surface as the seeds have sphericity value near to one. The sphericity of jackfruit seeds showed that they have a practical application in handling operations like conveying and grading. Though the plane shape seeds enable to slide and this property is important for the manufacturing of hopper and dehuller designs for seeds. Deshmukh, (2014) had reported that the sphericity of jackfruit seeds ranged from 0.606 to 0.664 and from 0.608 to 0.673 for the firm and soft flesh seeds, respectively at moisture content from 11.37 to 130.68 % (db). Burubai *et al.,* (2007) and Ozcan and Haciseferogullari, (2004) had found similar results in nutmeg and sumac fruits respectively. Another mean for the measurement of axial dimensions is the arithmetic mean diameter. The arithmetic mean diameter of jackfruit seed ranges from 1.87 cm to 2.11cm, statistics showed that there is a significant difference among the cultivars. Unal *et al.,* (2008) had found lower arithmetic diameter value than that of the present study in mung bean.

Aspect ratio is also very important for the handling operation of seeds like sphericity. The aspect ratio of the jackfruit seed was ranged from 49.36 to 82.45%. Higher the length of seed lowers the aspect ratios. Cultivar 'Katahri' (82.45%) has a higher aspect ratio as compared to other cultivars. aspect ratio has a significant difference among the jackfruit cultivars.

The bulk density of jackfruit seeds ranges from 0.44 to 0.53gcm^{-3} in the present study. The density of seeds showed that jackfruit seeds are heavier than both air and water. Deshmukh, (2014) found that the bulk density increases from 383.7 to 626.2 kg/m^3 in firm flesh seeds while from 362.9 to 657.6 kg/m^3 in soft flesh seeds. The bulk density of seeds was found similar to the results reported by Burubai *et al.,* (2007) in nutmeg is 0.49 gcm^{-3} and Burubai and Amber, (2014) Ipoli fruit is 0.53 g/cm^3.

Proximate Analysis

Proximate of Khaja, Safeda, and Katahri jackfruit cultivars were done. The moisture content of jackfruit seed was ranged from 48.62 to 67.84%. 'Khaja' seeds have the highest moisture content followed by 'Katahri' and 'Hadiyava'. Abedin *et al.,* (2012) reported moisture content was 35.97, 42.25, and 21.10% in three different cultivars viz. Khaja, Gala and Durosha seeds respectively. These values were found lower than the present values. While, Samadder, (1990) Hossain and Haq, (2006) Jagtap and Bapat, (2010) and, Gupta *et al.,* (2011) reported moisture content in jackfruit seeds 64.5%, 64.5%, 51.0 to 64.5%, and 61.8 % respectively, this is similar to the present study**.** Ash content was ranged in between 3.75 to 4.03%. The cultivar 'Khaja' shows higher ash content followed by 'Hadiyava' and 'Katahri' (Table 3). Abedin *et al.,* (2012) had reported ash contents were 4.07, 2.13% and 3.30% in Khaja, Gala, and Durosha seeds, respectively. Gupta *et al.,* (2011) reported ash content of jackfruit seed was 0.15%.

Jackfruit seeds are a good source of protein. The present study showed that the jackfruit cultivars seeds contain 13.30 to 16.60% of protein content. Safeda cultivar has the highest protein content (16.60%) than other

ISSN 2394 - 7780

cultivars. Abedin *et al.,* (2012) found protein content in Khaja, Gala and Durosha seeds were 13.13, 14.81 and 18.13% in respectively while Hossain and Haq, (2006) Jagtap and Bapat, (2010) and Gupta *et al.,* (2011) reported lowest protein content of jackfruit seeds 6.6%, 6.6 to 7.4 % and 11.85% respectively. Following results were similar to the current findings.

The fat content of jackfruit seed was 0.55 to 0.63%, which similar to the results reported by Hossain and Haq, (2006) Jagtap and Bapat, (2010) and Gupta *et al.,* (2011) 0.40 %, 0.40 to 0.43% and 1.0%, 0.40 to 0.43% and respectively. The fiber content of the jackfruit seed ranged from 2.84 to 3.35%. Highest fiber content was seen in Safeda Cultivars. Abedin *et al.,* (2012) reported fiber content in Khaja, Gala and Durosha seeds were 2.60, 3.83 and 1.56 % in respectively that is similar to the present study. Hossain and Haq, (2006) and Jagtap and Bapat, (2010) and reported a lower value of fiber content i.e. 1.0 to 1.5 %. Fiber helps in the digestion process and they provide a feeling of full of stomach. Carbohydrate content was ranged from 11.40 to 29.27 % which is similar to results were reported by Gupta et al.,(2011) i.e. 26.20% and Hossain and Haq, (2006) and Jagtap and Bapat, (2010) i.e. 25.80 to 38.40%. Statistical analysis nutritional quality of jackfruit seeds showed that there are significant differences among cultivars.

4. DISCUSSION

The shape of jackfruit seed is ellipsoidal because length and width are different due to the longitudinal section. ANOVA data showed that length, width, and thickness have significant differences among the cultivars. Further, as the three semiaxes of the seeds are not equal, the shape of seed can be ellipsoidal. These dimensional properties of seeds are essential for the design of machines for cleaning and sorting operations as well as the development of trough and hoppers. Deshmukh, (2014) had reported that the linear dimensions of jackfruit seed and averaged value were length (23.13, 27.99 mm), width (13.10, 18.64 mm) and thickness of the seeds was (9.86, 14.26 mm) for the firm and soft flesh, respectively.

Jackfruit pulp and seeds both are having an appreciable amount of protein and fiber. Generally seeds of fruit being removed during cooking or processing time. But they are having more nutritional values as compared to a pulp in terms of protein, fiber, and minerals. Here, from the nutritional point of view among the cultivars 'Safeda' could be best cultivars followed by 'Katahari' and others. Above results would help to make the best use of jackfruit seeds for different purposes and applications.

5. CONCLUSIONS

The following conclusions were obtained from the present study about the physical properties of Jackfruit seed at average moisture 54.04% (w.b.). The bulk density ranged from 0.44 to 0.53 g cm−3. Various physical properties of jackfruit seeds showed that they belong to oval to ellipsoidal shape. In short, this study deals with the physical properties of jackfruit seeds, enhancing the knowledge about the difference between cultivars and providing useful data for its industrial processing. Further studies should be performed to investigate the moisture-dependent physical properties of jackfruit seeds, and different products can be prepared by using this underutilized seed of jackfruit on the industrial scale. That could be playing an important role to eradicate malnutrition and deficiency of protein.

ACKNOWLEDGMENT

We are thankful to the Centre of Food Technology, IPS, and the University of Allahabad for providing all necessary facilities for this research.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

ETHICS APPROVAL

This article does not contain any studies with human participants or animals performed by authors.

ISSN 2394 - 7780

REFERENCES

- Abedin, M. S., M. M. Nuruddin, K. U. Ahmed and A. Hossain. 2012. Nutritive compositions of locally available jackfruit seeds (Artocarpus heterophyllus) in Bangladesh. Int. J. Biosci. 2(8): 1-7.
- AOAC Official Methods of Analysis. 2016. 20th Edn. Arlington: Association of Official Analytical Chemists, Inc.
- Altuntas, E., E. Ozgoz and O. F. Taşer. 2005. Some physical properties of fenugreek (Trigonella foenum-graceum L.) seeds. J. Food Eng. 71(1): 37-43.
- Altuntaş, E. and M. Yıldız. 2007. Effect of moisture content on some physical and mechanical properties of faba bean (Vicia faba L.) grains. J. Food Eng.78 (1): 174-183.
- Aydin, C. 2003. Physical properties of almond nut and kernel. J. Food Eng. 60(3):315-320.
- Burubai, W., A. J. Akor, A. H. Igoni and Y. T. Puyate. 2007. Some physical properties of African nutmeg (Monodora myristica). Int. Agrophys. 21(2): 123.
- Burubai, W. and B. Amber. 2014. Some physical properties and proximate composition of Ipoli fruits. Int. J. Food Process. Technol. 5.
- Deshmukh, P. S. 2014. Development of Jackfruit seed flour by different methods (Doctoral dissertation, College of Agricultural Engineering and Technology, Dr. BSKKV, Dapoli).
- Garnayak, D. K., R. C. Pradhan, S. N. Naik and N. Bhatnagar. 2008. Moisture-dependent physical properties of jatropha seed (Jatropha curcas L.). Ind. Crops Prod. 27(1):123-129.
- Ghosh, P. and N. Venkatachalapathy. 2014. Processing and drying of coffee–a review. Int. J. Eng. Res. Technol 3:784-794.
- Gupta, D., S. Mann, A. Sood and R. K. Gupta. 2011. Phytochemical, nutritional and antioxidant activity evaluation of seeds of jackfruit (Artocarpous heterolphyllus Lam.). Int. J. Pharma. Bio. Sci. 2(4): 336-345.
- Heidarbeigi, K., H. Ahmadi, K. Khuralipour and A. Tabatabaeefar. 2008. Some physical and mechanical properties of Iranian wild Pistachio (Pistachio mutica L.). Am. Eurasian. J. Agric. Environ. Sci. 3(4): 521-525.
- Hossain, A. K. M. A. and N. Haq. 2006. Jackfruit (Artocarpus heterophyllus). In: Tropical Fruit Trees, edited by Williams JT, Smith RW and Dunsiger Z, Southampton, UK: Southampton Centre for Underutilised Crops, University of Southampton.
- Jagtap, U. B. and V. A. Bapat. 2010. Artocarpus: A review of its traditional uses, phytochemistry and pharmacology. J. Ethnopharmacol. 129(2): 142-166.
- Maduako, J. N. and M. O. Faborode. 1990. Some physical properties of cocoa pods in relation to primary processing. Ife J. Technol. 2(1): 1-7.
- McCabe, W.L., J.C. Smith and P. Harriot. 1986. Unit Operations of Chemical Engineering. McGraw-Hill, New York.
- Menaka, T., G. Nagaraja, D. B. Yogesh, U. S. Kumar and L. Prakash. 2011. Physicochemical Properties of flour and isolated starch from Jackfruit seeds (Artocarpus Heterophyllus lam). J. Pharm. Sci. 1(1): 58-636.
- Milani, E., M. Seyed, A. Razavi, A. Koocheki, V. Nikzadeh, N. Vahedi, M. Moein-Fard and A. Gholamhossein Pour. 2007. Moisture dependent physical properties of cucurbit seeds. Int. Agrophys. 21(2): 157.
- NHB Database, 2016-17. National Horticulture Board, Gurgaon. Ministry of Agriculture, Govt of India.
- Odoemelam, S. A. 2005. Functional properties of raw and heat processed jackfruit (Artocarpus heterophyllus) flour. Pakistan J. Nutr. 4(6): 366-370.
- Ozcan, M. and H. Haciseferogullari. 2004. A condiment [sumac (Rhus coriaria L.) fruits]: some physicochemical properties. Bulg. J. Plant Physiol. 30(3-4): 74-84.
- Samaddar, H.N. 1990. Jackfruit. In. Fruits, Tropical and Subtropical (lst edn). Naya Prakash. 206 Bidhan Sarani. Calcutta. India, 637-639.

ISSN 2394 - 7780

- Singh, K. K. and T. K. Goswami. 1996. Physical properties of cumin seed. Int. J. Environ. Agric. Res. 64(2): 93-98.
- Tulyathan, V., K. Tananuwong, P. Songjinda and N. Jaiboon. 2002. Some physicochemical properties of jackfruit (Artocarpus heterophyllus Lam) seed flour and starch. Science Asia, 28(1): 37-41.
- Unal, H., E. Isık, N. Izli and Y. Tekin. 2008. Geometric and mechanical properties of mung bean (Vigna radiata L.) grain: effect of moisture. Int. J. Food Prop. 11(3): 585-599.

Table-1: Jackfruit seed linear dimensions and Geometric mean diameter

Jackfruit cultivar	Length (cm)	Width(cm)	Thickness(cm)	Geometric mean(cm)
Hadiyava	2.77±0.29bc	1.93±0.23b	1.63±0.22b	2.04±0.10c
Bhadaiyan	2.93±0.18c	1.45±0.29a	1.22±0.19a	1.72±0.06a
Khaja	2.66±0.11b	1.78±0.13b	1.34±0.13a	1.93±0.08bc
Safeda	2.86±0.13bc	1.48±0.45a	1.28±0.13a	1.85±0.08ab
Katahri	2.30±0.10a	1.90±0.14b	1.64±0.25b	2.00±0.14c

a-c Means superscript with different alphabets in the same column differs significantly ($p < 0.05$).

Table-2: Surface area, Sphericity, Aspect ratio and Bulk density of jackfruit seed (and other characters)

Jackfruit cultivars	Surface area (cm2)	Sphericity (%)	Arithmetic mean(cm)	The aspect ratio (%)	Bulk density (gcm−3)
Hadiyava	13.19±1.28c	74.89±11.04b	2.11±0.08d	71.12±14.63b	0.44±0.03a
Bhadaiyan	9.26±0.67a	58.64±2.56a	1.87±0.08a	49.36±8.37a	0.51±0.02bc
Khaja	11.71±1.04 bc	70.15±2.66 b	2.00±0.08 bc	67.98±3.10 b	0.45±0.02 a
Safeda	10.74±1.0 ab	62.25±1.92 a	1.97±0.08 ab	52.57±2.69 a	0.53±0.015 c
Katahri	12.67±1.85 c	84.06±4.16 c	2.02±0.14 bc	82.45±3.65 c	0.49±0.01 b

a-d Mean values superscript with different alphabets in the same column differs significantly ($p < 0.05$).

Table-3: Proximate analysis of jackfruit seeds

Parameters	Jackfruit cultivars				
	Khaja	Safeda	Katahri	Hadiyava	Bhadaiyan
Moisture	67.84±0.84d	49.97±0.38 ab	52.52±0.79 c	51.25±0.96bc	48.62±0.86a
Ash	4.03±0.10 b	3.75±0.11a	3.95±0.09 b	4.00±0.11b	3.86±0.08ab
Protein	13.30±0.17 a	16.60±0.16 d	15.47±0.27 c	14.33±0.92b	14.58±0.90b
Fat	0.61±0.03 bc	0.57±0.03 ab	0.63±0.04 b	0.55±0.01a	0.57±0.04ab
Fibre	2.84±0.05 a	3.35±0.11 c	3.21±0.10bc	2.88±0.10a	3.09±0.08b
Carbohydrate	11.40±0.79 a	25.74±0.44 c	24.21±0.80 b	26.98±0.78c	29.27±0.83d

a-d Means superscript with different alphabets in the same column differs significantly ($p < 0.05$).

Figure-1: Jackfruit seed cultivars A. Bhadaiyan; B. Hadiyava; C. Khaja; D. Safeda, E. Katahri

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019

ISSN 2394 - 7780

ASSESSMENT OF PROJECT COMPLEXITY: ERP SYSTEM IN LARGE SCALE PROCESS ENTERPRISES

K S Anjaneya Choudary[1], Dr. U V Adinarayana Rao[2], and M Arun Kumar[3]
Research Scholar[1], Associate Professor[2] and Assistant Professor[3], GITAM Institute of Management, GITAM – Deemed to be University

ABSTRACT

This paper focuses on project complexity with the aim to highlight the factors that contribute to it. Since projects are becoming more and more complex, it is imperative to understand project actuality through obtaining views from project management practitioners. To pursue on the subject, a questionnaire survey was carried out in a large scale process enterprise, which implemented the highly complex ERP project to integrate its operations. The study includes sizing of the project through a project sizing matrix, assessing project complexity levels and determining roles of project managers, and identifying factors contributing to project complexity and their means of mitigation.

OBJECTIVES

The objectives of the study are to investigate the perceptions of a project team implemented the ERP project in a large scale process enterprise and obtain their views on project complexity through a questionnaire survey. Based on the data collected, develop a framework to assess the levels of project complexity, and measure it as elaborated below:

i. To identify the size of the project with the help of a project sizing matrix.

ii. To identify the skills required by project managers to manage project complexity.

iii. To analyse the data collected and identify the factors that contribute to project complexity in actual project settings.

iv. To suggest means of mitigation of factors contributing to project complexity

Keywords: Project Complexity, Assessment, Contributing Factors, Means of Mitigation

1.0. INTRODUCTION

It is essential for the enterprises to focus their energies on rapid creation and delivery of new and unique products or services of high quality for their business survival in the present day's highly competitive and fast paced environment. The requirement to deliver these new and unique products or services, also known as *projects*, usually originates from the enterprise strategies and business plans. Enterprises need to convert their strategies and business plans into reality through detailed action plans, and ensure that the *projects* are successfully completed and effectively integrated into the business. The enterprise strategies and the detailed action plans are coupled through a *project management* approach. While results delivered by projects help the enterprise to achieve its business outcomes, early integration of these results into the business and transfer of ownership contributes to the efforts of the enterprise to reach the targeted strategies and business plans.

1.1. Need for the Study: Project complexity is a critical factor that poses additional challenges to achieve project objectives. Therefore, there is a need to study complexity as a separate factor influencing projects. The study includes identifying the effect of project complexity on project characteristics such as cost, schedule, quality, and project performance. Many facets of project complexity are known to be constantly changing variables such as project type, project size, project location, project team experience, interfaces within a project etc. Impacts of project complexity could be negative if it is not assessed and managed properly. Developing a methodology/framework to assess and measure the project complexity can help project teams predict project outcomes and increase the likelihood of success. The subject study increases the understanding of project complexity and improves the project management practices. The study explores factors contributing to the complexity of projects and provides a framework that can measure the levels of project complexity.

1.2. Project Management: *A Guide to the Project Management Body of knowledge*, PMBOK Guide, Sixth Edition, 2017, defines a *project and project management* in terms of their distinctive characteristics: 'A project is a temporary endeavour undertaken to create a unique product, service or result'. '*Project management* is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements'. Projects are successfully managed through application and integration of the project management processes.

ISSN 2394 - 7780

PMBOK Guide, Sixth Edition, 2017, identifies 49 project management processes and groups them under *five Process Groups* and *ten Knowledge Areas*, which are listed below:

A) Five Process Groups

· Initiating Process Group

· Planning Process Group

· Executing Process Group

· Monitoring and Controlling Process Group

· Closing Process Group

B) Ten Knowledge Areas

· Project Integration Management

· Project Scope Management

· Project Schedule Management

· Project Cost Management

· Project Quality Management

· Project Resource Management

· Project Communications Management

· Project Risk Management

· Project Procurement Management

· Project Stakeholder Management

1.3. Enterprise Resource Planning (ERP): Enterprise resource planning (ERP) is intended to integrate processes across all functional areas of enterprises with a view to improve workflow, standardise business practices, and create access to real-time and up-to-date data. ERP projects are technically complex, multidisciplinary, capital intensive and are of long duration; therefore, they can be characterised as highly complex and risky projects. Implementation of any large-scale integrated information system like ERP leads to significant changes in processes, tasks and resource related issues. The project complexity associated with ERP implementation makes it necessary for enterprises to deploy project complexity management approaches throughout the project life-cycle.

The ERP systems being complex, project teams are required to collaborate with upper management, different departments, users and consultants during the process of implementation. The ERP projects are considered to be challenging and demanding by the project managers, as they involve managing systems, resources (project team, users and external consultants), re-designing business processes etc. For effective implementation of ERP, a project management approach with clear and well defined goals and objectives, strategy, scope, and schedule is significant.

1.4. Large Scale Process Enterprises: Large scale process enterprises are generally capital and resource intensive, involving technological and process complexities and high volumes of operations. Introduction of any new system either to improve production/services or to improve business processes calls for high scale coordination without disturbing the ongoing processes. The process of implementation of highly complex and risky projects like ERP in large scale process enterprises becomes tougher as it calls for inclusion of concepts such as business process reengineering, change management, employee willingness and participation etc.

1.5. Project Complexity: The word ‘complex’ originates from the Latin words ‘cum’ meaning together or linked and ‘plexus’ meaning braided or plaited. The Oxford English Dictionary describes the term ‘complex’ as that ‘consisting of parts’ and ‘intricate – not easily analyzed or disentangled’. This is what Simon (1969) had meant when he described complex adaptive systems as something made up of large number of parts that interact in a non-simple way and the whole of which is more than the sum of its parts in a pragmatic sense.

“While many project managers use the term ‘a complex project’, there is no clear definition what it is meant. There is a general acceptance, however, that it means something more than a ‘big’ project” (Williams, 2002). Keeping in view the dynamic and complex contexts of projects, the concept of project complexity is gaining attention and various theories have been developed to better understand it.

ISSN 2394 - 7780

2.0 REVIEW OF LITERATURE

The theories developed by some of the researchers are presented below for better understanding of the concepts of project complexity:

Buchanan and Boddy (1992) define a project as a unique venture with a definitive beginning and an end, having established goals with parameters of cost, schedule and quality. Recently, the term 'complexity' has increasingly become an important point of reference concerning projects and their implementation. Practitioners of project management generally refer to their projects as simple or complex indicating that conventional tools and techniques alone may not be sufficient in executing complex projects.

Simon (1969) is one of the early researchers to describe a complex system as one that is made up of a large number of parts that interact in a non-simple way. He further adds that in such systems, the whole is more than the sum of its parts. Later researchers based their definitions on this one and furthered it by adding concepts such as non-linearity (Richardson & Cilliers, 2001).

Janice & Mengel, (2008) agree that the role of complexity, chaos and uncertainty within our projects and project environment is gaining recognition both in research and practice.

It is important to understand that there is no clear distinction between complex, large, or complicated projects. There is a general acceptance that it is something more than simply a 'big' project (Williams, 1999).

As Baccarini (1996, p.201) puts it, "certain project characteristics provide a basis for determining the appropriate managerial actions required to complete a project successfully. Complexity is one such critical project dimension." Complex systems primarily consist of two parameters, interconnection and interdependence of distinct parts (Baccarini, 1996).

Typically, the characteristics of a complex project would include difficulty, uncertainty (Williams, 2002), uniqueness (Crawford, 2005) indirect communication among elements (Luhman & Boje, 2001), dynamism (Kallinikos, 1998) and lack of clarity on the goals of the project (Turner & Cochrane, 1993).

In addition to the above mentioned characteristics, Dombkins (2008) added that complex projects have a high degree of disorder and instability. They are sensitive to small changes and are typically dynamic in nature.

The concept of complexity is still being used as an umbrella term associated with difficulty and interconnectedness (Geraldi, 2008). Geraldi (2008) talks about complexity of faith, complexity of fact and complexity of interaction.

- ***Complexity of Faith*** refers to complexity involved in creating something unique or solving new problems (Geraldi J., 2008). This type of complexity arises due to uncertainty. It is unsure whether the project outcome will work or not.
- ***Complexity of Fact*** is when we have to deal with large amount of interdependent information. However, there is no time to fully analyse and understand the information but a decision has to be taken. The challenge is to keep a holistic view of the problem and not get lost in the details (Geraldi J. , 2008).
- ***Complexity of Interaction*** is present in interfaces such as neutrality, ambiguity etc and it intensifies the two types of complexities discussed above.

Geraldi and Adlbrecht (2007) concluded that these complexities vary over the life cycle of a project and that complexity of interaction is perceived to have the greater intensity during all phases of the project followed by complexity of fact and faith, in that order.

Among the latest contributors are Remington and Pollack (2007), who provide a good starting point for categorizing complex projects. They emphasize that a clear distinction on the type of complexity helps in selecting the appropriate tool to manage the project and suggest four types of project complexity:

- Structural complexity
- Technical complexity
- Directional complexity
- Temporal complexity

Structural complexity stems from large scale projects which are typically broken down to small tasks and separate contracts. Projects in the engineering, construction, IT and defence sectors are likely to have this kind

ISSN 2394 - 7780

of complexity. Structurally complex projects are often classified as complicated projects and this may be a debatable issue. However, the complexity stems from the difficulty in managing and keeping track of huge number of interconnected tasks and activities (Remington & Pollack, 2007).

While on the subject of Structural complexity, Williams, (2002) suggests that uncertainty in goals usually adds to structural complexity. Perhaps a good example would be software development projects where the goals are uncertain, since user requirements are difficult to specify and are subject to change. This action of making changes increases the project (structural) complexity. In addition to that, Williams, (2002) suggests that there are two other aspects of structural complexity that needs to be taken into account:

1. The Objectives of our project – virtually all projects have multiple objectives with conflicting goals. This adds an element of structural complexity to the project.
2. Virtually all projects have complexity within the stakeholders.

Technical complexity is found in projects which have design characteristics or technical aspects that are unknown or untried" (Remington & Pollack, 2007). Complexity arises because of uncertainty regarding the outcome for many interdependent design solutions. Typically, architectural, industrial design and R&D projects are faced with this type of complexity.

It is interesting to note that Baccarini (1996) categorizes technological complexity in terms of differentiation and interdependencies. This view is shared by Remington & Pollock (2007).

The interdependencies are further elaborated by categorizing into three types given in ascending order of complexity:

- **Pooled**, in which each element gives a discrete contribution to the project
- **Sequential**, where one element's output becomes another's input
- **Reciprocal**, where each element's output becomes inputs for other elements

Directional complexity is characterized by projects where the direction for the project is not understood or agreed upon. "Directional complexity is often found in change projects, when it is clear that something must be done to improve a problematic situation, but it is unclear what this 'something' should be." (Remington & Pollack, 2007, p.51)

Temporal complexity results in projects where there is a high level of uncertainty regarding future constraints and could destabilise the project completely. Unexpected legislative changes, rapid change in technology making the project redundant are some typical situations where temporal complexity kicks in.

Being a fairly recent work, Remington and Pollack (2007) have been able to synthesise relevant models in the field of complex project management. Their approach is a big departure from traditional project management techniques. Their model sets the baseline upon which all the other models interact in different ways.

A deep understanding of context, the ability to embrace complexity, and a willingness to change leadership style will be required for leaders who want to make things happen in a time of increasing uncertainty (Snowden & Boone, 2007).

The above literature explains the concepts of project complexity convincingly, but does not point out the sources of complexity. So, it is essential to study the contributing factors of project complexity, identification of their sources and means of mitigation.

3.0. METHODOLOGY

The study is taken up to assess the complexity of ERP implementation project based on the real time experience of the project team and obtain their feedback through a questionnaire and develop a framework to bring out the contributing factors of project complexity and suggest means of mitigation. By definition, projects are temporary in nature and large process enterprises even though may have a pool of managers, they are not always working on projects. Moreover, projects like ERP implementation are in general one time occurrences and managers of the enterprise having experience in such installations is very rare. In this scenario, undertaking a complex and risky project like ERP implementation is difficult to any large enterprise. This can be overcome by appointing an internal project manager and engaging an external project management consultant to extend the necessary support.

ISSN 2394 - 7780

In the enterprise under study, the project manager and the project team were selected for ERP implementation project, based on the rich experience and expertise in their respective functional domains and this was their first ERP project. The project team was engaged in the project since inception till go-live and close out phase. However, implementation of ERP being a complex and specialized project, services of a consultant were hired. In any project, assessment of project complexity is to be undertaken in the initiation phase and periodically reviewed taking the progress of the project into consideration and making necessary changes to meet the constraints of cost and time.

GAPPS (Global Alliance for Project Performance Standards) has developed an approach to categorising projects based on their management complexity. The GAPPS framework uses a tool called the Crawford-Ishikura Factor Table for Evaluating Roles (CIFTER). The CIFTER is adopted as a part of the questionnaire survey method to obtain responses from the participants.

1.1. Questionnaire Survey Method

To facilitate conduct of survey, a questionnaire consisting of the following two parts was designed:

Part-A: Assessment of Roles of Project Managers based on Project Complexity through Crawford – Ishikura Factor Table for Evaluating Roles (CIFTER)

Part-B: Assessment of factors contributing to Project Complexity

The Part-A of the questionnaire consists of Crawford – Ishikura Factor Table for Evaluating Roles (CIFTER). The CIFTER includes seven factors, each factor is rated from 1 to 4 using a qualitative point scale and the respondents are to select a single option against each factor.

The Part-B of the questionnaire consists of 48 close ended questions, which include 5 questions on project characteristics to determine the size of the project. All the questions have different options varying from 2 to 5 and the respondents are requested to select only one option for each question and put a tick mark in the space provided against that option. The evaluation of responses is on a common time scale rating from 1to5 assigning equal weighting to all questions.

1.2. Sample size

The questionnaire was distributed among 30 members of the project team, worked on the ERP project and successfully implemented. The data was collected from 25 participants, while responses from 3 participants could not be received in spite of reminders and responses received from other 2 participants were incomplete, hence not taken into consideration.

3.3. Sizing of the Project

The project size was determined based on the answers provided by the project team members to the 5 questions of Part-B of the questionnaire on project characteristics, which include project duration, budget, team size, end users and integration with other units. The answers to these questions are rated on a 1-5 rated qualitative scale. All the 25 respondents provided the same information without any variation and the results are indicated in a Project Sizing Matrix against the indicators specified for Small, Medium and Large projects and shown in *Table-1*.

Table-1: Project Sizing Matrix Based on Project Characteristics

Sl No	Parameter	Unit of Measure	Small Project	Medium Project	Large Project	*Project Under Study*
1	Project Duration	Months	< 6	6 to 12	>12	***18 to 24***
2	Project Budget	Rs. Crores	<10	10 to 50	>50	***>50***
3	Project Team Size	Number	<10	10 to 20	>20	***>30***
4	End Users	Number	<25	25 to 250	>250	***>2000***
5	Integration With Other Units	----------	Minimal	Moderate	Significant	***Highly Significant***

The results displayed in the last column on the right side of the Table-1 show that, the project under study falls under *Large Project* category.

Roles of project Managers based on Project Complexity

GAPPS (Global Alliance for Project Performance Standards) has developed an approach to categorising projects based on their management complexity. The GAPPS framework uses a tool called the Crawford-Ishikura Factor Table for Evaluating Roles, or CIFTER which is shown in *Table-2*. The tool is used to differentiate project manager roles based on the complexity of the projects managed.

ISSN 2394 - 7780

Table-2: Crawford - Ishikura Factor Table for Evaluating Roles (CIFTER)

Sl. No.	Project Management Complexity Factor	Descriptor and Points			
1.	Stability of the overall project context	Very high (1)	High (2)	Moderate (3)	Low or very low (4)
2.	Number of distinct disciplines, methods, or approaches involved in performing the project	Low or very low (1)	Moderate (2)	High (3)	Very high (4)
3.	Magnitude of legal, social, or environmental implications from performing the project	Low or very low (1)	Moderate (2)	High (3)	Very high (4)
4.	Overall expected financial impact (positive or negative) on the project's stakeholders	Low or very low (1)	Moderate (2)	High (3)	Very high (4)
5.	Strategic importance of the project to the organisation or organisations involved	Very low (1)	Low (2)	Moderate (3)	High/Very high (4)
6.	Stakeholder cohesion regarding the characteristics of the product of the project	High/Very high(1)	Moderate (2)	Low (3)	Very low (4)
7.	Number and variety of interfaces between the project and other organisational entities	Very low (1)	Low (2)	Moderate (3)	High/Very high (4)

The CIFTER Factors

The CIFTER factors identify the causes of project management complexity. There are seven CIFTER factors (refer: *Table-2*), which together define management complexity of a project. Each factor is rated from 1 to 4 using a qualitative point scale, and the factors are totalled to produce a management complexity rating for the project. Each of the seven factors is given equal weight when evaluating the management complexity of a project. Since the characteristics of a project may change over time, the CIFTER factors may change over time as well.

The CIFTER Ratings

Each of the seven factors in the CIFTER has been rated on a point scale of 1 -4 with the total number of points across the seven factors determining whether a project is Global 1, Global 2 or neither and the following ranges were set.

- 11 points or less: This project *cannot* be used to provide evidence for a GAPPS compliant performance assessment.
- 12 points or more: This project *can* be used to provide evidence for a GAPPS compliant performance assessment at Global Level 1.
- 19 points or more: This project *can* be used to provide evidence for a GAPPS compliant performance assessment at Global Level 2.

Units of Competency

A summary of the Units of Competency is presented in *Table-3*. Units 1-5 shown in the Table are applicable to Global Level 1 project managers, while Units 1-6 are applicable to Global Level 2 project managers. Although the Performance Criteria are the same for both levels, the context in which that performance must be demonstrated is different as defined by the level of the project using the CIFTER.

Table-3: Units of Competency

Unit No.	Unit Title	Unit Descriptor
PM01	Manage Stakeholder Relationships	This Unit defines the Elements required to manage stakeholder relationships during a project. It includes the Performance Criteria required to demonstrate competence in ensuring the timely and appropriate involvement of key individuals, organisations, and groups throughout the project.
PM02	Manage	This Unit defines the Elements required to manage development of the plan for

ISSN 2394 - 7780

	Development of the Plan for the Project	the project. It includes the Performance Criteria required to demonstrate competence in determining how to realise the project in an efficient and effective manner.
PM03	Manage Project Progress	This Unit defines the Elements required to manage project progress. It includes the Performance Criteria required to demonstrate competence in ensuring that the project is moving constructively toward delivery of the product of the project and in support of the agreed project outcomes.
PM04	Manage Product Acceptance	This Unit defines the Elements required to ensure that the product, service, or result of the project will be accepted by relevant stakeholders. It includes the Performance Criteria required to demonstrate competence in ensuring that the product of the project is defined, agreed, communicated, and accepted.
PM05	Manage Project Transitions	This Unit defines the Elements required to manage project transitions. It includes the Performance Criteria required to demonstrate competence in getting the project underway, in moving from one project phase to the next, and in closing the project down at its conclusion.
PM06	Evaluate and Improve Project Performance	This Unit defines the Elements required to evaluate and improve project performance. It includes the Performance Criteria required to demonstrate competence in ensuring that opportunities for improvement are applied on this project and made available for future projects.

ANALYSIS OF THE STUDY

The 25 respondents rated the seven factors of the CIFTER on a point scale of 1-4 in Part-A of the questionnaire. The factor wise points specified by the respondents are summed up to arrive at their individual scores and shown in *Table-4(a)*. The frequency distribution of the respondents and their scores are shown in *Table-4(b)*.

Table-4(a): CIFTER Individual Scores

Sl No	Score
Job Title: Deputy Manager	
1	19
Job Title: Deputy Chief Manager	
2	21
Job Title: Assistant General Manager	
3	23
4	22
5	20
6	19
7	22
8	20
9	21
10	21
11	21
12	19
13	20
14	19
15	22
16	21
Job Title: Deputy general Manager	
17	22
18	21
19	22
20	20
21	21
21	20
23	19
24	23
25	22

ISSN 2394 - 7780

Table-4(b): Frequency Distribution of CIFTER Score

Respondents (No.)	5	5	7	6	2
Scores	19	20	21	22	23

Weighted average score: (5x19+5x20+7x21+6x22+2x23)/25=20.8

*The weighted average of the scores and the number of respondents works out to **20.8**. The CIFTER score of 20.8 falls beyond the specified score of 19 (Refer6.2.2: The CIFTER Ratings) and the project can be used to provide evidence for a GAPPS compliant performance assessment at Global Level 2 and applicable for Global Level-2 Project Manager.*

4.0. ASSESSMENT OF PROJECT COMPLEXITY

The part-B of the questionnaire consists of 48 questions on project management intended to assess the project complexity. These questions are categorized under the Knowledge Areas specified in PMBOK Guide. However, the questionnaire does not contain questions separately under Quality Management and Stakeholder Management knowledge areas and are part of the questions grouped under other knowledge areas.

The responses to all the questions are rated on a common scale of 1-5 with equal importance to all questions and to generate a weighted average score. The distribution of the questions knowledge area wise with relative weighting in percentage and maximum scores are indicated in *Table-5.*

Table-5: Project Complexity Assessment

Project Management Knowledge Areas	Number of Questions	Relative Weighting (%)	Maximum Score
Project Integration Management	11	24	55
Scope Management	11	24	55
Schedule Management	3	7	15
Cost Management	4	9	20
Resource Management	3	7	15
Communications Management	4	9	20
Risk Management	1	2	5
Procurement Management	8	18	40
Total	**45**	**100**	**225**

The complexity levels, definitions and corresponding scores in percentages are indicated in *Table-6.* The projects with scores 20 percent and below are not considered to be complex.

Table-6: Project Complexity Rating Table

Sl. No.	Complexity Level	Definition	Score %
1.	Low	Projects under this category have low complexity. The outcome of the project affects only a specific area or service or at most a specific simple project.	21-40
2.	Medium	Projects of medium complexity level may affect many services and may involve more significant procurement activities. It may involve some Information Technology enabled services or engineering activities.	41-60
3.	High	Projects of high complexity level introduce change and new capabilities, and may have a fairly extensive scope. IT enabled services may form a significant portion of the total project activity. There may be substantial change to business processes, technology infrastructure, internal resources, external clients, etc.	61-80
4.	Very High	Projects of very high complexity level often have serious consequences such as restructuring the organization, change in upper management etc. and require extensive capabilities to execute projects.	81-100

The options selected by the 25 respondents are summed up to arrive at their individual scores. The individual scores are shown in *Table-7(a)*. The frequency distribution of the respondents and their scores are shown in *Table-7(b).*

ISSN 2394 - 7780

Table-7(a): Project Complexity Assessment Individual Score

Sl No	Score
Job Title: Deputy Manager	
1	142
Job Title: Deputy Chief Manager	
2	145
Job Title: Assistant General Manager	
3	147
4	147
5	148
6	150
7	148
8	147
9	145
10	151
11	142
12	145
13	150
14	147
15	150
16	147
Job Title: Deputy general Manager	
17	148
18	147
19	145
20	150
21	142
22	148
23	147
24	145
25	148

Table-7(b): Frequency Distribution of Project Complexity Assessment Score

Respondents (No.)	3	5	7	5	4	1
Score	142	145	147	148	150	151

Weighted average score: (3x142+5x145+7x147+5x148+4x150+1x151)/25=146.84

Percentage: 146.84 ÷ 225 x 100 = ***65.26***

The Weighted average of the scores and the respondents works out to 146.84 out of a maximum score of 225 and is expressed as 65.26 percent. *With the score of 65.26 percent, the project falls under* ***"Category 3: High complexity"*** as per ***Table-6.***

The factors contributing to project complexity are identified on further study of the data and the possible means of mitigation are shown in *Table-8* and enclosed at *Annexure–A.*

5.0. LIMITATIONS OF THE STUDY

1. The process of data collection for the subject study targets mainly on impact of project complexity on the project characteristics and its performance. Project complexity being an abstract concept, collection of data to a high level of detail is a challenge and a limitation.
2. The study focuses mainly on project complexity and did not take into account the other similar areas, risk and uncertainty. However, these two areas are distinct from project complexity and need an in depth and separate study.
3. The study concentrates mainly on project management concepts and other operational complexities are not considered.

ISSN 2394 - 7780

4. The study is taken up to obtain the real time feedback on project complexity in a complicated project like implementation of ERP, which was already completed and in use in a large scale process enterprise. However, if similar studies are undertaken right from project initiation stage and reviewed till project completion stage for future projects, the chances of successful completion of projects improve.

6.0. CONCLUSION AND RECOMMENDATION

Project complexity is a critical factor that poses additional challenges in achieving objectives of the project. The present study develops a framework which facilitates project teams to assess, measure and determine the overall level of project complexity and leads to identify the contributing factors, thereby suggesting means of mitigation. Better understanding of project complexity and creating an appropriate management strategy will lead to optimal planning, efficient execution, and successful management of projects.

We hope that this work will help to undertake further study on assessment of complexity and identification of its contributing factors in management of ERP or other IT enabled projects of high magnitude and risk in large scale process enterprises and workout means of mitigation towards their successful implementation within the set boundaries of cost and time.

REFERENCES

1. Baccarini, D. (1996). The concept of Project complexity a review. *International Journal of Project Management , 14* (4), 201204.
2. Buchanan, A. D., & Boddy, D. (1992). *The expertise of the change agent: Public performance and backstage activity.* London: Prentice Hall.
3. Crawford, L. (2005). Senior management perceptions of project. *International Journal of Project Management , 23* (1), 716.
4. Davidson, F. J. (2002). *The New Project management.* Wiley & Sons.
5. Dombkins, D. (2008). The integration of project management and systems thinking. *Project*
6. *Perspectives 2008, Annual Publication of International Project Management Association*, 1621.
7. Fritzsche, D. (1997). *Business Ethics: A Global and Managerial Perspective, Management and Organizational Series.* London: McGraw□Hill International Editions.
8. GAPPS(2007) *A Framework for Performance Based Competency Standards for Global Level 1and 2 Project Managers* Sydney: Global Alliance for project Management Performance Standards
9. Geraldi, J. (2008). Patterns of complexity: The thermometer of complexity. *Project Perspectives 2008, The Annual Publication of International Project Management Association, ,* 49.
10. Geraldi, J., & Adlbrecht, G. (2007). On faith, fact and interaction in projects. *Project Management Journal , 38* (1), 3243.
11. Girmscheid, G., & Brockman, C. (2008). The inherent complexity of large scale engineering projects.
12. *Project Perspectives, annual publication of International Project Management Association* , 2226.
13. Janice, T., & Mengel, T. (2008). Preparing project managers to deal with complexity Advanced Project Management education. *International Journal of Project Management , 26* (3), 304315.
14. Kahane, A. (2004). *Solving Tough Problems: An Open Way of Talking, Listening, and Creating New Realities.* Berrett Koehler Publishers.
15. Kallinikos, J. (1998). Organized Complexity: Posthumanist Remarks on the Technologizing of Intelligence. *Organization , 5,* 371296.
16. Laufer, A., Gordon, R. D., & Shenhar, A. J. (1996). Simultaneous management: The key to excellence in capital projects. *International Journal of Project Management , 14* (4), 189199.
17. Muller, R., & Geraldi, J. G. (2007). Linking complexity and leadership competences of Project Managers. *IRNOP VIII Conference (International Research Network for Organizing by Projects).* Brighton.
18. Payne, J. (1995). Management of multiple simultaneous projects: a state of the art review.
19. *International Journal of Project Management , 13* (3), 163168.
20. Phelan, S. (2001). What is complexity science, really? *Emergence, 2001 , 3* (1), 120136.

ISSN 2394 - 7780

21. PMBOK. (2017). *A Guide to the Project Management Body of Knowledge* (Sixth Edition ed.).
22. Project Complexity and Risk Assessment Manual (Public Works and Government Services Canada) May, 2015, Version 5.
23. Remington, K., & Pollack, J. (2007). *Tools for Complex Projects.* Gower Publishing company.
24. Richardson, K. (2008). Managing complex organizations: Complexity thinking and the science and art of Management. *Emergence: Complexity and Organization , 10* (2), 1326.
25. Richardson, K., & Cilliers, P. (2001). What is complexity science? A view from different directions. *Emergence, 2001 , 3* (1), 523.
26. Simon, H. (1969). *The Architecture of Complexity', Organizations: Systems, Control, and Adaptation* (Vol. II). (J. Litterer, Ed.) NewYork: Wiley.
27. Snowden, D. F., & Boone, M. E. (2007). A Leader's Framework for Decision making. *Harvard Business Review* , 6976.
28. Stacey, R. D. (1996). *Complexity and Creativity in Organizations.* Berrett□Koehler Publishers.
29. Stephen, W. J., & Maylor, H. (2008). And then came Complex Project Management. *International Journal of Project Management , Article in Press*.
30. Thompson, J. (1967). *Organizations in Action.* NewYork: McGraw Hill.
31. Turner, J. R., & Cochrane, R. A. (1993). Goals and methods matrix: coping with projects with illdefined goals and/or methods of achieving them. *International Journal of Project Management, 11*(2), 93102.
32. Williams, T. M. (1997). *Managing and Modelling Complex Projects* (I ed.). Springer.
33. Williams, T. M. (1999). The need for new paradigms for complex projects. *International Journal of Project Management , 17* (5), 269273.
34. Williams, T. (2002). *Modelling Complex Projects.* John Wiley & Sons, Ltd.

ISSN 2394 - 7780

Annexure – A: Factors Contributing to Project Complexity and Means of Mitigation

The factors contributing to increase in project complexity and the means of mitigation are identified and tabulated below:

Sl No	Knowledge Area	Contributing Factors	Means of Mitigation
1	Project Integration management	Inadequate support of governance structure	• Develop appropriate, clearly established and documented governance structure
2	Project Integration management	Weak alignment of the project with the strategic objectives of the organization	• Establish strong alignment of the project with the strategic objectives of the organization
3	Project Integration management	Inadequate strength of the business case of the project to the organization	• Define and establish a strong business case of the project as a part of organization strategy and business plan
4	Project Integration management	Project management plan not well defined	• Develop a well defined project management plan which covers scope, cost, schedule, control, risk, deliverables etc.
5	Project Integration management	Improper/no documentation of project reporting and control processes	• Ensure availability of proper documentation of project reporting and control processes for effective control and reporting on project progress
6	Project Integration management	Non-adoption of practices like quality assurance, risk and issue management	• Ensure quality, risk and issue management processes are developed
7	Scope management	Priority of the project is below normal level to the organization	• Establish that the project is normal priority and essential to business process improvement
8	Scope management	Overall effect of the project on the organization structure	• Make sure that the project does not call for substantial changes to technology and infrastructure and fits the overall organization structure
9	Scope management	More intricate requirements of the project solution	• Reduce intricate requirements of the project solution such as high degree of availability, customization beyond normal configuration, high degree of quality and high degree of reliability just enough to meet the project needs
10	Scope management	Increased project requirements, details, people, and/or stakeholders	• Keep project requirements, details, people, and/or stakeholders just adequate
11	Scope management	Non-employment and non-verification of sources/methods to provide information for planning, integration and development	• Verification of sources/methods such as research, consultations, workshops, surveys, and existing documentation and provide information for planning, integration and development
12	Scope management	Inappropriate validation of the project requirements with the end users	• Validate project requirements with end users using the techniques such as walk-throughs, workshops etc.
13	Scope management	Non-conduct of feasibility studies	• Conduct feasibility studies which include options analysis activities, prototypes (to simulate the full system or part to test the viability or usefulness of the system) or proof of concept exercises (what is to be proven and to what degree)
14	Scope	Indefinable requirements	• Minimise indefinable requirements

ISSN 2394 - 7780

	management	(known unknowns) i.e tasks dependent on results from a previous task	• Reduce levels of dependency of tasks
15	Scope management	Inclusion of uncertain requirements or non-inclusion of accepted requirements in the specifications	• Ensure requirements are relevant, clear, and complete for inclusion and further communication
16	Scope management	Unstable project requirements	• Maintain stability of project characteristics such as integration, functionality, design, schedule, quality, and testing
17	Scope management	Non-inclusion of contingencies for dependent tasks	• Accommodate critical path or other methods to tie up dependent tasks
18	Scope management	Project is untried, unique and/or leading edge	• Make sure that the project is proven and time tested.
19	Schedule management	Project susceptible to time delays due to changes in technology and scope creep	• Freeze technological requirements • Do not allow scope creep
20	Time management	Prolonged project timelines	• Adherence to specified timelines • Explore concurrent performance of activities wherever scope permits • Ensure supplies as per specified timelines • Review resource allocation and plan for resource levelling
21	Cost management	Increase in project cost	• Ensure cost estimates are realistic • Periodical review of cost estimates and budgetary control • Adherence to specified timelines • Discourage scope creep
22	Cost management	Project cost estimates not well defined	• Work out realistic cost estimates • Periodical review of cost estimates as project progresses
23	Resource management	Inadequate human resources leading to increased requirement	• Plan availability of personnel with required skills to meet urgent needs of the project
24	Resource management	Roles and responsibilities for project team not well defined; Inadequate delegation and authority of powers to project manager and project team	• Define clear roles and responsibilities, record and communicate • Empower project manager and project team with adequate delegation and authority for smooth handling of the project
25	Resource management	Unstable project team	• Maintain stability of the project team with staff reserves and replacements
26	Resource management	Project manager and project team do not possess knowledge and experience to deal with the project	• Assign Project manager and project team with required skills and experience to handle the project • Hire services of a consultant
27	Resource management	Change management plan does not exist	• Introduce change management plan, a structured approach to transition organizations and personnel from a current state to a desired future state

ISSN 2394 - 7780

28	Communications management	Project reach to many areas (outcome of the project either change or directly affect business processes)	• Limit the project reach to relevant areas
29	Communications management	Low level of understanding of the project at relevant levels of the organization	• Ensure clear and comprehensive understanding of the project at relevant levels of the organization through different means of communication
30	Communications management	Inadequate communication plan	• Clearly defined and well documented communications management plan and its distribution to all relevant level
31	Communications management	Assigning inadequate personnel and personnel with inappropriate skills	• Reassess the staffing plan to make-up the skill gaps and assign adequate personnel with appropriate skills
32	Communications management	Inadequate information management processes	• Adopt information management processes like collection, distribution and protection of project information such as plans, designs, baselines etc.
33	Risk management	Non-preparation of risk management plan	Prepare risk management plan, which includes: • Assessment, identification, and prioritization of risks • Integration of risk management plan into project management plan • Exercise appropriate controls and mitigations of risk
34	Procurement management	Increase in project procurement	• Standardize and combine requirements • Invite consortiums
35	Procurement management	Inappropriate procurement strategy	• Well defined procurement strategy, its documentation and distribution
36	Procurement management	Availability of limited number of qualified suppliers/service providers for the products/services	• Encourage wider participation of available qualified suppliers/ service providers through flexible scope of work and contract terms
37	Procurement management	Constrained potential of the selected supplier/service provider to supply the products or services on time	• Ensure selected supplier/service provider strengthens abilities to supply the products/services on time or organize alternate sources of delivery
38	Procurement management	Weak contracting capabilities and/or controls	• Strengthen contracting capabilities of the enterprise personnel • Engage external agency to help in contract management • Establish sound measures of controls for contract management and conti- nuously improve or update
39	Procurement management	More number of contracts leads to increased control	• Reduce number of contracts through combining requirements • Invite participation of consortiums
40	Procurement management	Selection of qualified suppliers through different means such as, a *sole source*, a *standing offer call-up* (an offer from a potential supplier to supply goods or services at pre-arranged prices under set	• Prefer the *public tender* method for selection of supplier

ISSN 2394 - 7780

		terms and conditions, when and if required), and a *public tender* limits the control over methods of selection	
41	Procurement management	In effective mechanisms/ methods for managing the contracts	• Involve authors of the contracts to manage the contract • Periodical review of the contracts till project completion • Devise mechanisms/methods to address the contractual disagreements

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

DRUG ADDICTION AMONG YOUTH IN KASHMIR

Ridwana
Research Scholar, School of Education, Central University of Kashmir

ABSTRACT
In the past, people addicted to drugs were considered as morally flawed and lacking willpower. Due to which it was taken as immoral act rather than a health issue. But with the advancement of science, our views and response towards the drug addiction changed dramatically. It is taken as brain disease which can be treated through proper medication and behavior therapy instead of punishment. Pioneering findings about brain have transformed our knowledge of compulsive drug use, enabling us to mount an effective response to the problem. Drug abuse is the chronic use of drug, despite the harmful consequences and results in deterioration the person's health. The present paper focuses on the drug addiction among the young in Kashmir and is based on secondary source. In Kashmir due to turmoil and unemployment, more number of youngsters including females are getting indulges in drug abuse. As per the report published by U.N Drug Control Programme (UNDCP) about 70 thousand drug addicts were identified in Kashmir, among them 31% were women.

Keywords: Drug addiction, Drug abuse, Relapse, Psychic disorder and Compulsive drug seeking.

INTRODUCTION
Nora DVolkaw,M.D. Director, National Institute on Drug Abuse defines "Drug addiction as a brain disease which can be treated"

Many people believe that those involved drugs abuse lack commitment and willpower and moral principles and values. In actuality, drug addiction is a multifaceted disease, and refraining from it usually requires good intentions or a strong will power. Drugs trade the mind in approaches that make quitting hard, even for folks that need to. Luckily, researchers know extra than ever approximately how medicine have an effect on the brain and feature observed treatments which can assist humans recover from drug dependency and lead productive lives.

What is drug addiction?
Addiction means chronic brain disease which is characterized by obsessive quest for drugs and its use, even with the harmful consequences. It is considered as a brain disease because drugs change the brain— its structure and function. Changes that occur in the brain are found to be long-lasting, but it does not mean that it cannot be cured. There should be proper treatment and continues supervision regarding how patient responds. Treatment plans need to be reviewed often and modified to fit the patient's changing needs.

Who gets involved by Addiction?
People of all ages go through the damaging effects of drug abuse and addiction.

- Babies exposed to drugs in the womb may be born premature and underweight. Which results in slowing down the cognitive development and affects the behavior .
- Adolescents who abuse drugs often act out, do poorly academically, and drop out of school. They are at risk for unplanned pregnancies, violence, and infectious diseases.
- Adults who abuse drugs often have problems thinking clearly, remembering, and paying attention. They develop poor social behaviors because of prologed drug abuse, and their work performance and personal relationships suffer.
- Parents' drug abuse often means chaotic, stress-filled homes, as well as child abuse and neglect. These conditions affect the normal and desired development of children and becomes the breeding ground for drug abuse in the next generation.

What happens to the brain once an individual takes drugs?

Most medicines have an effect on the brain's "reward circuit" by flooding it with the chemical messenger Dopastat. This reward system controls the body's ability to feel pleasure and motivates an individual to repeat behaviour required to thrive like feeding and defrayal time with adored ones. This overstimulation of the reward circuit causes the intensely pleasant "high" that may lead folks to require a drug once more and more. As an individual continues to use medicine, the brain adjusts to the surplus Dopastat by creating less of it or by reducing the power of cells within the reward circuit to respond it. Drug addicts may increase dosage of the

ISSN 2394 - 7780

drug for achieving the desired dopamine levels. It leads to getting of less pleasure from other delicacies which they once enjoyed, like food and other social activities. Prolonged use of drugs leads to the chance in brain chemical systems and circuits as well, affecting the mechanism and functions which include:

- Learning
- Judgment
- Decision-making
- Stress
- Memory
- Behavior

OBJECTIVE

The aim of this research article is to know the drug addiction menace among the youth in Kashmir.

METHODOLOGY

The data in this papers based on secondary source. The data was collected from multiple secondary sources like research articles, books, reports of various national and international organizations, journals, and different web based sources.

DRUG ADDICTION IN KASHMIR

Today in Kashmir, youth are facing a number of problems whether that is related to their job, failing exams, late marriage, unrest in the valley, failure in relationships, lack of ability to tackle daily life problems etc. One of these is an addiction to drugs. A large number of people, both male and female, are taking drugs and have become addicted to these drugs. Some people take it as a treatment against mental stress, frustration, and trauma and to get a stable state. While other people become addicted to these harmful drugs because of the bad company they keep, too much pocket money they possess, lack of parental direction or guidance, easy availability of drugs and so on.

Drugs commonly used by the youth in Kashmir includes- Narcotics, Brown sugar, Naas, Alcohol, Cannabis (charas), Opiates (like codeine, heroin, morphine), Benzodiazepines (sleeping pills, like alprax, valium), Inhalants (like Fevicol SR, glue, paint thinner, petrol, shoe polish etc.)

As per the report of U.N International Drug Control Programme (UNDCP) 2008 total drug addicts in Kashmir numbered around 70,000, which also included 4000 Women addicts. The report also revealed that 65- 70 % of the students in Kashmir are taking drugs of which 26 % of female are students. The age group of 70 percent drug addicts falls in the age group of 18-35 years.

Leading Psychiatrist Dr. Mushtaq Margoob in his study, 'The Menace of Drug Abuse In Kashmir' found that there are 24.32 lakh substance abusers in Kashmir, which includes 2.11 lakh opium, 1.37 lakh cannabis, and around 38,000 alcohol abusers. According to this study, around 35% of boys of very prestigious schools from 8th standard to 12th standard use these substances daily. Statistics issued by the lone drug de-addiction center at Police Control Room (PCR) Srinagar reveal that in 2013, the center has received 1441 drug addiction cases which are more than double the cases registered in 2012.

As per the records of the Government Psychiatry Disease Hospital, Rainawari and Psychiatry Department of Shri Maharaja Hari Singh (SMHS), the Hospital had registered 69,434 patients from April to December 2015. SMHS had received 38,297 and Rainawari hospital received 31,137. Out of the total patients registered by two hospital, 899 were found to be drug addicts.

According to assessment done by doctors at Rainawari Hospital, drug abuse among Women is a fast growing phenomena in Kashmir. Psychiatrists at the hospital say they have been receiving alarming cases of Women drug addicts for the past many years.

Can addiction be cured?

Research shows that combining treatment medications with behavioral therapy is the best way to ensure success foremost patients. Treatment strategies should be tailored to deal with each patient's drug use styles and drug-associated clinical, psychiatric, and social troubles. Different kinds of medicinal drugs can be useful at exclusive levels of remedy to assist an affected person to forestall abusing drugs, stay in a remedy, and keep away from relapse.

ISSN 2394 - 7780

1. Treating Withdrawal. When patients try to discontinue using drugs, they encounter multiplicity of physical and emotional symptoms which include depression, anxiety, and other mood disorders, as well as wakefulness or insomnia. Certain treatment medications are designed to reduce these symptoms, which makes it easier to stop drug use.
2. Staying in Treatment. Some treatment medicines are used to help the brain adapt progressively to the absence of the abused drug. These medicines act slowly to stave off drug cravings and feature a chilled impact on body systems. They can assist patient's consciousness on counseling and other psychotherapies associated with their drug treatment.
3. Preventing Relapse. Science has taught us that stress, cues related to the drug revel in (such as people, places, matters, and moods), and exposure to drugs are the most not unusual triggers for relapse. Medications are being evolved to intrude with those triggers to assist sufferers sustain recuperation.

In addition to the above, there is a need to open more and more Government de-addiction centers' in Kashmir as there are very few centers, of the two original de-addiction centers one was opened by the JK Police. There are also some non-government organizations running the de-addiction center. But due to the lack of funds, such an organization fails to work as per the increasing demand of society. So the number of the de-addiction center has to be drastically increased especially in the villages and remote areas where the menace is unchecked.

Requisite training needs to be imparted to the doctors working in the primary health centers. Patients need to be treated by different possible ways like- detoxification, relapse prevention, and psychological counseling.

People need to be sensitized about the ill effects of drugs. Parents need to be educated regarding the signs and symptoms of drug addiction. They should be trained in such a way that they can provide counseling by themselves to their children. People have to be given the confidence that what is happening is essentially a medical problem that can be dealt with professionally.

The menace of drug abuse is rising in Kashmir, so there is need to find proper solution for it. If it is not tackled on war footing, it may destroy the mental health of the present generation resulting in numerous other social problems.

REFERENCES

1. Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, U.S. Department of Health and Human Services. *Best Practices for Comprehensive Tobacco Control Programs*—2007. Available at: http://www.cdc.gov/tobacco/ stateandcommunity/best_practices/pdfs/2007/bestpractices_complete.pdf.
2. Dr. Simrit Kahlon, (2014). *The menace of drug addiction in Jammu and Kashmir*, Defence Info. Com, Indian Defence News and Views Portal.
3. *Growing Drug Addiction in Kashmir is Alarming* by K Reader, 31 March, 2017.
4. Lewis M. (2017). Addiction and the Brain: Development, Not Disease. Neuroethics,10(1), 7-18.
5. National Institute on Drug Abuse, Drugs, Brains and Behavior, *The Science of Addiction*.
6. Nation Institute on Drug Abuse, (2016). *Understanding Drug Use and Addiction*, WWW. Drugabuse.gov.
7. Nusrat Sidiq (2016). Of 70,000 drug addicts in Kashmir, over 4000 are females, Kashmir Observer.
8. Office of National Drug Control Policy. *The Economic Costs of Drug Abuse in the United States, 1992–2002*. Washington, DC: Executive Office of the President (Publication No. 207303), 2004.
9. Rehm, J., Mathers, C., Popova, S., Thavorncharoensap, M., Teerawattananon Y., Patra, J. Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. *Lancet*, 373(9682):2223–2233, 2009.
10. Shah Tajamul (2017). *Growing Drug Addiction in Kashmir is Alaraming*, Kashmir Reader.

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

JOB SATISFACTION OF SECONDARY SCHOOL TEACHERS IN KADAPA DISTRICT

Karanam Mahaboobvali

ABSTRACT
The successful running of any educational system depends mainly upon the teacher, the pupil the curriculum, and facilities of these; the teacher is the most important one and is the pivot on when the entire educational structure rests. Today teacher is insured we expect this job compare to the other job, teacher job is considered as less value that is why teachers are not satisfaction in this job. The teacher has a power and abiding influence in the formation of the character of every future citizen. He/She acts as a pivot for the transmission of intellectual and technical skills and cultural, traditions from one generation to other. Now a day we find that standard of the school has gone down. Teacher is the most responsible factor for it. Teacher should have teaching capacity interest about teaching job satisfaction and desire to improve one. If teacher has job satisfaction he/she gets happiness and prestige automatically. This paper reflects the idea, how to develop and increase job satisfaction among secondary school teachers in Kadapa district. Hence in their content investigator made an attempt to study the Job satisfaction of secondary school teachers. The objective of the study is 1. To find out the significance difference between the Job satisfaction of secondary school teachers with respect to their Teaching Experience and Marital Status. In this study was selected at Kadapa district of Andhra Pradesh by using simple random sampling technique. The total number of sample consists of 700 Teachers.

Keywords: Curriculum, insured, intellectual, job satisfaction, and happiness.

INTRODUCTION

Job satisfaction has always been a flash point of discussion among the researchers and scholars since long. This critical issue has gained enthusiastic attention of researchers all around the world after the beginning of industrialization, but now it is applied to each and every organization. The education system has also been changed into an organization. In the field of education measuring the job satisfaction of teachers has become a prime focus of attention for researchers to make it a dynamic and efficient one. The job satisfaction of teachers particularly at secondary level is very vital. The value of secondary education is undeniable; it is very important to provide teachers with the utmost facilities so that they must be satisfied with the status of their job. The highlighted topic is a very serious issue due to the importance of secondary education which is central stage of the whole pyramid of education system in the world. A better performance from a teacher can only be expected if they are satisfied with their jobs. Job satisfaction is only possible if the job fulfills the basic needs of teachers in term of salary and better status as explained by Khan (1999), "salary or emoluments caters the material needs of the employees in allowing a sense of status and importance".

In today world education is a great power to develop the life an individual and society. Education is not for the preparation of the life but education is life itself. Education means the power student is like a garner and un blossomed flower. Mahatma Gandhi said, Education should make every person self sufficient than that is not true education, from education not only literates but we have to develop humans. Education means development of brain and soul. Quality of every society is depended of the quality of education in the society.

When we think about the teachers status, grade, salaries, current rules and regulation of service, head of institution, procedure of institute, teacher, college and student, then we found that there are various problem of teacher related to their professions.

Job satisfaction Definitions

Bullock (1953) in Patel (2004) states job satisfaction as a product of attitudes which result from summation of many specific likes and dislikes experienced in connection with job. This attitude manifests itself in evaluations which may rest largely upon one's own success or failure in the achievement of personal objectives and upon the perceived contributions of the job and employing organization to these ends. Thus, a worker may like certain concept of his/her work yet thoroughly dislike others.

REVIEW OF RELATED LITERATURE

Sujit Bordhan (2015) reported that there is a significant difference in job satisfaction of teacher educators in relation to teaching experience at 0.01 levels. So it can be concluded that teacher educators having different experience are differ from each other in job satisfaction.

Lal Kumar A.C (2016) examined on Teachers Effectiveness of Higher Secondary Teachers. The study revealed that higher secondary teachers teacher effectiveness towards school level. Teaching is a unique

ISSN 2394 - 7780

profession that leads to betterment of the society, making of good human being and responsible citizens. Teachers have to perform this strenuous duty with utmost care and expertise. Therefore teacher's personal effectiveness regarding teaching and other factors related to it is very important.

Hadiya Habib (2017) explored that the A study of teacher effectiveness and its importance. The results of the revealed that teacher effectiveness is the measure of success of teacher in carrying out institutional and other specified duties demanded by the nature of teacher position. Teachers are the nature role models to the younger generation. Teacher effectiveness is important because effective teaching helps student learning. It has become even more important as the emphasis on quality in higher education has increased. The study also revealed that the teacher effectiveness is directly related to student achievement. Moreover, the qualities of effective teacher have impact on students' performance. Effective teachers strive to motivate and engage all their students in learning rather than simply accepting that some students cannot be engaged and destined to do poorly. They believe every student is capable of achieving success at school and they do all they can to find ways of making each student successful.

Sushila Sharma (2018) study on Teacher's effectiveness among secondary school teachers in relation to emotional intelligence. The results of the study revealed that teacher effectiveness of secondary school teachers has a significant positive relationship with their emotional intelligence. So, the higher the EI, the better teacher effectiveness. The study are emotionally intelligent teachers seek to have confidence not just in their content and materials but also in their flexibility and readiness to respond, they put energy into getting materials and methods planned but also into preparing to meet learners' expectations.

OBJECTIVES

The objectives of the study are:

(i) To find out the significance difference if any in the Job satisfaction of Secondary school teachers due to variations in their Teaching Experience and Marital Status.

HYPOTHESES

To study the present problem the researchers formulated the following hypotheses.

H1: There will be no significant difference in the Job satisfaction of Secondary school teachers due to variation in their Teaching Experience.

H2: There will be no significant difference in the Job satisfaction of Secondary school teachers due to variation in their Marital Status.

METHODOLOGY

Keeping in view and scope of the study the investigator adopted survey method.

Sample

The population of the present research study is Secondary school teachers. In this problem the investigators selected 700 Secondary school teachers who are working in Govt., Z.P. and Municipal schools located in Kadapa district of Andhra Pradesh by employing Simple random sampling technique.

Tools Used

Job satisfaction questionnaire constructed and validated by the researcher.

Statistical techniques

To analyze the collected data the investigators Mean, SD, "t" and ' F' ratios statistical techniques were employed.

Result and discussion

The obtained results from the analysis were presented and discussed hereunder in two parts.

JOB SATISFACTION OF THE SECONDARY SCHOOL TEACHERS WITH RESPECT TO THEIR TEACHING EXPERIENCE

Objective

To find out the Job satisfaction of Secondary school teachers with respect to their Teaching Experience.

To study the above objective the investigator divided the Secondary school teachers into three groups based on their Teaching Experience viz. (1) Blow to 10 years, (2) Between 11-20 years and (3) 21 years above and the following hypothesis was formulated.

ISSN 2394 - 7780

Hypothesis

There will be no significance difference in the Job satisfaction of Secondary school teachers due to variation in their Teaching Experience.

To test the hypothesis Mean, S.D, F-ratio and t-values were computed for the total scale and for each dimension of the scale. The obtained results are shown in table no.-1.

Table No-1: Mean, SD, F-ratios and t-values of the Secondary school teachers for the Job satisfaction scale with respect to their Teaching Experience

Job satisfaction		Teaching Experience		N	Mean	S.D.	F-Ratio	t-value	
A	Profession	1	Blow to 10 years	265	51.52	6.642	**4.435***	t 1.2 t 1.3 t 2.3	**2.341*** **2.790**** 0.365@
		2	Between 11-20 years	258	52.97	7.420			
		3	21 years and above	177	53.20	5.467			
		Total		700	52.48	6.708			
B	Teaching and Learning	1	Blow to 10 years	265	51.94	6.646	**4.320***	t 1.2 t 1.3 t 2.3	1.566@ **3.147**** 1.409@
		2	Between 11-20 years	258	52.93	7.785			
		3	21 years and above	177	53.92	6.223			
		Total		700	52.80	7.023			
C	Administration	1	Blow to 10 years	265	51.82	6.621	2.685@	t 1.2 t 1.3 t 2.3	1.520@ **2.416*** 0.759@
		2	Between 11-20 years	258	52.78	7.737			
		3	21 years and above	177	53.22	5.755			
		Total		700	52.54	6.875			
Total Scale		1	Blow to 10 years	265	155.28	16.643	**5.104****	t 1.2 t 1.3 t 2.3	**2.128*** **3.326**** **1.004***
		2	Between 11-20 years	258	158.67	19.670			
		3	21 years and above	177	160.41	14.708			
		Total		700	157.83	17.486			

@= not significant at 0.05 level *= Significant at 0.05 level **= Significant at 0.01 level

It is obtained from the table-1 that the calculated F-ratio of the Job Satisfaction scores of Secondary School Teachers with regard to Teaching Experience is 5.104 and significant at 0.01 level. Hence there exists significance difference among the Teaching Experience groups of the sample in their Job Satisfaction. From the calculated t-values for the Job Satisfaction scale it is observed that

(i) t-value of the Job Satisfaction scores of the teachers with 'Below to 10 years' and 'Between 11-20 years' of Teaching Experience groups are significantly differ (t12: 2.128, significant at 0.05 level).

(ii) There is significant difference observed between the Secondary School Teachers with 'Below to 10 years' and '21 years and above' of Teaching Experience in their Job Satisfaction (t13: 3.326, significant at 0.01 level).

From the Mean scores of the total scale it is clear that the teachers from'21 years and above' of Teaching Experience group are expressed more Job Satisfaction (M=160.41) than their counter parts (Mean: 'Below to 10 years' =155.28 and 'Between 11-20 years'= 158.67).

From the F-ratio of the dimensions of the Job Satisfaction namely Profession and Teaching-Learning it is clear that teachers differs significantly with their Teaching Experience (Profession: 4.435, Teaching-Learning: 4.320) and F-ratio of the 'Administration' dimension of Job Satisfaction is 2.685 and not significant at 0.05 level.

For the Job Satisfaction dimensions of Profession from the calculated t-values it is found that, the Secondary School Teachers with 'Below to 10 years' and 'Between 11-20 years' of Teaching Experience groups (t12: 2.341, significant at 0.05 level) and the Secondary School Teachers with 'Below to 10 years' and '21 years and above' of Teaching Experience groups (t13: 2.790, significant at 0.01 level) are significantly differ in their Job Satisfaction. Similarly for the dimension 'Teaching-Learning' it is found from that there is significance between 'Below to 10 years and 21 years and above' groups (t13: 3.147, significant at 0.01 level) of teachers in their Job Satisfaction. Likewise for the dimension 'Administration' it is observed that there is significance between 'Below to 10 years and 21 years and above' groups (t13: 2.416, significant at 0.05 level) of teachers in their Job Satisfaction.

It is evident from the Mean scores that, teachers having '21 years and above' Experience are expressed more satisfaction in their job than the other two groups of sample for the all the dimensions of Job Satisfaction. It is also observed from the Means scores that as increasing the years of Experience the Job Satisfaction also

ISSN 2394 - 7780

increased among the Secondary School Teachers. It may be obvious that Job Satisfaction increases as Experience increases.

Hence the formulated hypothesis "there will be no significant difference in the Job Satisfaction of Secondary School Teachers due to variation in their years of teaching Experience" is rejected for all the three dimensions and for the total Job Satisfaction. Therefore it is concluded that years of Experience has shown the significant impact in the Job Satisfaction of the teachers working in Secondary schools.

Therefore it can be assumed that Management/Government has been extending the support with regard to financial benefits in the form of increments and promotions, job security, Rewards and Compliments, Security of present and future, working hours and remuneration for other than regular activities and responsibilities to the teachers as years of Experience increased. So teacher working in different management of the study are feeling more satisfaction in their profession.

JOB SATISFACTION OF THE SECONDARY SCHOOL TEACHERS WITH RESPECT TO THEIR MARITAL STATUS

Objective

To find out the Job satisfaction of Secondary school teachers with respect to their Marital Status.

To study the above objective the investigator divided the Secondary school teachers into two groups based on their Marital Status viz. (1) Married, and (2) Unmarried and the following hypothesis was formulated

Hypothesis

There will be no significance difference in the Job satisfaction of Secondary school teachers due to variation in their Marital Status.

To test the hypothesis Mean, S.D. and t-values were computed for the total scale and for each dimension of the scale. The obtained results are shown in table no.-2.

Table-2: Mean, SD and t-values for the Job satisfaction scale Dimension wise and in total of the teachers with respect to Marital Status

Job satisfaction scale		Marital Status	N	Mean	SD	t-value
A	Profession	Married	604	52.50	6.727	0.165@
		Unmarried	96	52.38	6.621	
B	Teaching and Learning	Married	604	52.84	7.048	0.343@
		Unmarried	96	52.57	6.893	
C	Administration	Married	604	52.50	6.866	0.475@
		Unmarried	96	52.85	6.958	
Total Scale		Married	604	157.83	17.509	0.014@
		Unmarried	96	157.80	17.431	

@= not significant at 0.05 level *= Significant at 0.05 level **= Significant at 0.01 level

It is observed from table- 32 that the calculated t-value for the total scale (0.014) is less than the table value and not significant at 0.05 level. It is depicted from the results that, there is no variation between the Mean and SD scores of the Married and Unmarried Secondary School Teachers to the total scale of Job Satisfaction scale.

Calculated t-values of all the dimensions Job Satisfaction i.e. Profession, Teaching-Learning and Administration are not significant at 0.05 level. It is also found that, there is no significant variation between the Job Satisfaction scores of the Married group and Unmarried group of Secondary School Teachers for all the three dimensions.

Hence the hypothesis "there will be no significant difference in the Social Intelligence of Secondary School Teachers due to variation in their Marital status" is accepted for the total scale and all the dimensions namely Profession, Teaching-Learning and Administration. Therefore it is concluded that both the Married and Unmarried Secondary School Teachers do not have any significant difference in their Job Satisfaction.

IV. FINDINGS

- There exists significance difference among the Teaching Experience groups of the sample in their Job Satisfaction with regard to the dimensions Profession and Teaching-Learning and for total scale.
- It can be assumed that Management/Government has been extending the support with regard to financial benefits in the form of increments and promotions, job security, Rewards and Compliments, Security of

ISSN 2394 - 7780

present and future, working hours and remuneration for other than regular activities and responsibilities to the teachers as Teaching Experience increased.

- There is no significant variation in the total Job Satisfaction of the teachers working Urban and Rural locality Secondary schools. Similarly for all the three dimensions of Job Satisfaction scale it is found there is no significant difference exist in the Job Satisfaction of the Secondary School Teachers with respect to their Locality. Therefore it is concluded that teachers working in both Urban and Rural Secondary school don't have any significant difference in their Job Satisfaction.

REFERENCES

1. Deore.K.V. (2013) A Study on Job satisfaction of primary school teachers in relation to their emotional intelligence' *International conference on Current Issues in education & social Sciences, p.p.137-139.*
2. Lal Kumar A.C (2016). Teachers Effectiveness of Higher Secondary Teachers. *International Journal of Computational Research and Development*.1(1).66-69.
3. Hadiya Habib (2017). A study of teacher effectiveness and its importance. *National Journal of Multidisciplinary Research and Development .2(3).530-532.*
4. Janardhan Reddy. B and Digumarti Bhaskara Rao (2018). Emotional intelligence and teacher effectiveness of secondary school teachers. *International Journal of Advanced Education and Research.3(1).11-14.*
5. Sushila Sharma (2018). Teacher's effectiveness among secondary school teachers in relation to emotional intelligence. *International Journal of Research in Economics and Social Sciences (IJRESS).8(3).870-876.* http://euroasiapub.org

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019

ISSN 2394 - 7780

RIVER OF SMOKE AS A SOCIAL TRAUMA BY AMITAV GHOSH

Ganta Srinivasulu
Lecturer in English, Sri ABR Govt. Degree College, Repalle, Andhra Pradesh

ABSTRACT
The first installment of Ibis Trilogy, Sea Of Poppies by Amitav Ghosh persuades us to comprehend the second installment, River Of Smoke. Although in many cases, the book is the anecdotal with characters out of the blue. However the characters and story line of the book rediscover the social trauma from the point of India in the end of nineteenth century and early period of twentieth century. River of Smoke luckily or shockingly has association from its previous installment .However the writer's endeavour to make it look crisp in idea is remarkable. The book draws out the genuine conditions prevailing in India and China. The imaginary skill and expertise display in the introduction of the characters than the story line. The accomplishment of a book lies on the surprising characters in it and their profundity of comprehension.

Keywords: Characterization, reality, fiction, subjugation, suppression, social trauma

The first installment of Ibis Trilogy, *Sea Of Poppies* by Amitav Ghosh persuades us to comprehend the second installment, *River Of Smoke*. Although in many cases, the book is the anecdotal with characters out of the blue. However the characters and story line of the book rediscover the social trauma from the point of India in the end of nineteenth century and early period of twentieth century. *River of Smoke* luckily or shockingly has association from its previous installment .However the writer's endeavour to make it look crisp in idea is remarkable. The book draws out the genuine conditions prevailing in India and China. The imaginary skill and expertise display in the introduction of the characters than the story line. The accomplishment of a book lies on the surprising characters in it and their profundity of comprehension.

The characters in this fiction have particularly similar to the conditions of winning at that time, speaking to the seasons of inconveniences and entanglements. They are viewed as negligible impressions of the age of the general public. The story has been extremely significant in the idea and portrayal by the creator. It will make you a trip back to the past and feel the compassion with the characters and conditions. It is evident truth that we interface with characters in novel superior to whatever else. It is just through characters we tend to feel the voyage they had experienced in their life to achieve their objectives. Although Ghosh's book has been called as fiction, every fiction has its starting point from Reality. There can be drawn a parallel line with characters in Mulk Raj Anand's "Coolie" (character of Munoo-a casualty of circumspection in the public eye), Anita Nair's "Women Coupe" (All lady characters exposed to concealment in one frame or the other are sensibly anecdotal characters as per the activity camouflaged then on ladies). Similarly, the characters and story line in River of Smoke speak to the current framework amid nineteenth Century India.

Amitav Ghosh is the creator of the most acclaimed books, The Circle of Reason, The Shadow Lines, In An Antique Land, Dancing in Cambodia, The Calcutta Chromosome, The Glass Palace, The Hungry Tide, and the three installments of The Ibis Trilogy; *Sea of Poppies*, *River of Smoke* and *Flood of Fire*. Amitav Ghosh was born in Calcutta and experienced childhood in Delhi, examined in Oxford which made him scholastically developed and increasingly more grounded where he got presented to various societies and their history.

The Ibis trilogy is a set of three books by Amitav Ghosh. It is a work of recorded fiction. It includes Sea of Poppies (2008), River of Smoke (2011), and Flood of Fire (2015). The story is set in the main portion of the nineteenth century. It narrates the opium trade between India and China run by the East India Company and the transportation of coolies to Mauritius. River of Smoke made it to the extensive choice of the Man Asian Literary Prize in 2011.

The tale has got positive audits from pundits based on its merits and inventive reasoning around the current winning at that point. David Davidar writing in Outlook notes,

"Standard way of thinking has it that in the time of Twitter, long striders in the realm of fiction are bound to termination. Abilities to focus have dwindled, the intellectuals state, curtness is all, and the fabulous account is to be relegated to the waste load. All things considered, express gratitude toward God, Amitav Ghosh hasn't been focusing on the alleged specialists however has chosen to go where his tendencies have driven him. Liberal helpings of funniness, experience (the chase for the brilliant camellia was a top choice), history, sentiment, villainy and anticipation are expertly mixed into the story to make for a rich and engaging read".

ISSN 2394 - 7780

Amitav Ghosh, a gifted son of the soil of India spent his youth all over Asia. An Oxford-made anthropologist, he's personally comfortable with the investigation of societies and familiar with the trades among divergent people groups. He has since a long time ago partitioned his time between the U.S. and India and now in his mid-50's, he's articulated the Ibis set of three his life's venture. It appears, at first look, that he's taken an incredible takeoff from past work. (Missing is the wildly post-modern style that portrayed in the past books.) But his worries—a commitment with history and expansionism, the moving of outskirts (and memory), and the social event of learning—too the governmental issues, stay much the equivalent.

The Ibis, a set of three of an anecdotal overwhelming depiction aimed to draw out the truth of the age. The chronicled, political, and efficient conditions were the back ground set up for the setting of the three books. The books take us back to the then circumstances. Amitav Ghosh was acknowledged for his remarkable portrayal and learning on the idea.

The voyage of three ships began from India on a business expedition to China. Canton is the place they set for. The control and supremacy of British and American business houses on the opium trade is unmistakably focal point in the novel. The non - local inclination among the businessmen and their expertise in milking profits in free trade scenario is depicted with all facts.

In the first book of Ibis trilogy, Sea of Poppies, the reader can feel the voyage, data on exchanging, relations between the nations on practical basis which were well introduced. The book has bountiful of characters. The knowledge of the creator lies in the account of perspective through his characters. He never sticks to the portrayal from just a single individual point of view; it continues changing starting with one character then onto the next which influences the narrative to get associated with the on-going storyline. It is similarly spread to practically all characters. It is where the plot is presented to attitude of every single character.

The second book of Ibis trilogy, River of Smoke conveys the continuation of the past story ahead, yet the writer was watchful in not letting both the books conflict and get likenesses. He attempted to make the second book all crisp and more sensible. His endeavours laid organic product when he presented just couple of characters for his rest of the portrayal. The characters are the exceptional appreciation for the book with their view of life of Ghosh through their eyes. Ghosh brought just three characters into lime light and ensured that the portrayal was effective in their words and encounters. Every single character has been casualty of the general public. This is the place the truth of life develops in this anecdotal book.

In the first book, Sea of Poppies, what gets through Ghosh's story most plainly is cosmopolitanism (modern way of life), best represented by an unparalleled wealth of dialect. Taking an attempt at exactness and delighting in the wit, he blends a few Indian tongues with the Anglo-Indian lingual authority of the decision class. To make the dialect increasingly compelling he recreates Laskari, the most widely used language of oceangoing mariners known as lascars.

The books portray a scope of characters from various societies, including British brokers and authorities, Bengali Zamindars, Parsi representatives, Bihari workers, Cantonese pontoon individuals, a Cornish botanist, and a mulatto mariner. Notwithstanding their local tongues, the books likewise acquaint the readers with different pidgins, including the first Chinese Pidgin English and variations spoken by the lascars.

In the year 1838, three boats were taken in a seething tempest off the shore of Canton. The Anahita, possessed by Bahram Modi, a Parsi opium dealer from Bombay, the Redruth, owned by Fitcher Penrose, on a campaign to collect rare types of plants from China and the Ibis (from Sea of Poppies) deporting convicts and immigrant workers. The convicts Neel Rattan, a Bengali Zamindar and Ah Fatt, a criminal from Canton, escaped from the ship, Ibis with other three fellow sufferers during the storm.

The story spins around these characters and their encounters they had in Canton. The Ibis set of three—named after the ship that sets the whole story into movement—is very significant in view of India and China's re-emergence as financial powerhouses. The characters in the trilogy as a part of history make the works captivating and remarkable.

While Ghosh intersperses the consistent unfurling of occasions in Sea of Poppies with numerous indications of sick sign, River of Smoke continues at a moderate pace. Not at all like, Sea Of Poppies, Ghosh decides not to specifically proceed with the plot from the main book, which finishes on a remarkable cliffhanger, however, outlines an increasingly meandering course. Questions encompassing the characters' fates settle just to some degree, and after some time. In addition, the Ibis' most recognizable faces move away out of spotlight for a great part of the novel.

ISSN 2394 - 7780

The expectation behind illustration a parallel line can be seen between characters in Rive of Smoke and Munoo from Coolie by Mulk Raj Anand; Characters in Ladies Coupe by Anita Nair are impressions of the treatment upheld on them or an approach to show the control of higher class, Male closed-mindedness or racial contrasts. The set of hindrances each character confronted is groundbreaking and demonstrates their battle for directly of presence. Every single character played and pulled influences the reader to acknowledge how they have opposed to "living".

Munoo endured to have a personality and life to live, all lady characters Akhila, Janaki, Sheela, Margaret Shanthi, and Prabha Devi, are casualties of enslavement. So as the characters in Rive of Smoke: Bahram Modi, Parsi opium dealer, Fitcher Penrose, Neel Rattan, Ah Fatt and other escapers are bearing light over the situation at that timeframe.

All the three books of Ibis trilogy of Amitav Ghosh are taken as impressions of societal working framework. It's that society which gives least significance to individuals existing and waving a celebrity main street for the power showed or utilized by individuals in higher classes. It may not be right to state it that it is society that has made those characters worth remembering and resuscitating to know our history. History isn't about war, fights, landmarks, design, Kings and Queens, it's about individuals; their adventure, their accomplishments, their exploitation, their reliability, their prosperity.

River of Smoke, the halfway point in Ghosh's Ibis trilogy —his account of the Opium Wars, the nineteenth-century question between the British Empire and the Qing Dynasty over the destiny of exchange China—is thickly stuffed with happenings and interest while never figuring out how to meet up as a novel. Rather, it peruses as a long prelude to what one can just assume will be the episode of war in the third book, Flood Of Fire.

The tale of the opium exchange is a revolting one, however the soul of the novel is excited tragicomedy, not instructional post-hoc dimness. Also, for the whole essayist's compassion for the Chinese experts, there's no bewail in here for the loss of past immaculateness. The composing can't resist descending in favour of the rich intercourse of ports and dealers, the hybridist conceived of social contact, dialect in pidgin and port slang, and sexual experiences over the boundaries of race and council.

The epic draws out the chronicled data and results of the unfurling parts of the hundreds of years working of the general public. Even though Ghosh intended to make it as verifiable fiction, it ended up being the sensible way to deal with the life in that time of exchanging. The epic begins as an exchanging segment attempting to characterize the prudent conditions however thusly gets whirling into the story. The truth comes into cutting edge through the characters of Deethi, Bankrupt Raja, Parsi merchant Bahram, who are seeing the life through their own perceptual point.

The changing of portrayal starting with one individual then onto the next, keeps the pursuer made up for lost time mindful to the story line. What's more, the vital part of Opium exchange among Indian and Chinese business houses and their relations faultless. In any case, the segregation appeared to a local and non-local belief system was intriguing. Bahram being a business big shot has been exposed to separation, this shows the sensible ways to deal with the anecdotal account by the creator.

Another social insidiousness 'sati' was brought when the main female character of *Sea Of Poppies* was compelled to bite the dust alongside her significant other. The fiction which professes to be fiction ended up being reality tossing centre around the principal characters live and their past. All in all, however, the novel's quality lies in how altogether Ghosh rounds out his examination with his novelistic dream, allured by each new circumstance that presents itself and each new character, so that getting it done the scenes read with an exotic freshness as though they are going on now. The decisions of history are liberally conceded.

All the first substance is practical, it is either appeared through characters or through portrayal or through story line. It's not just Ghosh, Anand or Nair yet in addition numerous Indian writers who have prevailing with regards to bringing out actualities of the day and cleared path for new life and new age of knowing our way of life, our history our most noticeably bad conditions, fortitude of our legends, and trust in living better through their characters in the long method to keep running for opportunity. The tale has seen private enterprise, subjection, social shades of malice, monetary disturbance, ascent of opium, India-China political conditions. All these brought about making River of Smoke a sensible fiction which remains as a blend of realistic circumstances with fictional characters.

WORKS CITED

- Ghosh, Amitav, Sea of Poppies. John Huray: India, 2008. Print.

ISSN 2394 - 7780

- --- River of Smoke. Penguin Group: India, 2011. Print
- --- Flood of Fire, Penguin Group: India, 2015. Print
- Atlas, Amelia. River of Smoke: Review, 2011. Print.
- Anand, Mul Raj. Coolie: Lawrence and Wishart, UK. 1936.Print.
- Gulliver, Katrina. River of Smoke: Review. The Berlin Review of Books. 2011. Print.
- Hanna, James. Farrar. River of Smoke: Review. Straus & Giroux: New York. 2011.Print.
- Hadley, Tessa. River of Smoke by Amitav Ghosh: Review: London. 2011. Print.
- Long, strange trip: River of Smoke finds globalization's roots in the Opium Wars.
- The Paste Magazine, 2011. Print.
- Nair, Anita. Ladies Coupe: Penguin Books India 2001.Print.

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

BOUNDARY VALUES OF POLYTROPIC FLUID SPHERES USING RAMANUJAN'S METHOD

Aswathy Mary Prince and Sanish Thomas
Department of Physics, FOS, SHUATS, Prayagraj

ABSTRACT
A new approach for solving the nonlinear Lane-Emden equations, a basic equation describing the Newtonian equilibrium structure of a self-gravitating polytropic fluid sphere has been proposed. The nonlinear second order differential equation is solved using New Iterative Method and the boundary values of the obtained series has been calculated using Ramanujan's method. It is used to model galactic structure, stellar interiors and stars clusters etc.

Keywords: Lane Emden Equation, Polytropic Model, Ramanujan's Method

1. INTRODUCTION

Polytropes give simple structure of stars interior. It assumes a relation between pressure and density from the centre till boundary of a star. All physical quantities depend only on distance from the centre of the star. Assuming stars as isolated, static and spherically symmetric, then its structure can be defined using four fundamental equations.

$$\frac{dM(r)}{dr} = 4\pi r^2 \rho(r) \tag{1}$$

$$\frac{dP(r)}{dr} = -\frac{GM(r)\rho(r)}{r^2} \tag{2}$$

$$\frac{dL(r)}{dr} = \varepsilon\rho(r)4\pi r^2 \tag{3}$$

$$\frac{dT(r)}{dr} = \frac{-1}{4\pi r^2 \lambda} L(r) \tag{4}$$

In polytropic stellar model, M(r), P(r), ρ(r), L(r), T(r) are mass, pressure, density, luminosity nd temperature inclosed inside 'r' respectively. ε is the energy generation rate per kg, λ is the coe□cient of conductivity and Pressure (P) and density (ρ) is related by the relation $P = K\rho^{(n+1)/n}$ and n is polytropic index. It was first considered by Lane[1] (1870) but the same problem was independently considered by Ritter[2] (1878).

Plugging the value of $M(r)$ in equation (2) and differentiating it with respect to r gives $\frac{1}{r^2}\frac{d}{dr}\left(\frac{r^2}{\rho}\frac{dP(r)}{dr}\right) = -4\pi G\rho(r)$ (5)

Introducing a dimensionless $y(r), [y(r)]^n = \frac{\rho(r)}{\rho_c}$ where ρ_c stands for the density at the center of the star. This transforms eq. *(5)* to

$$(n+1)\frac{K\rho_c^{\frac{1-n}{n}}}{4\pi G}\frac{1}{r^2}\frac{d}{dr}\left(r^2\frac{dy(r)}{dr}\right) + y(r)^n \tag{6}$$

Introducing a dimensionless radius 'x'and plugging it in equation (6)

$$r = \left[(n+1)\frac{K\rho_c^{\frac{1-n}{n}}}{4\pi G}\right]^{\frac{1}{2}} x$$

which finally yields the following

[1] **Lane, J. H.** (1870).On the Theoretical Temperature of the Sun under the Hypothesis of a Gaseous Mass Maintaining its Volume by its Internal Heat and Depending on the Laws of Gases Known to Terrestrial Experiment.. The American Journal of Science and Arts, 2nd series, 50: 57–74.

[2] **Ritter, A.** (1878). Wiedemann Annalen, 6:135.

ISSN 2394 - 7780

$$\frac{1}{x^2}\frac{d}{dx}\left(x^2\frac{dy}{dx}\right) = -y^n \tag{7}$$

This is desired **Lane-Emden equation for polytropic fluid sphere** with two boundary conditions.

y= 1, $\frac{dy}{dx} = 0$ when x= 0 (at the center)

y(x=x_1) = 0 (at the surface)

Unfortunately, the Lane-Emden equation does not have analytic solution for arbitrary values of n .In fact there are only three analytical solutions, in other cases a numerical solution is required. This equation was solved by [Pascual, 1977], [Mohan & Al-Bayaty, 1980], [He,2003], [Dehghan & Shakeri, 2008], [Cardenas, 2014] and [Rach, 2014].

In this paper we have used new iterative method [Daftardar, Jafari, 2006] to solve it. The boundary values of the solution are obtained using Ramanujan's method.

2. RAMANUJAN'S METHOD

The smallest root of the equation $f(x) = 0$ (10)

where $f(x)$ is of the form $f(x) = 1 - (a_1x + a_2x^2 + a_3x^3 + \cdots)$ using an iterative method is described by Srinivasa Ramanujan (Berndt, 1985)

For smaller values of x, we can write

$$[1 - (a_1x + a_2x^2 + a_3x^3 + \cdots)]^{-1} = b_1 + b_2x + b_3x^2 + \cdots$$

Expanding left hand side by Binomial theorem and comparing the coefficients of like powers of x on both sides we get

$$b_1 = 1$$

$$b_2 = a_1 = a_1b_1$$

$$b_3 = a_1^2 + a_2 = a_1b_2 + a_2b_1$$

$$b_n = a_1b_{n-1} + a_2b_{n-2} + \cdots + a_{n-1}b_1 \qquad n = 2,3,..$$

The successive convergents, viz., b_n/b_{n+1} approach root of the equation (10) of the above given form

3. SOLUTION OF LANE EMDEN EQUATION

The volterra integral form of first kind of lane emden equation of the form $y'' + \frac{2}{x}y' + (y)^n = 0$; $y(0) = 1$ $y'(0) = 0$ is set as (Wazwaz 2001, 2013, Al-Jawary 2015)

$$y(x) = 1 - \int_0^x t\left(1 - \frac{t}{x}\right)y^n dt$$

Differentiating the equation, using Leibnitz rule

$$y'(x) = -\int_0^x \left(\frac{t^2}{x^2}\right)y^n dt \tag{8}$$

Solving equation (6) using New Iterative Method

$$y(x) = -\int_0^x \int_0^x \left(\frac{t^2}{x^2}\right)y^n dt dx \tag{9}$$

Substituting the expansion in equation (8) and using the recurrence relation

$$y_0 = 1$$

$$y_1 = N(y_0) = -\int_0^x \int_0^x \frac{t^2}{\eta^2}y_0 dt dx = -\frac{x^2}{6}$$

ISSN 2394 - 7780

$$y_2 = N(y_0 + y_1) - N(y_0) = -\int_0^x \int_0^x \frac{t^2}{x^2}(y_0 + y_1)^n dt dx + \int_0^x \int_0^x \frac{t^2}{x^2} y_0 dt dx = \frac{nx^4}{120}$$

$$y_3 = N(y_0 + y_1 + y_3) - N(y_0 + y_1) = -\frac{n(8n-5)}{7!}x^6 \ldots\ldots\ldots$$

Summing up the series,

$$y(x) = y_0 + y_1 + y_2 + \cdots = 1 - \frac{x^2}{6} + \frac{n}{120}x^4 - \frac{n(8n-5)}{7!}x^6 + \cdots$$

which is the series solution of lane emden equation near the origin. The series is solved using Ramanujan's method.

4. RESULT AND DISCUSSION

The obtained x_1 for different values of polytropic index till 'n=3' using Ramanujan's method is presented in Table 1. The second column gives the boundary value for various polytropic index 'n' found using Ramanujan's method while third column gives Chandrasekhar's values (reference). The fourth column gives the percentage error of the boundary values. The obtained result is also compared with Jabbar's values and is presented in Table 2.The method employed gives result which almost matches with the earlier obtained results. The percentage error σ is 1% which shows the efficiency of Ramanujan's method in solving such equations.

Table-1: The comparison for boundary value (x_1) using Ramanujan's method with Chandrasekhar's value

n	Ramanujan's method (x_1)	Chandrasekhar's value	% error
0.0	2.449490	2.44940	0.003674
0.5	2.723209	2.74280	0.714270
1.5	3.102147	3.14159	1.255511
1.5	3.656008	3.65375	0.061800
2.0	4.467717	4.35287	2.638420
2.5	5.361691	5.35500	0.124949
3.5	6.826056	6.89680	1.025751

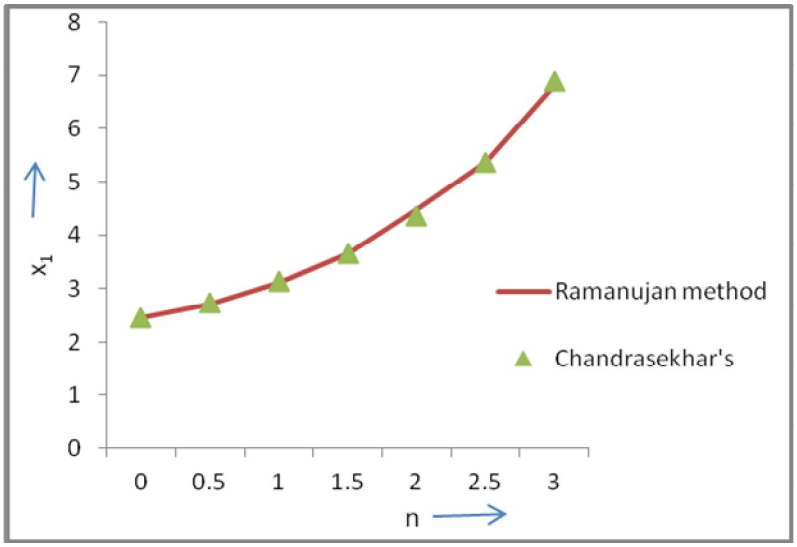


Figure-1: Comparison between numerical values obtained using Ramanujan's method with Chandrasekhar's values

Table-2: The comparison for boundary value (x_1) using Ramanujan's method with Jabbar's value

n	Ramanujan's method (x_1)	Jabbar's value	% error
0.0	2.449489743	2.449489743	6.86669E-10
0.1	2.498013419	2.504544963	0.260787635
0.2	2.549363917	2.562219186	0.501724022
0.3	2.603807455	2.62267871	0.719541253
0.4	2.661643441	2.686105326	0.910682265

ISSN 2394 - 7780

0.5	2.723209184	2.752698054	1.071271513
0.6	2.788885184	2.822675074	1.197087463
0.7	2.859100959	2.896275842	1.283540816
0.8	2.934341238	2.973763866	1.325681180
0.9	3.015152198	3.055429345	1.318215601
1.0	3.102147063	3.141592654	1.255592147
1.1	3.196009827	3.232608407	1.132168674
1.2	3.297494943	3.328869674	0.942504028
1.3	3.407419231	3.430813445	0.681885353
1.4	3.526639837	3.538926616	0.347189428
1.5	3.656008231	3.653753736	0.061703521
1.6	3.796284867	3.775904764	0.539740915
1.7	3.947992614	3.906065667	1.073380496
1.8	4.111182450	4.045010309	1.635895502
1.9	4.285091726	4.193614622	2.181342639
2.0	4.467716598	4.352874596	2.638302560
2.1	4.655437294	4.523926299	2.907010101
2.2	4.843063301	4.708070908	2.867254893
2.3	5.024915229	4.906807490	2.407017992
2.4	5.197362399	5.121870454	1.473913598
2.5	5.361690693	5.355275459	0.119792788
2.6	5.523042134	5.609382739	1.539217575
2.7	5.679636891	5.886967917	3.521864374
2.8	5.809475019	6.191322127	6.167456640
2.9	5.933498294	6.526374126	9.084306555
3.0	6.826056177	6.896848619	1.026446223

5. CONCLUSION

In this paper we have found the boundary values for polytropic fluids, the Lane-Emden's equation. The general lane Emden's equation has been converted to volttera integral equation (Wazwaz 2001, 2013). The series has been obtained using iterative method, and has solved using Ramanujan's Method. The Ramanujan's method can therefore be seen as a useful tool for solving series of non-linear functional equations.

REFERENCES

1. *Berndt B. C., 1985 Ramanujan's Notebooks. Part I., Springer.*
2. Cardenas P.P., 1939, William A.U., 2014, Applied Mathematics, 4, 28-32.
3. Chandrasekhar S., 1939, "An Introduction to the Study of Stellar Structure", Dover Publications, New York, NY, USA.
4. *Cherrault Y., 1988, Kybernetes 8, 31-38.*
5. Daftardar V, Jafari H., 2006, j. Math. Anal. Appl, 316, 753-763.
6. Das D., Ghosh D. et.al, 2015, int.J Appl.Comput.Math, 1, 369-379.
7. Dehghan M., Shakeri F., 2008, New.Astron.13, 53-59.
8. He J.H., 2003, Appl. Math. Comput. 143,539-541.
9. Hojjati G., Parand K., 2011, World Academy of Science,Engineering and Technology, 56, 889-891.
10. Jabbar R.J., 1984, Astrophysics and Space Science, 100,447-449.
11. Jawary L., AL-Qaissy H.R. , 2015, MNRAS 448, 3093-3104.
12. Jerri A.J., 1999, Introduction to integral equation with Applications, sec.edn. Wiley Interscience.
13. Mohan C., Al-Bayaty A.R. , 1980, Astrophys.SpaceSci.73, 227-239.
14. Pascual P., 1977, Astron.Astrophys.60, 161-163.
15. Rach R., 2014, et.al, journal Math Chem. 52, 255-267.

ISSN 2394 - 7780

16. Shastri S. S., 2008, Introductory methods to Numerical Analysis, Prentice Hall of India.
17. Wazwaz A.M., 2001, Applied Mathematics and Computation, vol. 118, no. 2-3, pp. 287–310.
18. Wazwaz A.M., 2002, Applied Mathematics and Computation, vol. 128, no. 1, pp. 45–57.
19. Yildirim A., Ozis T., 2007, Phys.Letter A369, 70-76.
20. Yousefi S.A., 2006, Applied Mathematics and Computation, 175, 574-580.

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

C&C BASED SECURE SPYWARES FOR MONITORING INTERNAL USER ACTIVITY IN ORGANIZATIONS

Sanketh S. Iyer[1], Hiren Dand[2] and Rajendra Patil[3]
Student[1] and Coordinator[2], Department of Information Technology, Mulund College of Commerce, University of Mumbai, Mulund (W), Mumbai
Coordinator[3], Department of Information Technology, S. K. Somaiya College, University of Mumbai, Mumbai

ABSTRACT
Very high technological advances in the field of information technology and computing have made life easy for all organizations however, as the saying goes, with power come problems, it has also attracted a lot of vicious actors prying on this in order to take undue advantage of the situation. This has given rise to lot of information security threats that need to be addressed to keep the organization smoothly running and secure. Data is the most critical asset of any organization, with personal and organizational data requiring the highest level of security. However, many organizations take all these threats lightly and end up being victims of dangerous cyber-attacks and data leakages. More than 50 % of the cyber security threats to data are due to inside users knowingly or unknowingly playing a role in adding a successful attack. This may be due to either disgruntled employees or employees who do not pay strong attention to information security guidelines. This has shifted the attention of researchers to a new domain called UBA (User behaviour analytics). UBA maybe in the form or enforcement of policies and procedures and also collection of logs and monitoring of user activity. In order to mitigate insider threats these behaviour analytics play a very crucial role.

I. INTRODUCTION
Cyber and information security has become crucial for each and every organization. Every day we see numerous forms of cyberattacks taking place in different locations of the world. Every organization deploys various mechanisms in place in order to defend itself from such attacks. These methods involve using antiviruses, deploying honeypots, using network monitors, SOC etc. However, each organization has some or the other weak spot that they tend to ignore. One such known weak spot is that of insider threats, wherein a user can sabotage the organization.

II. INSIDER THREATS
Disgruntled individuals inside an organization may pose grave threat to the entire infrastructure both physical or cyber. Such threats are categorized under this category. These employees maybe from the lowest to the highest grade in an organization. It is not only disgruntled employees but also negligent employees who may ignore the safety guidelines in an organization who may contribute to this threat. The data that maybe most vulnerable are account credentials, employee data, IP's, Sensitive personal information, Operational/Infrastructure details etc.

III. NEED FOR MONITORING THE USERS
As said earlier, inside users pose a great amount of threat for the organization, however the organizations try to mitigate this threat aided with policies and procedures, and other mechanisms in place. A survey has published a report on insider threats the highlights of which are given below: -

- 36% of cyber-attacks are insider threats, out of which 51% are accidental or unintentional users.
- 56% threat is posed by regular employees followed by privileged IT administrators and Contractual/ temporary staff.
- Confidential business information stands as the most vulnerable information with a rating of 57% followed by other critical information like Credentials, personal details etc.
- Databases form the most vulnerable of all assets followed by insecure file servers etc.
- Phishing remains the highest enabler of insider threats.

All this prompts us to have better monitoring mechanisms for the users.

IV. USER BEHAVIOUR ANALYTICS - A BRIEF REVIEW
It is the process of detection of insider threats, targeted attacks, financial frauds by analysis of user behaviour over the information asset. This is a very complicated process and requires constant analysis of information and logs being obtained from the target system. The systems that are deployed in order to achieve this include a range from SOC, log monitoring tools, network sniffers, etc. Security tools give so much data that it's hard to reveal data that genuinely demonstrates a potential for genuine attack. Analytics tools help comprehend the

ISSN 2394 - 7780

tremendous amount of information that SIEM, IDS/IPS, framework logs, and different apparatuses accumulate. UBA tools utilize a specific sort of security analytics that centres around the working of systems and the users utilizing them. A new variety of tools called employee monitoring software are available now in the market that tend to make these tasks easy. It involves a centralized server with various agents installed on the target system in order to take regular screenshots and monitor actions of the user. The problem however with these systems that they are extremely costly and are not very pleasing to maintain for an organization considering that the organizations always try to reduce on their costs. The other tools also require complex setups in order to perform high end analysis of user actions. Furthermore, the company or an organization must ensure that the following are followed before monitoring user actions very carefully: -

- Be open about user monitoring..
- Allow privileged access only to significant clients who need it for powerful work generation – a policy known as the rule of least privilege.
- Decrease the number of shared accounts and implement robust password policies.
- Create thorough authentication procedures for privileged accounts, such as 2FA or MFA.
- Administer remote access through company-based policies. Deny insecure network base file sharing protocols.
- Gather and protect chain-of-custody criminological proof including files, screen captures and keystrokes.
- Besides deploying user activity monitoring solutions, organizations should adapt and impose data protection policies, such as appropriate file sharing activity, handling instructions for sensitive data, authorized services and applications, and other policies outlining acceptable use.
- If any restricted action is performed, such as downloading sensitive customer information, the security officers should have the ability to gauge the severity of the activity.

V. WORKING OF SPYWARES

Spyware is a software technology that allows the surreptitious collection of personal information from computers linked to the internet. This indirect infiltration occurs using download of some freeware's and sharewares on the internet from untrustworthy sources. They serve to record and transmit a user's computer uses and behaviours to third parties. They are frequently used by adverse marketers to `extract customer data for segmentation and targeting purposes, and can throw too many advertisements on the target computer, commonly known as Adware's. Legal usage is possible since installations can be authorized as part of the licensed "click wrap" agreement that users agree to during installation of some freeware's. The main purpose therefore is established as to monitor and analyse user activity in order to store and utilize them for some purpose wither genuine or malicious. Their purpose being to covertly monitor and exfiltrate information, they are usually lightweight and run very covertly in the background rarely posing noticeable performance issues on the target system.

VI. PROPOSED ARCHITECTURE

The proposed architecture involves creation of a centralized C&C server over the intranet network of the organization with all requisite functions. This mainly involve collecting the required data from target systems, issuing any special directives etc. The topology can be random and to keep the system lightweight we can use a peer-to-peer topology(P2P) or to keep it much more professional we can use a hierarchical topology. Given below is an example of hierarchical topology wherein there is a central C&C Server and various enterprise assets joining the network communicating with it.

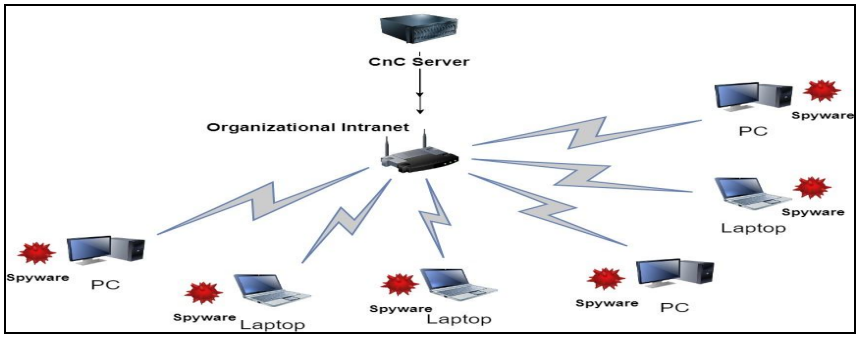


Figure-1: Proposed Architecture

ISSN 2394 - 7780

No sooner does the target asset joins the network the spyware initiates communication with the C&C server. The C&C server is only going to issue commands and only would be acting as the moderator. Most of the logs would be stored on the target system itself. Local storage has been preferred over centralized storage in order to reduce network load. However, a C&C controller can issue commands to fetch the local data whenever it would be necessary. The spyware is developed a s a very secure limited spyware that would monitor the keystrokes, processes, take screenshots whenever require etc. A malware therefore has been cultured safely for our use. This is because malwares a built to function covertly, i.e. to run without the knowledge of its target system user. A lightweight program built as a spyware now works storing all data collected locally and the C&C server will only step into picture in case it needs to issue any directives to its slaves. The process of this spyware also would be disguised by some unique name which would give an impression that the target program is nothing but a genuine program and poses no issues to the target system. All this goes in sync with out proposition of using a malicious program for our own benefit or self-defence.

VII. C&C SERVER

C&C stands for the command and control server. As the name suggests, this server in a botnet infrastructure acts as the switch or the main master which coordinates the entire botnet network. We have named our central server as the C&C as it will perform almost similar functions except for contributing to the spread of our spyware which traditional botnets do. Our C&C would purely issue additional commands to the spyware and would fetch the data from target system whenever required.

VIII. PREDICTED ADVANTAGES AND DRAWBACKS OF THE TARGET SYSTEM

The following are supposed advantages of the target system.

- The target system being built same as a malware would be strongly serving its purpose of being covert in its operations.
- It would aid the incident handlers and forensics analysts to more strongly gather evidence in case of any cyber incident.
- Secondary evidence can be locally or centrally made available which would support the primary evidence and would establish a certain activity.
- The monitoring of processes would help us more as it would connect the dots like what the user was doing when and on what.
- Being highly lightweight it won't load the network in any manner or affect the activity being performed by the user.
- Security loopholes would be low as the target systems won't be exposed to the internet and the port through which the spyware communicates would be firewalled at the perimeter.
- Above all the companies would be willing to invest as this would be cost effective compared to the professional solutions available in the market with very interactive GUI's.

IX. CONCLUSION

This research tries to simplify employee monitoring and reduce internal threats. Various advanced software's and applications are available to keep other types of cyber security threats at bay. The best examples would be smart firewalls that provide defence against network related threats, the advanced AI based Antiviruses that mitigate threats of malicious applications targeting the system etc. Every one of these have a heavy cost component involved that's what makes the organizations reluctant to go for other software's. An all-round solution never exists however some quality solutions can be implemented together to mitigate all the risks. Such is the logic behind implementing the proposed solution. It guarantees early warning of what the users are doing and increases predictability when the evidences are correlated with the inputs from other solutions. At the same time being developed as a light weight solution save as adverse actors do, we can keep it very cost effective and get it highly customized to our environment.

X. REFERENCES

1. https://www.veriato.com/docs/default-source/whitepapers/insider-threat-report-2018.pdf
2. Kucera, K., Plaisent, M., Bernard, P., & Maguiraga, L. (2005). An empirical investigation of the prevalence of spyware in internet shareware and freeware distributions. Journal of Enterprise Information Management, 18(6), 697-708.
3. Stafford, T. F., & Urbaczewski, A. (2004). Spyware: The ghost in the machine. The Communications of the Association for Information Systems, 14(1), 49.

ISSN 2394 - 7780

4. Dagon, D., Gu, G., Lee, C. P., & Lee, W. (2007, December). A taxonomy of botnet structures. In Twenty-Third Annual Computer Security Applications Conference (ACSAC 2007), IEEE,325-339
5. Hunker, J., & Probst, C. W. (2011). Insiders and Insider Threats-An Overview of Definitions and Mitigation Techniques. JoWUA, 2(1), 4-27.
6. Cappelli, D., Moore, A., Trzeciak, R., & Shimeall, T. J. (2009). Common sense guide to prevention and detection of insider threats, CERT
7. Haim, B., Menahem, E., Wolfsthal, Y., & Meenan, C. (2017, March). Visualizing insider threats: an effective interface for security analytics. In Proceedings of the 22nd International Conference on Intelligent User Interfaces Companio, ACM, 39-42
8. Barroso, D. (2007). Botnets-the silent threat. European Network and Information Security Agency (ENISA), 15(2007), 171.

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019

ISSN 2394 - 7780

DESIGN OF ARDIUNO BASED WIRELESS DISTRIBUTED SENSOR NETWORK (WDSN) FOR SMART AGRICULTURE

P. S. Vikhe, N. K. Palte and C. B. Kadu
Department of Instrumentation & Control Engineering, Pravara Rural Engineering College, Loni

ABSTRACT
Agriculture sector plays vital role in overall socio-economic status of India. However, 54.6% of population in India is engaged in agriculture and allied activities (census 2011). The net cropped area is 43% of total geographical area of India and area under irrigation is 68 million hectares. The irrigation is supply of water to agriculture field and is an important in agriculture. Thus, water is wasted in traditional irrigation. As, it is not convenient to measure environmental and soil parameters using wired instrumentsand sensors over wide agriculture fields.Therefore, in this research work we have design an ardiuno based Wireless Distributed Sensor Network (WDSN) foragriculturetosavewater andtime.The approach consist of master unit to acquire soil moisture, soil temperature, air temperature, humidity, solar radiation and wind speed data from various sensor nodes distributed within field. The upper and lower limits of these parameters are set in master unit. In standalone mode, based on obtained data master unit activates control-signals to effectively control drip irrigation through node units.

Keywords: Agriculture, Ardiuno, Irrigation, Network, Soil-moisture, Wireless

1. INTRODUCTION

Soil moisture and temperature, relative humidity, air temperature, wind speed, solar radiation, rainfall are major parameters, play vital role in the field of precision agriculture [1]. Thus, monitoring of these parameters along with soil major nutrients like nitrogen, potassium, phosphors and pH of soil is also essential, to increase crop production and productivity. But these parameters have different effect on growth of plants and crops. The relative humidity in air affects disease attack on plants. However, moisture measurement in soil ensures water availability and helps to schedule the irrigation for plant. Evaporation and transpiration of water from soil, depends on air temperature, relative humidity, wind speed, solar radiation and soil moisture [5]. Thus, evapotranspiration rate can be computed to determine irrigation schedule, to assist pest management decision. To evaluate soil and plant health conditions measurement of nutrient level in soil plays a significant role. This provides information about stress on plant due to nutrients deficiency, helps to decide time for use of fertilizer [3].

It is difficult and inconvenient to measure soil moisture, temperature and humidity continuously using wired instruments and sensors over wide agriculture fields. However, wireless instrument and sensor nodes can provide continuous measurement of these parameters [4]. The wireless distributed sensor network includes more than one sensor nodes operating continuously without manual interaction. Sensor nodes are low-power; multifunction, and can be operated on solar or battery having sensing, computational and communicational ability [2].

In this research work wireless sensor node has been designed using Ardiuno-nano microcontroller having different sensors and wireless communication module. The dedicated sensors are used, to sense soil moisture, relative humidity, air temperature, soil temperature, wind speed and solar radiations. In this, multiple sensor nodes form a group for monitoring, recording and controlling soil parameters. The obtained data is further collected at central location. In wireless sensor network battery-powered sensor nodes are scattered throughout a physical area [8]. Each sensor node in the network collects data of soil moisture, temperature along with other environmental factors and has excellent characters such as low energy- efficiency, low cost and small size. The WDSN is relatively inexpensive, portable, accurate and easy to use [3].

2. METHODOLOGY

The proposed designed system consists of single master unit and multiple slave units, having wireless connection between each other. The system work in master-slave configuration. A start network topology is used as elaborated in Fig.1. In this topology if anyone slave unit fails, entire system will not be affected.

ISSN 2394 - 7780

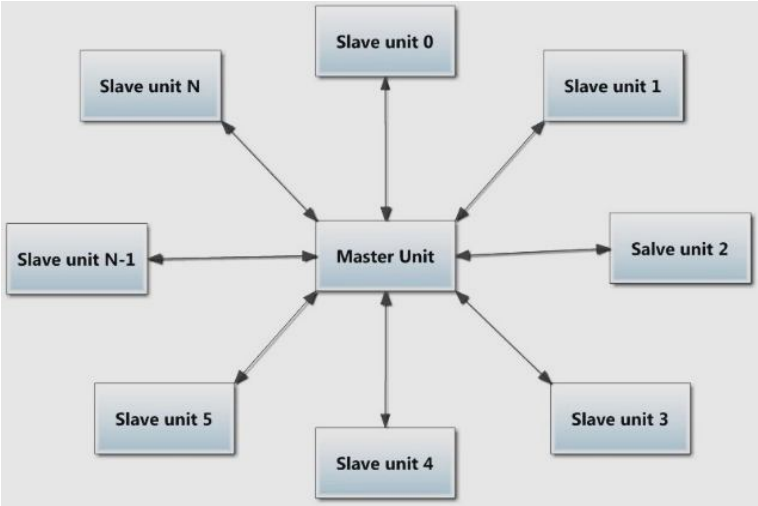


Fig-1: Star network topology.

2.1 Sensor used in system
To sense the soil and environmental parameters various sensors were used in sensor node and are discussed below.

1. Capacitive Soil Moisture Sensor - It is made up of two parallel metal plates or rod and connected to an oscillator to form electric circuit. When inserted in soil, it acts as dielectric medium for capacitor form due to two parallel plates. Thus, assoilmoisturechanges,capacitance changes and can be detected,due tochange in operating frequency of circuit.

2. Soil temperature sensor - It is buried at given depth in soil, to measure temperature. A sealed digital temperature DS18B20 probe, precisely measure temperatures in wet environments with a simple 1-wireinterface.

3. Digital Humidity-Temperature Sensor –Thishastwoelectrodeswithmoistureholding substrate. The change in humidity causes change in resistance between two electrodes.

4. Anemometer - It is used to measure wind speed and direction.The typical range of wind speed measure is 1 to 322 kmph. Aanemometer is installing in the unobstructed region.

5. Solar Radiation - Pyranometer has been used to measure solar radiation. The unit of solar radiation is (W/m2). The solar radiation are measured using an Ardiuno and electronic components like resistor and a small solar photo-voltaic cell of maximum output voltage upto 5 volts. Solar radiation is estimated calculating power from solar cell and dividing it by area of solarcell.

Power = pow (analogRead (A0), 2) / Resistance

*Area = length * width (assuming we have a rectangle)*

Solar radiation = power / area

2.2 Modules used in system
Different Modules used in the system are discussed below.

1. Wireless Module - The nRF24L01 is a single chip 2.4 GHz transceiver with an embedded baseband protocol engine, designed for ultra-low power wireless applications. The nRF24L01 is configured and operatedthroughaSerialPeripheral Interface (SPI.) The air data rate is supported withnRF24L01 and is configurable to 2Mbps [7].

2. Real-Time Clock (RTC) - The DS1307 is a low-power, full binary-coded decimal (BCD) clock/calendar RTC module. The address and data are transferred serially through an I2C, bidirectional bus. The clock/calendar provides seconds,minutes, hours, day, date, month, and year information.

3. SD Card Module - This is flash based memory card, designed to meet security, capacity, performance and environment requirements. The Micro SD Card communication is based on an advance 8-pin interface (clock, command, 4x data and 2x power lines) and is used to log sensor data.

ISSN 2394 - 7780

3. DESIGN AND DEVELOPMENT OF SYSTEM

The designed system includes single master unit and multiple sensor nodes. Both master and sensor node are consist of ardiuno microcontroller, wireless module, designed to power by solar as well as 3.7 v lithium-ion battery to make it portable.

3.1 Design of Master Unit

The masterunit has SDcardreadermoduleand 16x2 LCD display, tostore sensor data and display data locally. The numbers of maximum nodes, upper and lower limits for controlling parameters are updatedthroughserialcommunication using smart phone (hand-held device) in master unit. The schematic representation of master unit is shown in Fig.2.

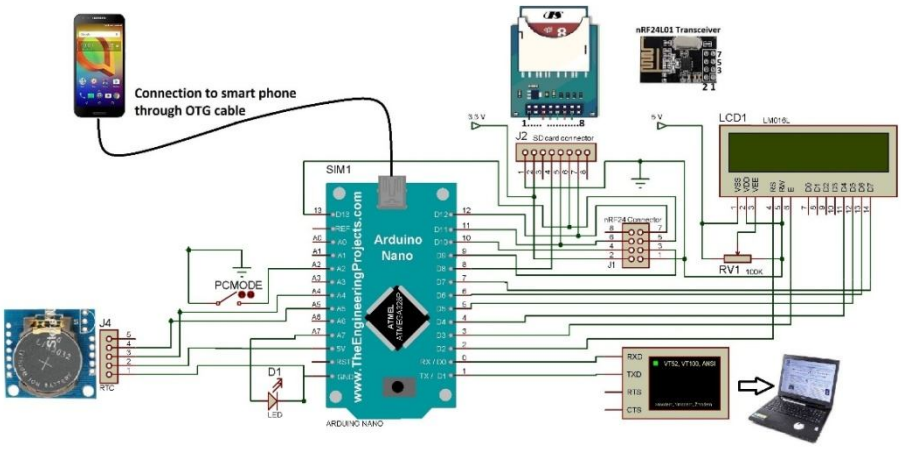


Fig-2: Schematic representation of master unit circuit

The list of designed master unit components is as below.

- Micro-Controller –Ardiunonano
- Wireless Module - nRF24L01.
- SD card read-write module.
- LCD for standalone display.
- Real Time Clock (RTC) ds1307 module.
- Serial COM to connect with PC and Smart phone.

3.2 Design of SlaveUnit

In this each slave unit have factory set unique ID number. This unique numberisrecalled by master unit. Thus,after matching node number, slave unit send sensor data to master unit. A special slaveunit,numbered 0 (zero)have sensors, tocollect data of solar radiation and wind speed. Similarly, all otherslaveunitsareidenticaltoeachother and have sensors, to collect data of soil moisture,humidity and temperature, distributed in specifiedfarm

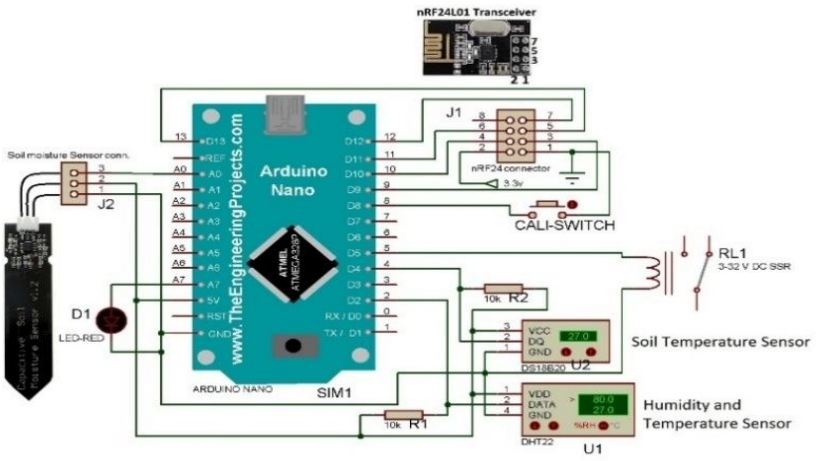


Fig-3: Schematic representation of slave unit circuit

ISSN 2394 - 7780

The list of designed slave unit components is as below

- Micro-Controller –Ardiunonano
- Sensors - DHT22, DS18B20, capacitive soil moisture sensor.
- Wireless Module - nRF24L01.
- Relay or SSR to control valves, pumps, motors etc.
- Serial COM to connect with PC and Smart- phone.
- Node-0: Standard Anemometer
- Node-0: Small solar cell

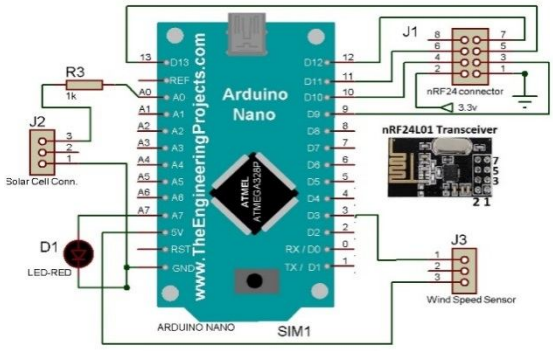


Fig-4: Schematic representation of node-0 circuit

3.3 Printed Circuit Board (PCB)

Single and bottom sided printed circuit board (PCB) layout was designed using EGALE 7.6.0 (Easily Applicable Graphical Layout Editor) software. The printed circuit board of master and slave unit is shown in Fig. 5 and Fig. 6 respectively.

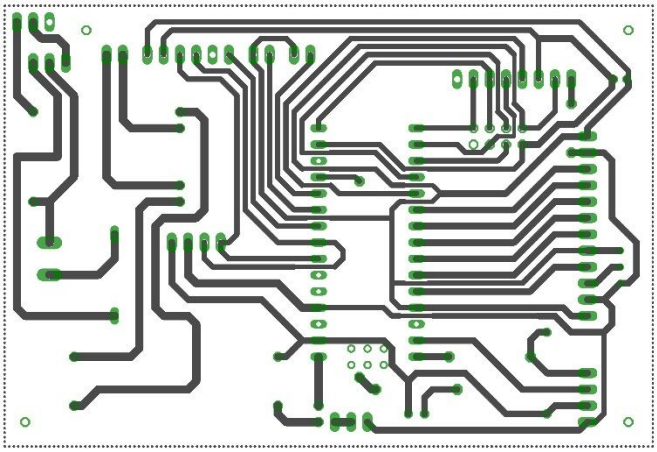


Fig-5: PCB circuit of master unit

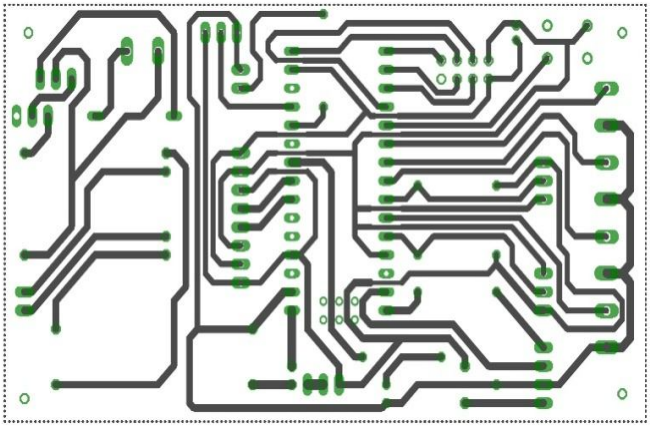


Fig-6: PCB circuit of slave unit

ISSN 2394 - 7780

4. DISCUSSION

In this research work, initially master unit sends node number (Unique ID) on the network, all working sensor nodes receive message from master unit. But sensor matching node number only will respond to message, includes sensor data. The master unit waits for predefine time for acknowledge from node. Furthermore, data is logged in SD card according to respective node numbers. If sensor node does not respond within predefine time, master unit will skip that node and jump to next node number. This process is repeated for all nodes and all parameters data is then averaged in master unit.

The averaged data is compared with set points stored in master unit. The control signal is generated depending on upper and lower limits of set points. It is further transmitted to slave unit to ON/OFF the irrigation system. The slave unit, on receiving request from master unit, acquires data from different sensors and sends data to master unit. Slave unit also receive control signal from master unit to control valve, pump or motor of water irrigation system. The designed system uses low powered, low cost components to minimize overall cost of system. It is portable, easy to install and use. The wireless communication of data provides advantages over wired systems specifically in agriculture fields. The data logged can be used for analysis, to compute need of irrigation based on evapotranspiration rate for particular agriculture field.

5. CONCLUSION

Installation procedure of sensor used for soil moisture, temperature, humidity, solar radiation and wind speed has been studied. Based on this study different sensor modules were designed and developed in this work for data acquisition and logging process, used to acquire data from soil and environment. This research work deals with wireless communication established between multiple nodes, to transfer data and control signals. Thus, designed irrigation system effectively save water, time and manual labor involved in watering of the plants/crops.

6. REFERENCES

[1] Obota, M. E., and H. C. Inyama. "Soil moisture based irrigation control system for rice cropping using wireless sensor network." *The International Journal of Engineering and Science (Ijes)* 2, no. 3 (2013): 37-43.

[2] Chaudhary, D. D., S. P. Nayse, and L. M. Waghmare. "Application of wireless sensor networks for greenhouse parameter control in precision agriculture." *International Journal of Wireless & Mobile Networks (IJWMN)* 3, no. 1 (2011): 140-149.

[3] Mohanraj, I., V. Gokul, R. Ezhilarasie, and A. Umamakeswari. "Intelligent drip irrigation and fertigation using wireless sensor networks." In *2017 IEEE Technological Innovations in ICT for Agriculture and Rural Development (TIAR)*, pp. 36-41.

[4] Ghadge K. M., H.K. Ghadge and VidhyaSeeman. "Fertigation System toConserve WaterandFertilizersUsingWireless Sensor Network."*International Journal of Engineering Research in Computer ScienceandEngineering*,ISSN(Online)2394- 2320, 5(3) (2018):20-25

[5] Sibale, Davis, M. S. Mane, S. T. Patil, and P. M. Ingle. "Evaluation of three methods for estimating reference evapotranspiration (ETo) at Dapoli, Maharashtra." *Journal of Agrometeorology* 18, no. 1 (2016): 157.

[6] Roopal R. Rewatkar, S. B. Hedau,S. R. Mudliyar, M. A. Dharmik and P. Bhede. "Automation in DripIrrigation Using Embedded Control System." *International Journal of Science, EngineeringandTechnologyResearch*,ISSN:2278 7798, 5(4):860-863

[7] "nRF24L01 Single Chip2.4GHz Transceiver Product Specification," Revision 2.0 by *NordicSemiconductor ASA*, Otto Nielsensvei12, 7004 Trondheim.

[8] A. Di Nisio, T. Di Noia, C. G. C. Carducci and M. Spadavecchia, "Design of a low cost multipurpose wireless sensor network," *2015 IEEE International Workshop on Measurements & Networking (M&N)*, Coimbra, 2015, pp. 1-6.

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019

ISSN 2394 - 7780

ECONOMIC ADVANTAGES OF WASTE HEAT RECOVERY BOILERS OVER COMBUSTION BOILERS IN PLANTS WITH HIGH EXHAUST HEAT

Abhishek Chandramohan
Research Engineer and Scientist, VPA Laboratory Private Limited, Chennai

ABSTRACT

In a sponge iron plant, the exit gases from rotary kiln (pyro processing device) has a peak average temperature of 850°C to 950°C. Although it is possible to convert these waste heat into usable power, such potentials are not fully realized because most of the industries, particularly in Asia, continue to operate with older systems. The appreciable volumes of heat released are cooled by cooling systems before the flue gases are released into the environment. These cooling systems requires power to operate in addition to the power requirements of the plant, which are produced by combustion boilers. However, waste heat recovery boilers (WHRB) converts such heat into functional energy by eliminating the cooling systems. In addition to that, the installation and operation costs of WHRB are lower than combustion boilers. WHRB not only produces operable power but also reduces the emission of pollutants since waste heat acts as the fuel source instead of external fuel source. Therefore, the importance of such conversion techniques are emphasized in terms of economic analysis to reduce the use of conventional energy sources and use the available resources to its maximum potential.

Keywords: Waste heat recovery boiler; steam generation; fluidized bed combustion; economic analysis; energy.

1. INTRODUCTION

Conventional fuels are exhausted every day, which are under regulations for its use due to environmental impacts. Although energy from solar, tidal and wind are increasingly adopted worldwide, the capital and time needed to generate enough quantity to operate an industry, iron processing in particular, is difficult to meet with alternative fuels. In such cases, conventional fuels source i.e., coals are widely used to meet these requirements.

India, being an energy dependent country because of diverse climatic conditions, uses conventional fuel sources for most of the energy demands. Be it for domestic, commercial or industrial usage, the requirements are most commonly met with use of coals and the coals used in India are Grade 7 i.e., bituminous coal, a widely available resource. India is among the top five countries for global carbon dioxide emissions in recent years. The total CO_2 emission per capita is still greater than 1.5 tonnes (Olivier et al. 2015). This is considered high because India is among the top three countries for both energy consumption as well as production of coal. The present energy produced by burning coals are 1130 terawatt hour (TWh) but these are not enough to meet the energy demands, which is expected to reach 4000 TWh by 2040 (Penney et al. 2015). Arguments does rise about the use of bio-waste as burning fuel but from an engineering point of view, the consideration of calorific values supersedes these arguments. Hence, bio-wastes can be used only as a combination along with coal as fuel.

From various advancements in iron processing industries, the most interesting development is the use of waste heat recovery system (WHRS) as a tool to replace cooling systems in fluidised bed combustion system (FBCS), especially atmospheric fluidised bed combustion system (AFBCS) in a sponge iron plant (recovery systems are typically used as an additional arrangement). In FBCS, the rotary kiln of a sponge iron plant emits large quantities of heat. These heat are in turn cooled by gas coolers before they are released as flue gases into the environment (Koornneef et al. 2007). Power is required to operate these cooling systems, which is produced by atmospheric fluidised bed combustion boilers (AFBCB) (Hughes et al. 2005) or circulating fluidized bed combustion boilers (CFBCB). Both rotary kiln as well as combustion boilers requires fuel (coal) to operate (Fig. 1). In case of WHRS, WHRB replaces AFBCB and its improved version i.e., CFBCB (most efficient in its family; the major difference is that CFBCB can use wide variety of fuel combinations) (Nag et al. 1987). The heat from rotary kiln is converted into power and hence, only the rotary kiln requires fuel to operate since the cooling systems are eliminated (Fig. 2). Based on this design, this work highlights resource utilizations, environmental impacts and economic advantages in the field and emphasizes the importance of implementing such techniques for energy conservation in industrial sectors.

ISSN 2394 - 7780

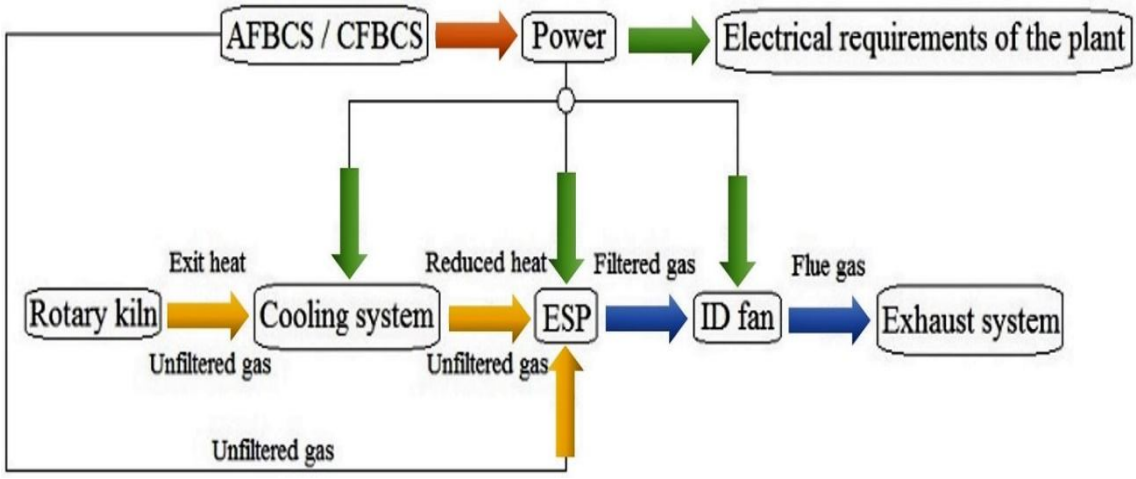


Fig-1: Layout in a sponge iron plant with AFBCB or CFBCB

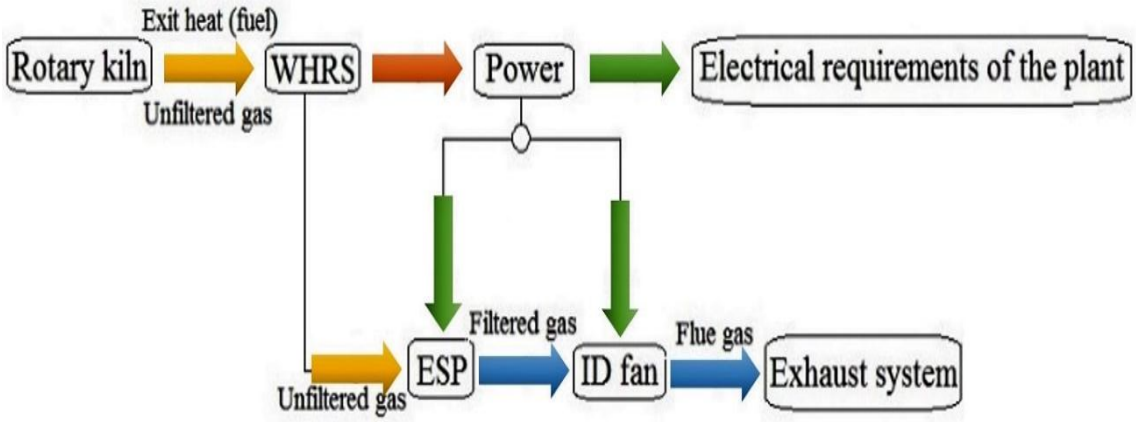


Fig-2: Waste heat recovery steam generation (WHRSG) in sponge iron industry

2. METHOD

In AFBCB system (Fig. 1) the energy produced from the boilers are used to operate the gas cooler. The average energy requirement for its operation is 35 MW/hr (megawatt / hour). Similarly, the average energy requirement for electrostatic precipitators (ESP) and induced draft (ID) fan are 93 kW/hr and 55 kW/hr respectively (Chandramohan, 2013). The remaining energy produced is utilized by the plant for general requirements such as lights, fans and etc., where the power is produced by burning coals. In WHRSG system (Fig. 2) however, the exit heat from rotary kiln were used as fuel, which averaged at 900°C. This heat is ultimately used to produce superheated steam for power generation similar to combustion boilers. The generated power is then used to satisfy the electrical requirements of ESP, ID fan and rest of the plant (Loganathan et al. 2013). The fuel used for AFBCB was '55% coal + 25% char + 20% rice husk' with a combined gross calorific value of 2300 kcal/kg. Although, variants such as 'coal fines, dolochar and pet coke' in combinations with coal can also be used as fuels for CFBCB.

3. COMPARISON BETWEEN AFBCD AND WHRB

For comparisons, AFBCB of 30 TPH (tonnes per hour) capacity with an efficiency of 84 ± 2% and WHRB of 11 TPH capacity with an efficiency of 80 ± 2% are considered. 1 TPH generates approximately 2.2 MW (megawatt) power, which signifies the power generation capacity of the boiler; higher the capacity, more the need for fuel. These two different capacities are compared because on a lower scale, the performance as well as construction costs are relatively equivalent. Both boilers were designed at 67 ATA (atmospheric pressure absolute) at an outlet super heater temperature of 490 ± 5°C. Due to high exit heat from rotary kiln, WHRB was designed based on the gas flow rate of 25 kNm^3/hr at 975°C at the inlet. In contrast, AFBCB was designed at a net heat input capacity of 25.4 megacalorie / hour (MCal/hr). In both of these systems, the average gas density of flue gases were 1.3 kg/Nm³ and the CO_2 content were lesser for WHRB at 13.35% than 17% with AFBCB (Chandramohan, 2013). The final flue gas temperature in WHRB system was at 170°C (inlet capacity of 975°C). This signifies that an average of 82% of the total heat from rotary kiln were utilized in WHRS compared to 50% by AFBCS (Chandramohan 2013, Loganathan 2013). The major difference being the 30% to 40% extra heat (as illustrated in Fig. 3) that was converted into usable power for electrical requirements of the plant.

ISSN 2394 - 7780

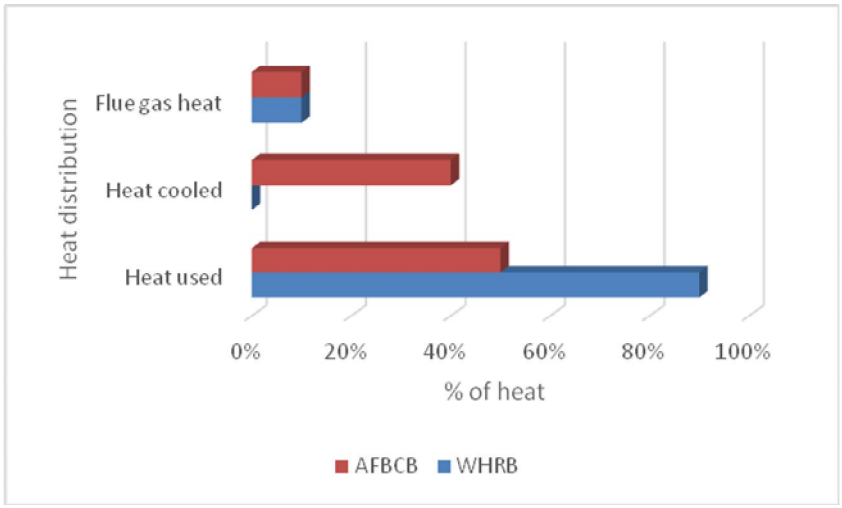


Fig-3: Break-up of total heat produced

4. RESULTS AND DISCUSSIONS

The economic analysis were made by comparing WHRB with AFBCB in terms of equipment (construction), fuel and power production.

4.1. Equipment cost

As mentioned earlier, rotary kiln requires fuel to operate and hence, most equipment such as fans, valves, feeders, pumps, dosing systems, fuel and ash handling systems and etc. are in common with AFBCS. Hence, the equipment mentioned in Tab. 1. alone differs (Chandramohan, 2013).

Tab-1: Equipment cost differences

Equipment	WHRB	AFBCB
Electric overhead traveling (EOT) crane	x	✓
Soot blowers	✓	x
Cooling tower	x	✓

The only equipment cost for WHRB (as illustrated in Fig. 4, with $ 1 = ₹ 63.5 - median average during the work) was soot blowers that was at $ 7,874 based on the market price in India (Chandramohan, 2013). In case of AFBCB, EOT crane costs at $ 7,086 and cooling tower at $ 787,401. Therefore, the equipment cost for AFBCB was more than 100 times when compared with WHRB.

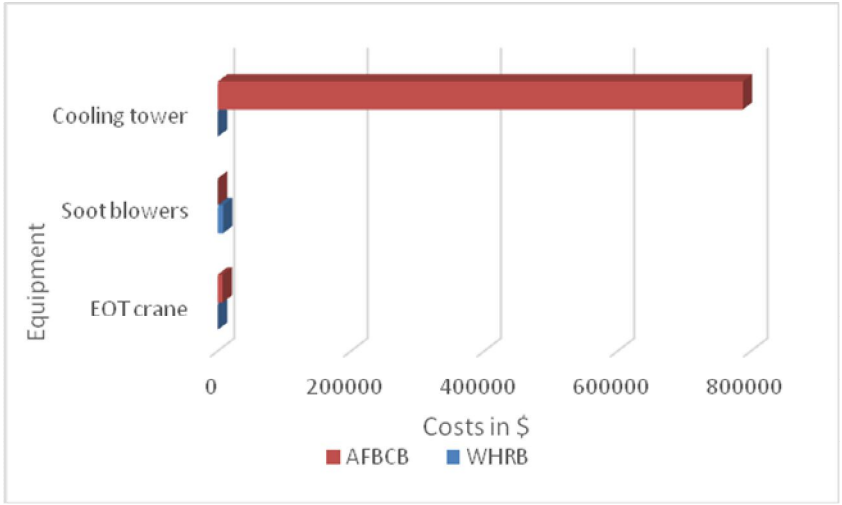


Fig-4: Equipment costs by construction

4.2. Fuel cost

The AFBCB requires external fuel source to operate, where 30 TPH capacity of AFBCB requires burning of 2 TPH of coals. With the average cost of coal in India at $ 78.7 per ton (during the work) and the operating time per day at 8 hours (Chandramohan, 2013):

Fuel cost per day:

ISSN 2394 - 7780

= Fuel consumed at TPH * cost of coal per ton in $ * operating time in hours

= 2 * 78.7 * 8

= $ 1,259

Considering five working days per week, the fuel cost (as illustrated in Fig. 5) becomes $ 25,196 per month and $ 302,362 per year for AFBCB. WHRB does not require any external fuel source since it uses exit heat from rotary kiln as input and hence, fuel cost per month and annum for WHRB is $ 0.

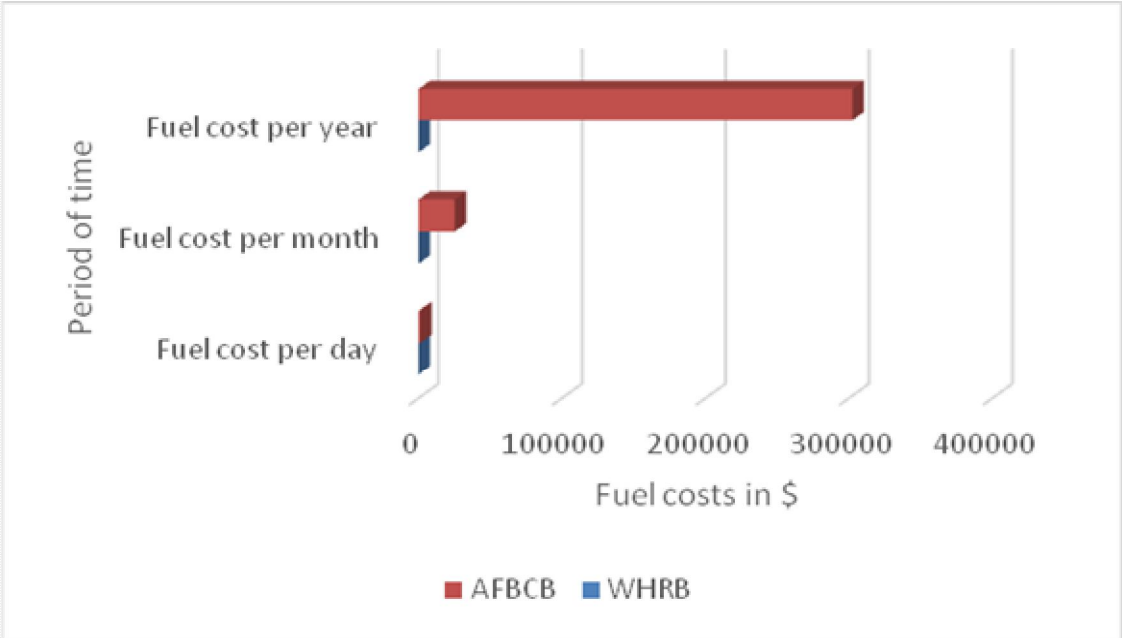


Fig-5: Fuel costs for the use of coal

4.3. Power production cost

Power production cost involves the consideration of all available resources, including workforce. By Indian industrial standards (during the work), typical production cost for a kWhr (kilowatt-hour) for WHRB and AFBCB were $ 0.02 and $ 0.07 respectively (Chandramohan, 2013).

Power generated per day = (Power generated by boiler in kW * operating time in hours)

For WHRB:

= (11 * 2.2 * 1000) * 8

= 193,600 kWhr

For AFBCB:

= (30 * 2.2 * 1000) * 8

= 528,000 kWhr

Production cost per day = (Production cost in $ per kWhr * power generated per day)

For WHRB:

= 0.02 * 193,600

= $ 3,872

For AFBCB:

= 0.07 * 528,000

= $ 36,960

Considering five working days per week, the production cost (as illustrated in Fig .6) per month becomes $ 77,440 for WHRB and $ 443,520 for AFBCB. Similarly, it costs $ 929,280 per year for WHRB and $ 5,322,240 per year for AFBCB. Therefore, production cost per annum for AFBCB was more than 5 times when compared with WHRB.

ISSN 2394 - 7780

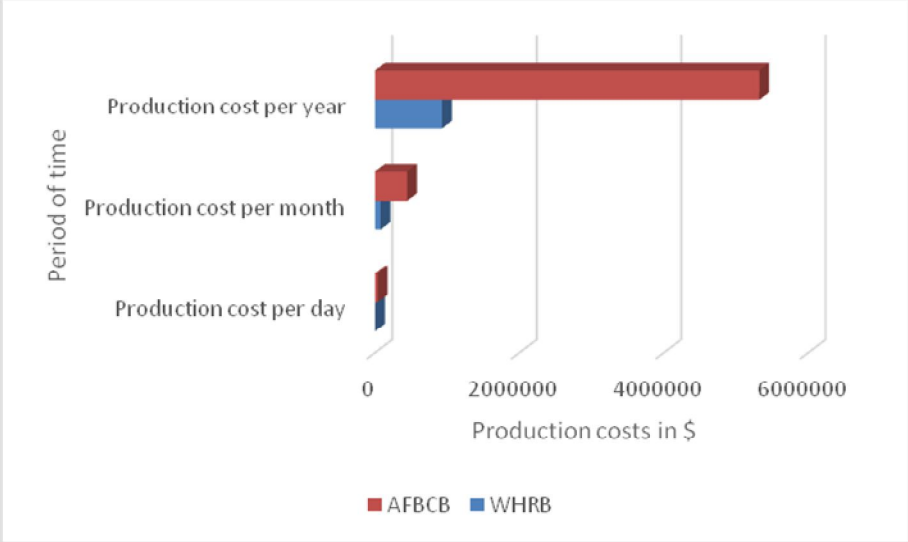


Fig-6: Production costs for power at the plant

4.4. Profits

After satisfying the electrical requirements of the plant, the ratio of surplus power to total power produced per day (8 hours consideration) were 40 kW : 193.6 MW for WHRB and 145 kW : 528 MW for AFBCB. The surplus power were exported to grid by wheeling and the peak average cost earned was $ 0.09 / KW (during the work) (Chandramohan, 2013).

Earning per day = Selling cost in $ per kW * surplus power in kW

For WHRB:

= 0.09 * 40

= $ 3.6

For AFBCB:

= 0.09 * 145

= $ 13

Considering five working days per week, the profits per month (as illustrated in Fig. 7) becomes $ 72 for WHRB and $ 261 for AFBCB. Similarly, profits per year becomes $ 864 for WHRB and $ 3,132. Although the profits per annum through export is more for AFBCB, the cost spent on fuel per year alone is $ 302,362, whereas it is $ 0 for WHRB Therefore, the use of WHRB effectively makes the plant 'independent'. However, it can also be classified as a 'captive' if the surplus power were to be stored for personal use instead of exporting.

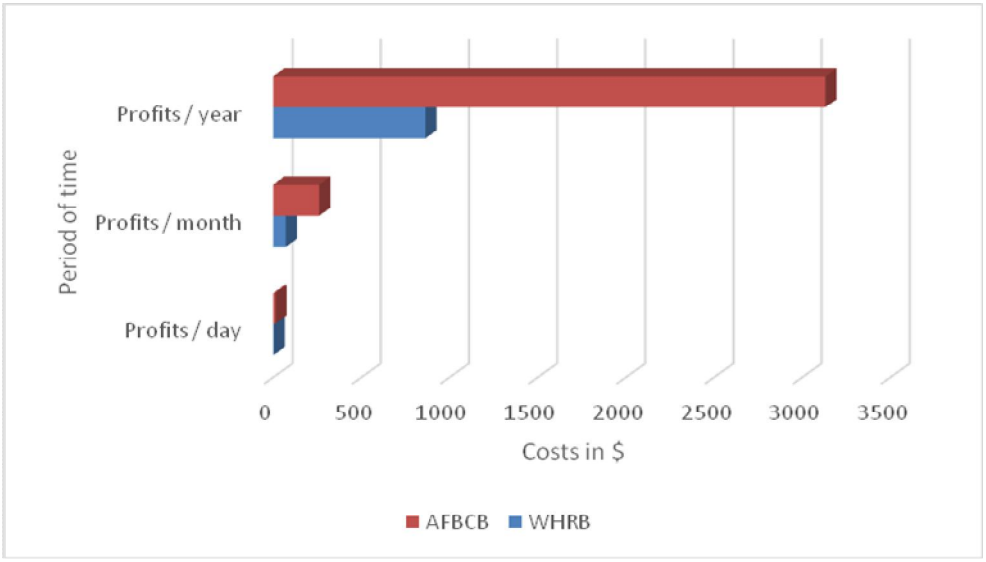


Fig.-7: Profits by exporting the surplus power

ISSN 2394 - 7780

4.5. Market

The reason for unfavourable WHRS installation is regular maintenance. As with any boilers, maintenance is necessary to prolong its life. However, WHRB requires additional care in order to maintain its efficiency. It is to be noted that 11 TPH capacity of WHRB has an efficiency of 80 % when compared to 30 TPH capacity of AFBCB with efficiency of 84 %. For the same application, the WHRB operates only at 36 % capacity of the AFBCB with significantly lesser costs. Even without the consideration of equipment or production costs, WHRBs are economically viable in terms of fuel cost alone. Therefore, it is up to the users to realize such potentials and also with the manufacturers to advice well.

5. MERITS OF WHRSG

- Effective utilization of energy resources in the plant i.e., 80% to 90% of the total heat.
- Eliminates external fuel source for boilers, thereby reducing the pollutants.
- Eliminates gas cooler and its power requirement, thereby saving power.
- Significantly reduces the costs in 'equipment, fuel and production'.

6. CONCLUSION

In any combustion process, heat is generated by burning fuels. Most of the time however, these heats are wasted without realizing its potential that ultimately brings an energy dependency. Therefore, it is important to advocate methods to reduce such dependency and to make use of available resources more efficiently when and where applicable. Through sponge iron industry, a case was made in terms of economic analysis, where attaining self-sufficiency in power usage was one of the primary goals for long-term gain as well as being relatively eco-friendly to the environment. Therefore, systems with 'ovens, incinerators, engine exhausts, crackers, dryers, castings, furnaces, and etc.', which are much similar to rotary kiln may also be promoted to realize such potentials.

ACKNOWLEDGEMENT

The author expresses deep gratitude to Mr. MUNUSAMY CHANDRAMOHAN for his expertise, support and funds during the course of work.

REFERENCES

- Anthony, E. J., Hughes, R. W., Lu, D. Y., & Macchi, A. (2005). Design, process simulation and construction of an atmospheric dual fluidized bed combustion system for in situ CO_2 capture using high-temperature sorbents. *Fuel Processing Technology*, 86(14-15), 1523-1531.
- Basu, P., & Nag, P. K. (1987). An investigation into heat transfer in circulating fluidized beds. *Journal of heat and mass transfer*, 30(11), 2399-2409.
- Chandramohan, A. (2013). Utilization of waste heat for power generation for sponge iron industries", Bachelors Dissertation, Vels University, India.
- Cronshaw, I., & Penney, K. (2015). Coal in India 2015. Canberra: Office of the Chief Economist.
- Faaij, A., Junginger, M., & Koornneef, J. (2007). Development of fluidized bed combustion – An overview of trends, performance and cost. *Progress in Energy and Combustion Science*, 33, 19-55.
- Janssens-Maenhout, G., Muntean, M., Olivier, J. G. J., & Peters, J. A. H. W. (2015). Trends in global CO2 emissions 2015 report. The Hague: PBL Netherlands Environmental Assessment Agency.
- Loganathan, R., & Sivakumar, P. (2013). Waste Heat Recovery Steam Generator in Sponge Iron Plant. *The SIJ Transactions on Industrial, Financial and Business Management*, 1(1), 23-28.

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019

ISSN 2394 - 7780

MORPHOLOGICAL, ANATOMICAL AND PHYTOCHEMICAL SCREENING OF MEDICINAL HERB *BOERHAAVIA DIFFUSA L.*

Dr. Sandeep Pandey[1*], Ankita Patel[2], Balwant Singh[3] and Ram Krishna Gupta[4]
[2,3,4]Research Scholar, Center for Botany, School of Environmental Biology, A. P. S University, Rewa

ABSTRACT
Boerhaavia diffusa L. has been an important medicinal plant known globally as well as in Indian system of traditional medicine for curing various ailments. It has common name 'Punarnava' which literally means 'to rejuvenate'. The herb has woody root-stock that emerges out from cracking rocks. The plant root has higher medicinal value due to presence of rotenoids mainly boeravinone B, C and E. In India it is a common weed but has various applications in form of medicine and vegetable with nutritious value. Although this herb is adulterated with other similar species for commercial uses, thus it requires proper scientific techniques for the identification and validation of this species. This comprehensive account includes distribution, morphological, anatomical features and chemical composition of the aerial as well the below ground part of this species for collecting valuable information about its constituents for maximum utilization in drug industries.

Keywords: Boerhaavia diffusa, morphology, anatomy, chemical composition

1. INTRODUCTION

Herbal medicine has been recognized as the second largest therapeutic system in the world with 80% of the population in Asian and African countries mainly depending on these medicines for primary healthcare [1]. Global approach towards naturopathy has gain momentum to study phyto-chemistry for identifying bioactive compounds and medicinal properties of the plant and employing new techniques for their mass production [2, 3]. In order to develop a standard therapeutic system special focus should be on composition and use of natural products for fighting disorders in human being [4]. Apart from this, environmental and genetical reasons of disease should also be recognized under naturopathy [5]. Plant products are worth in combating antibiotic resistant bacteria and fungal pathogens. As a safe natural product, they are a better substitute for synthetic drugs and moreover they should be used in preparing new blended products by combining antibiotics or other organic compounds with unique synergistic property for safe utilization in food, fragrance and pharmaceutical industries [6].

For millennia, Indian system of traditional medicine has gained a global attention and the indigenous communities are using natural crude drugs for curing various ailments. This alternative system of medicine is gaining increasing popularity worldwide [7]. In fact the Indian sciences were always concerned about the well being of not only the mankind but also of the other living or even non-living things [5]. The continuous exploitation of medicinal plant has causes their depletion and many of them are at the verge of extinction [8]. Thus there are need of wide research and implementation of modern scientific techniques [9] to identify various plant species with a potentiality to prepare drugs that can fight chronic diseases [10] and to conserve useful medicinal plant.

Boerhaavia diffusa a prominent member of family Nyctaginacea, as a medicinal plant has been used in traditional medicines in various parts of the world. The genus "Boerhavia" was given its name after Hermann Boerhaave, a Dutch physician in 18th century, and the species "diffusa" is so called due to its diffuse branching [11,12]. The herb also known as red spiderling, spreading hogweed, or tarvine [13] with common name as Punarnava (and also, Shothagni, Rakta punarnava) in Ayurveda as is believed to be a rejuvenator [7].This comprehensive review focuses on plant profile and chemical composition of the plant to explore its identity and further use in medicinal industries.

2. DISTRIBUTION AND MORPHOLOGY

The plant is native to Africa, Asia, the Pacific, Caribbean and North and southern America [13] generally found in open places in the settled areas at low and medium altitudes [7]. It grows wild in India and Brazil and is a common weed in and about towns, and is pantropic in distribution. The identification of true species of *Boerhaavia diffusa* is a difficult task and remain taxonomical conflicts as it is extensively adulterated with the similar species having a slight differentiation in morphological features and habits [14, 15]. The plant bears small sticky fruit and thus easily dispersed by migratory birds [16].

ISSN 2394 - 7780

Fig-1: *Boerhaavia diffusa* plant

The plant is a diffusely branched, pubescent, prostrate, creeping and spreading perennial herb, with woody, fusiform, robust, tapering, root-stock which is about 30-50 cm deeply penetrated in the soil and get dries during the summer. The plant shows orthotropic and superimposed axis which becomes pendulous giving rise to shoots whose distal part later on converts to main axis. The plant possess cylindrical, creeping purple or greenish stem with swollen nodes. The branches are sylleptic 100 to 175 cm. in length showing alternate emergence from every node. The plant bears small fleshy petiolate; opposite; sub orbicular or cordate and ovate leaves [7]. Boerhavia species mainly shows brochidodromous type venation in which primary vein passes through the middle of lamina. In *B. diffusa*, the secondary veins are 4 to 5 pairs and mostly alternate and basal pair shows an acute angle of divergence. 3-4 tiers arches are found in the intramarginal region. Tertiary veins are interangular, curved and convex, with equal or unequal arms. These veins, the angle of origin near the medial side is sometimes obtuse or acute and mostly obtuse. At lower parts 1-2 unbranched, sparce, convex oining veins are present. The veins mainly present cascade pattern in a maximum region. 5 or 6 degree order venation is rare. The third, fourth, and fifth degree orders of vein unite to form areoles which are irregular and sizes [17].

The plant has composite inflorescence that dies after fruiting giving rise to new branches in the coming season [7]. The plant bears small pedicelate; bracteolate; paniculate; pink flowers, without differentiation in calyx and corolla; having oblique and stipitate ovary with erect ovule and peltate stigma [18]. The plant has achene fruit that are detachable, ovate, five-ribbed, five-angled glandular and enclosed in perianth tube. The plant shows pre-monsoon seed germination that get matured in October–November.

3. ANATOMICAL FEATURES OF NODE, LEAF, STEM AND ROOT

3.1 Nodal anatomy

Boerhavia species contains trilacunar node. The T.S. of node shows that the point of attachment of the petiole contains seven vascular traces with two large, three medium and 2 small one. The phloem is present outside xylem i.e., ectophloic, semilunar. The distal ends of the petiole contain nine traces. Epidermal cells are one layered thick; rectangular or barrel-shaped, compact, thin walled, concealed with thick cuticle having multicellular trichomes. A Parenchymatous cortex is massive, more or less compact with rounded cells, isodiametric, containing minute intercellular spaces. They contain 1 to 3 tracheids, concealed with parenchymatous sheath cells. The sheath cells are thin walled, oblong and loosely arranged. Free vein endings exhibit centric pattern [17]. A study clarified that in Boerhavia species the leaf vein shows Kranz anatomy, and anthocarp possessing five ribs or three wings containing sclerenchyma within or between the ribs [19]. Boerhaavia sp. generally presents unilacunar nodal vasculation. The node cell shows secretory cells containing crystal deposition. The dorsal node possesses dense surface appendage compare to ventral region. Also, the internodes have large ground tissue compare to nodes [20].

3.2 Anatomical features of leaf

According to an observation, leaf shows uniseriate epidermis concealed with a thin cuticle containing stomata and trichomes on dorsal and ventral surface. The stomata are anisocytic, containing uniseriate or multicellular trichome possessing an elongated terminal cell. Epidermis exhibits dorsiventral organization with one or two strata of palisade and 3 to 4 layers of spongy tissue. Microscopic study reveals that length and width of palisades are 50-72 mm and 24-38 mm, respectively. The T.S. of leaf passing through midrib contains a single convex shape on the dorsal surface. The vascular bundle are three in number, crescent shaped, collateral embedded in the thick walled grounded parenchyma tissue. The central midrib contains two small vascular bundles. In lamina portion, the bundles are collateral and surrounded by parenchyma sheath. They contain raphide crystals and sheath cells that are linked together forming horizontal cordons of cells [18]. The primary structure of leaf shows central medullary bundles with middle ring 6-14 and outer ring 15-20 small bundles and third ring forming a complete inter a fascicular cambium [20].

ISSN 2394 - 7780

Trichomes containing apocarps are unevenly distributed and are more on a reproductive compare to vegetative parts. Their quantity changes with the temperature. Genetic study of trichome observed 700 expressed sequence tags or cDNA clones from cDNA library of average length 435 bp. Cluster analysis study reveals that at least 44% of the total cDNA clones produces some useful genes. Nearly 93 sequences are associated with gene ontology and 65 sequences are concerned with Keyto encyclopedia of gene and genomics. Only selected sets are involved in synthesis of secondary metabolite. The study also reported saturated and unsaturated lipids and, proteins like chalocone synthase, flavon-6-phosphate, lipoxygenase etc [21]. RAPD markers genetic study discloses that the species collected from different geographical origin in India shows significant polymorphism. These studies reveals that among the 28 screened accessions, 9 primers were found most informative, whereas the accessions collected from other region presented lower level of polymorphism. These tools are also found applicable in studying plant morphological character and flower colour along with character of ovate leaf and genotype of ovoid leaf [22].

3.3 Anatomical features of stem and root

The stem shows 3-5 rings of successive cambia with fusiform cambial initials mainly in the initial stages of secondary growth and ray cells mostly absent or showed paedomorphic nature. Epidermis is single layered containing isodiametric cells and concealed with thin cuticle and parenchymatous cortex. The stem and root of B. diffusa contains raphides in the cortical region. The plant root mainly contains crystals. Xylem contains rays like upright cells which are absent in a cambial zone. The cambial cells are fusiform and are 210 220 µm long and 17 23 µm wide. In T.S. the undivided cambium appears 2-3 and divided cambial zone 4-6 layered. Cambial variant generally occurs in plant that means cambium stop dividing after a limited period and second ring is formed from the parenchyma cells present outside the phloem which is produced by ground parenchyma. Before formation of second cambial ring, the parenchyma cells exhibit periclinal divisions forming a band of cells. The second new cambium further forms secondary cortex. On the basis of functioning cambium is of two types- one segment forming centrally Xylem and phloem towards periphery and another segment forming centripetally thick walled conjunctive tissue and centrifugally thin walled parenchymatous tissue in cambial rings. The study also discloses that root contains more conjunctive tissues compare to stem. The mature stem shows xylem containing vessel elements, tracheids and fibers, without xylem rays. Secondary xylem successive rings shows alternation with phloem rings. In B. diffusa the length and width of vessels are 140-145 µm and 45-50 µm respectively, whereas fiber length ranges from 260- 465 µm containing starch [18].

The attempt on regeneration of the plant from leaf and stem explants using MS medium shows that IBA and 2, 4-D gave maximum regeneration and callus formation with induction period of 7 and 8 days respectively [23]. In another study, nodal explants regeneration using random amplified polymorphic DNA (RAPD) markers reveals monomorphic banding pattern among the parent plant and new plants [24].

4. CHEMICAL COMPOSITION

Various studies on chemical composition of *Boerhaavia diffusa's* aerial and under ground part, shows presence of bioactive compounds [7, 12, 25]. There are studies that advocated use of modern genetic engineering and biotechnological techiques for increasing quality of the chemical components of the medicinal plant [26]. *Boerhaavia diffusa* mainly contains flavonoids, rotenoids, xanthones, lignans, purine nucleoside, and steroids [15], 12a-hydroxyrotenoid and boeravinone C [27], boeravinone B and E [28, 29]. The aqueous leaf extracts mainly contains alkaloids, saponins, and flavonoids with 82.22% moisture, 10.56% carbohydrate, 44.80 mg/100g dry weight vitamin C, 97.00 mg/100g vitamin B, 162.50 and mg/100g sodium, 174.09 mg/100g calcium, 8.68 mg/100g magnessium and 0.002mg/100g iodine [30]. The H-nuclear magnetic resonance study of plant root using simulation method of boeravinone C shows remarkable splitting patterns due to ABC spin systems [27]. Several researches proposed economical methods of extraction of boeravinone B and E. According to a study microwave-assisted extraction (MAE) yielded 0.15 and 0.32% (w/w) [28] whereas high-performance liquid chromatography (HPLC) was found effective for quantitation of these two rotenoids [29].Similar technique also confirms presence of Boeravinone- B in poly-herbal formulation and hydro-alcoholic extracts of whole plant [31]. A study suggests that UPLC using photodiode array (PDA) can also be employed for separation and quantification of boeravinones from the plant roots. This extraction can be carried out using solvent methanol, water and 0.1% acetic acid and a BEH Shield C18 -column with a flow rate of 0.4 mL/min and the compounds can be detected at λmax 273 nm [32]. Phytochemical assay of the decoctions and hydro-alcoholic extracts of the root using HPLC-DAD shows presence of ferulic acid and vanillin and boeravinone B and eupalitin, respectively [33].

Certain studies suggest that geographical origin do not influence the chemical composition of the plant. According to an assessment of leaf and root samples collected from different regions, reversed-phase HPLC-

ISSN 2394 - 7780

PAD-ESI/MS reveals presence of 10 phenolic compounds viz 3,4-dihydroxy-5-methoxycinnamoyl-rhamnoside, quercetin 3-O-(2''-rhamnosyl)-robinobioside, quercetin 3-O-rhamnosyl(1-->6)galactoside (quercetin 3-O-robinobioside), 3,5,4'-trihydroxy-6,7-dimethoxyflavone 3-O-galactosyl(1-->2)glucoside [eupalitin 3-O-galactosyl(1-->2)glucoside], kaempferol 3-O-(2''-rhamnosyl)-robinobioside, kaempferol 3-O-robinobioside, caffeoyltartaric acid, eupalitin 3-O-galactoside, kaempferol and quercetin in these samples [34]. The spectroscopic study isolated eupalitin 3-O-beta-D-galactopyranosyl-(1''' --> 2'')-O-beta-D-galactopyranoside (1), 4',7-dihydroxy-3'-methylflavone (5), 3,3',5-trihydroxy-7-methoxyflavone (4) and 3,4-dimethoxyphenyl-1-O-beta-D-apiofuranosyl-(1'' --> 3')-O-beta-D-glucopyranoside (7) as a major and eight other known compounds [35]. The HS-SPME-GC-MS analysis also confirmed presence of phenylpropanoids, terpenes, norisoprenoids, indol compounds, organic acids (oxalic, pyruvic, ketoglutaric, fumaric and quinic acids) in volatile composition of leaves and roots of the plant [36].

In recent year, some medicinal plants and their ethno medicinal properties has been well identified and documented [37, 38] likewise this species along with it chemical composition should be explored using newly evolved scientific techniques, and developing new amplitudes for utilization of this herb in pharma industries.

REFERENCES

1. www.marketresearchfuture.com
2. Pandey, S., Phytochemical constituents, pharmacological and traditional uses of *Ocimum gratissimum L* in tropics. Indo American J Pharma Sci. 2017, *4*, 4234-4242.
3. Pandey, S., Kushwaha, G.R., Singh, A., Singh, A., Chemical composition and medicinal uses of *Anacyclus pyrethrum.* Pharma Science Monitor. 2018,*9*,551-560.
4. Pandey, S., Singh, S.K., Kumar, N., Manjhi, R., Antiviral, antiprotozoal, antimalarial and insecticidal activities of *Ocimum gratissimum L.* Asian J Pharma Res Devp. 2017, *5*, 1-9.
5. Bhowmik, D., Sampath Kumar, K.P., Srivastava, S., Paswan, S., Sankar, A., Dutta, D., Traditional Indian Herbs: Punarnava and Its Medicinal Importance. Journal of Pharmacognosy and Phytochemistry. 2012, *1*, 52–57.
6. Pandey, S., Antibacterial and antifungal activities of *Ocimum gratissimum L.* Int J Pharm Pharma Sci. 2017, *9*, 26-31.
7. Chaudhary, G., Dantu, P.K., Morphological, phytochemical and pharmacological, studies on *Boerhaavia diffusa* L. Journal of Medicinal Plants Research. 2011, *5*, 2125-2130.
8. Kumar, S., Pandey, S., An ethnobotanical study of local plants and their medicinal importance in Tons river area, Dehradun, Uttarakhand. Indian J Trop Biodiv. 2015, *23*, 227-231.
9. Pandey, S., Shukla, A., Pandey, S., Pandey, A., An overview of resurrecting herb 'Sanjeevani'(*Selaginella bryopteris*) and its pharmacological and ethnomedicinal uses. The Pharma innovations. 2017, *6*, 11-14.
10. Pandey, S., Shukla, A., Pandey, S., Pandey, A., Morphology, chemical composition and therapeutic potential of Somlata (*Sarcostemma acidum* Wight. & Arn.). Pharma Science Monitor. 2017, *8*, 54-60.
11. Chopra, G.L., Angiosperms: Systematics and Life Cycle, S. Nagin and Company, Jalandhar, Punjab, India 1969.
12. Mishra, S., Aeri, V., Gaur, P.K., Jachak, S.M. Phytochemical, Therapeutic, and Ethnopharmacological Overview for a Traditionally Important Herb: *Boerhavia diffusa* Linn. BioMed Research International. 2014, *2014*, 808302.
13. www.ars-grin.gov/npgs
14. Selvaraj, D., Shanmughanandhan, D., Sarma, R.K., Joseph, J.C., Srinivasan, R.V., Ramalingam, S., DNA barcode its effectively distinguishes the medicinal plant *Boerhavia diffusa* from its adulterants. Genomics, Proteomics & Bioinformatics 2012, *10*, 364-367.
15. Douglas, N.A., Manos, P.S., Molecular phylogeny of Nyctaginaceae: taxonomy, biogeography and characters associated with a radiation of xerophytic genera in North America. Am J Bot, 2007, *94*, 856–872.
16. Carlquist, S., "Dispersal to Islands" in: Sherwin Carlquist (Ed.) *Plant Discorveries,* 2008.
17. Pramanick, D.D., G. G. Maiti., Foliar anatomical study of Boerhavia diffusa L.: a potent medicinal plant. Annals of Plant Sciences, 2017, *6*, 1598-1601.

ISSN 2394 - 7780

18. Patil, V.S., Rajput, K.S., Malpathak, N.P., Comparative study on morpho-anatomy of leaf, stem and root of Boerhaavia diffusa L. (Nyctaginaceae) and its adulterant plants. Brazilian Journal of Pharmaceutical Sciences. 2016, *52*, 433-442.
19. Struwig, M., Jordaan, A., Siebert, S.J., Anatomy of the southern African Boerhavia and Commicarpus species (Nyctaginaceae). Bangladesh J Plant Taxon, 2011, *18*, 105-115.
20. Gomathi, R., Amala, S., Karpagam, S., Nodal anatomy of Boerhaavia diffusa. Int J Curr Sci, 2012, 268271.
21. Chaudhary, G., Dantu, P.K., Analysis of Some Important Genes from the Trichomes of Boerhaavia diffusa L. Fruits by RNA isolation. Eur Exp Biol, 2018, *8*, 25.
22. Shukla, N., Sangwan, N.S., Misra, H.O., Sangwan, R.S., Genetic diversity analysis in *Boerhavia diffusa* L. of different geographic locations in India using RAPD markers.Genetic Resources and Crop Evolution, 2003, *50*, 587-601.
23. Jain, V., Singh, D., Saraf, S., Saraf, S., In-vitro culture studies for callus and root generation of Boerhaavia diffusa linn. Anc Sci Life, 2003, *22*,134-139.
24. Patil, K.S., Bhalsing, S.R., Efficient micropropagation and assessment of genetic fidelity of *Boerhaavia diffusa* L- High trade medicinal plant. Physiology and Molecular Biology of Plants, 2015, *21*,*425*-432.
25. Vasundhara, C.C.S., Gayathri Devi, S., Antihyperlipidemic property of Boerhavia diffusa leaf extract in streptozotocin-induced diabetic rats. Asian J Pharm Res Dev, 2018, *11*, 173-176.
26. Pandey, S., Morphology, chemical composition and therapeutic potential of *Stevia rebaudiana.* Indo American Journal of Pharmaceutical Sciences, 2018, *5*, 2260-2266.
27. Lami, N., Kadota, S., Tezuka, Y., Kikuchi, T., Constituents of the Roots of Boerhaavia diffusa L II.[1)] Structure and Stereochemistry of a New Rotenoid, Boeravinone C[2)]. Chem Pharm Bull, 1990, *38*, 1558-1562.
28. Bhope, S.G., Ghosh, V.K., Kuber, V.V., Patil, M.J., Rapid microwave-assisted extraction and HPTLC-photodensitometric method for the quality assessment of Boerhaavia diffusa L. JAOAC Int, 2011, *94*,795-802.
29. Bhope, S.G., Gaikwad, P.S., Kuber, V.V., Patil, M.J., RP-HPLC method for the simultaneous quantitation of boeravinone E and boeravinone B in Boerhaavia diffusa extract and its formulation. Nat Prod Res, 2013, *27*, 588-91.
30. Ujowundu, C.O., Igwe, C.U., Enemor, V.H.A., Nwaogu, L.A., Okafor, O.E., Nutritive and Anti-Nutritive Properties of *Boerhavia diffusa* and *Commelina nudiflora* Leaves. Pakistan J Nutrition, 2008, *7*, 90-92.
31. Singh, A., Sharma, H., Singh, R., Pant, P., Srikant, N., Dhiman, K.S., Identification and Quantification of Boeravinone-B in dry fruit extract of Boerhaavia diffusa Linn and in its Polyherbal Formulation. Journal of Natural Remedies, 2017, *17*, 88-95.
32. Bairwa, K., Srivastava, A., Jachak, S.M., Quantitative analysis of boeravinones in the roots of Boerhaavia Diffusa by UPLC/PDA. Phytochem Anal, 2014, *25*, 415-420.
33. Tacchini, M., Spagnoletti, A., Marieschi, M., Caligiani, A., Bruni, R., Efferth, T., et al. Phytochemical profile and bioactivity of traditional ayurvedic decoctions and hydro-alcoholic macerations of Boerhaavia diffusa L. and Curculigo orchioides Gaertn. Nat Prod Res, 2015, *29*, 2071-2079.
34. Ferreres, F., Sousa, C., Justin, M., Valentão, P., Andrade, P.B., Llorach, R., et al. Characterisation of the phenolic profile of Boerhaavia diffusa L. by HPLC-PAD-MS/MS as a tool for quality control. Phytochem Anal, 2005, *16*, 451-458.
35. Maurya, R., Sathiamoorthy, B., Deepak, M., Flavonoids and phenol glycosides from Boerhavia diffusa. Nat Prod Res, 2007, *21*, 126-134.
36. Pereira, D.M., Faria, J., Gaspar, L., Valentao, P., de Pinho, P.G., Andrade, P.B., Boerhaavia diffusa: metabolite profiling of a medicinal plant from Nyctaginaceae. Food Chem Toxicol, 2009, *47*, 2142-2149.
37. Pandey, S., Ethnomedicinal potential of Sarcostemma *acidum* in different regions in India. Asian J Pharm Res Dev, 2018, *11*, 395-400.
38. Pandey, S., Sharma, A., Panika, G., Kumar, M., (2019) Morphological studies, traditional and industrial uses of *Bixa Orellana*. A review. Current Sci Int, 2019, 08, 70-74.

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

ANALYSIS OF VOLTAGE CONTROL TECHNIQUES FOR DC MICROGRID

Rakesh P. Sukhadia[1] and Saurabh Pandya[2]
Ph. D. Scholar[1], KSV University, Gandhianagar
Professor[2] & Head in EED, LE College, Morbi

Abstract
This work present a performance study of a DC microgird which going interested in renewable sources application. DC microgrid has become a new trend with the advantages of new highly reliable, simple and low losses. In this paper several distributed generators have been merged together with a common grid and try to regulated grid voltage and to control the load sharing between different sources. The drawbacks of traditional droop control strategies, an improved DC droop control strategies based on remove circulating current between DG units. The proposed control strategies simulated PV sources, permanent magnet synchronous generator based wind turbines, and battery storage with bidirectional boost converter, which can applying small residential and commercial buildings. There are many control strategies applied to control the voltage of dc microgrid in the literature. This paper focus on the analysis of the proportional, proportional integral, proportional integral derivative controllers to regulate the microgrid dc voltage and also compare in terms of performances. The controllers are designed and simulated in the MATLAB programming environment.

Index terms: DC microgrid, DC bus voltage, conventional droop control, P, PI, and PID controller.

I. INTRODUCTION

Renewable energy has greatly increased the attraction these days as it can be recycled. Solar energy can be transformed, solar energy into electricity, more efficient than other renewable sources. However, compared to hydroelectric, wind and geothermal energy, solar energy is not widely used all over the world, due to the high initial cost of solar cells. Therefore, it is essential to recover as much energy as possible. In addition to the rapid decline of fossil fuel reserves in the world, another important factor working against fossil fuels is pollution linked to their combustion. On the contrary, it is known that renewable energy sources are much cleaner and produce energy without the harmful effects of pollution, unlike their conventional counterparts.

Solar energy, which is a combination of light and heat, is produced by the sun. This energy moves from the sun and reaches the Earth, where the human being collects it through the solar collectors and converts it into any form of desirable energy. By hypothesis, this renewable energy source is powerful enough to replace the need for electricity that we get from 650 barrels of oil per year.

Wind energy is also important for the society. Wind and solar are the main source of energy which are plentiful, inexhaustible and pollution free but it has the disadvantages that the degree and period of its availability are uncertain. Also in wind energy movement of large volumes of air required, to produce even a moderate amount of power. Another disadvantage of wind energy is that large tracks of land are needed to so that the appropriate number of turbines can be installed. One of the major reasons as to why the installation of turbines is considered to be a waste of time is because the electrical energy that is usually produced is too little to warrant the wastage of huge tracks of land. The PV source, fuel cell, wind energy source, battery etc. connected with common grid with dc load.

The design of dc microgrid is basic requirement of dc loads and micro sources could be easily integrated on the network [1]. Compare with ACMG that DCMG has no skin effect and no reactive power losses in dc cables. Also the benefit of not require voltage synchronization and effect of phase imbalance. But there are one main disadvantage of voltage control and overload protection at point of common coupling at dc microgrid [5] and [6]. That generic topology of dc microgrid shown in the figure one side PV, Battery and one of the DC generator connected with the dc microgrid and other side dc loads are connected. Now when the load is given to the unit that voltage level of the three sources should be fixed. Author investigated either voltage control or energy management system in [1] microgrid controls based on PQ, frequency and voltage levels It means that a microgrid can operate in a stable manner during nominal operating conditions and during transient load operation or transition between grind connected to islanded mode. As well microgrid energy management system (EMS) is based on supervisory controller structures which optimize the utilization of power generation, charging and discharging of energy storage system and load consumption are discussed [1].

Literature in [2] on extracting maximum power from the photovoltaic module during the variation of solar irradiation from 1200W/m2 to 400 W/m2 at the same time providing a regulated output voltage to DC microgrid bus at set level 800 volts (±25). In proposed PV system the Incremental Conductance method is more

ISSN 2394 - 7780

efficient compare to all other methods because panel terminal voltage is changed according to its value relative to the MPP voltage. The Incremental conductance method offers good performance under rapidly changing atmospheric conditions. On the other hand, the DC / DC boost converter has low switching losses and greater efficiency than others [2].

In [3] it is proposed to improve the maximum power point (MPP) tracking (MPPT) with better performance based on voltage-oriented control (VOC) to solve a rapidly changing irradiation problem. In VOC, a cascade control structure is used with an external intermediate circuit voltage control loop and an internal current control loop. The currents are controlled in a synchronous orthogonal dq frame using an decoupled feedback control. The reference current of the proportional-integral axis controller (PI) is taken from the voltage regulator on the DC side by applying the energy balance control. Furthermore, to obtain a power factor of the unit, the reference of the axis q is set to zero. The MPPT controller is applied to the external photovoltaic loop (PV) control reference. Without measuring the power of the PV generator, the proposed MPPT identifies the correct direction of MPP processing of the current axis d reflects the side of the grid and the error signal from the PI external circuit designed to represent only the change in power due to the conditions of atmospheric change localization capacity under rapidly increasing and decreasing irradiation is experimentally verified with a photovoltaic matrix emulator. Simulations and experimental results show that the proposed method provides effective, rapid and perfect follow-up [3].

The specifically bidirectional DC-DC converter power for a distributed energy application is presented in [4] that two banks of different voltage distributed DC batteries must interface with each other using a bidirectional DC-DC converter to minimize the load currents unbalance at the output of the three inverters connected to the network system. Through this connection, a current can flow from one system to another or vice versa, depending on the systems that need it most. Therefore, the unbalanced current of the network line has been reduced to a minimum and the reliability and performance of the system connected to the DER network have increased. A detailed mathematical analysis of the converter in stationary and transient conditions is presented. Mathematical models are derived for boost and buck modes and the Simulink model is built to simulate the system. Furthermore, the model has been validated in the actual operation of the converter, which shows that the results simulated in MATLAB Simulink are consistent with the experimental ones [4].

In this [5], the state of the art of MG hardware and application topologies was studied, along with the practical concerns related to its large-scale implementation. Various types of prominent hardware topologies before proceeding to assess their suitability for practical applications such as DC houses, EV charging stations, RES ESS hybrid and parks are represented. As for hardware topologies, the common industrial approach based on the direct connection of the battery to the common DC bus can be replaced by more flexible structures that include the regulated bus [5].

The market acceptance of the DER technologies and the gradual and constant increase in their penetration depth have generated a significant interest in the integration, controls and optimal functioning of the DER units in the context of micro-networks. Initially, the micro-network was perceived as miniaturized versions of conventional energy systems, and intuitively control / operating concepts were based on simplified and reduced versions of control or operational concepts of large power systems. They highlighted the main differences between microgrid systems and high power systems and, on this basis, calls for a new approach to the development of control and command concepts for the micro-network. [6].

In this literature [7] that improved reliability and flexibility of DC Microgrid system, droop control is found to be effective as it does not require communication network. However, it results in DC link voltage stability problem. A combination of decentralized average current sharing loop based on low bandwidth communication and droop control can mitigate the voltage stability issue.

Author investigated in [8] that high efficient high gain dc-de converter shows better performance as compared to conventional converters. The converter keeps 90.57% efficiency with voltage gain of 11.77. Reduced switching losses are the main features of this converter. The obtained value of switching voltage is 35.6V. As a result, efficiency of converter gets improved. Incremental conductance algorithm is added in this converter for improving tracking accuracy. MPPT algorithm is programmed by using A VR at mega 32 microcontroller. The energy flow through the converter is verified by using hardware set up.

In [9] the results of the simulation of a DC micro-grid with fall voltage regulation were presented. Some aspects of the design of voltage regulators have been presented. Two types of compensators have been studied, with voltage drop. The P controller showed a faster response, while the PI showed better power regulation and a steady-state zero error. Both controllers, P and PI, showed a good shared load characteristic. The voltage drop

ISSN 2394 - 7780

method proved to be a good strategy for sharing currents between different converters without the need for a central controller.

In [10] the five parameters identified for the mono crystalline photovoltaic module technology allowed the data to trace the MPP and a comparison of the simulation results with the experimental observation evaluated the favorable capacity of the INC method to trace the MPP under acceptable irradiation Temperature changes

In this article [11] we analyzed the MPPT implementation in the pressure increase converter using the incremental conductivity method. The performance was compared with the P&O algorithm. The photovoltaic system, MPPT and the Buck-Boost converter were simulated in MATLAB Simulink. The result of the simulation showed that the IC method had better performance than the P&O method. The IC method also successfully suppressed the oscillation around the MPP point, but the disadvantage is that it had a slower tracking time. The follow-up time can be improved by adjusting the increase / decrease phase of the work cycle. The increment / decrement phase can also be modified adaptively to obtain a better response time.

REQUIREMENT OF VOLTAGE CONTROL DC MICROGRID

The main problem of DC Microgrid is that when the converters are connected in parallel, the converter output voltage will not always be constant. The main reason for this change is due to the change in load and input power and also to the voltage and feedback current. Even a small misalignment of the output voltage will start the circulating current and the difference in the shared current will cause an overload in the converters and also a change in the shared power. The converter with higher output voltage will give more power. There are several control problems related to the DC microgrid, which includes the voltage control between parallel converters, load sharing, interconnection schemes between DER and the common DC network, maximum power point detection and energy storage. These control problems can be solved using different control techniques. Can be classified into three. a) Load distribution and voltage control, b) Storage-based control and d) Optimization and economic dispatching.

The main problem associated with voltage control is the lack of shared load between the converters connected in parallel and the circulation current that arises due to this problem. The problem of circulation current occurs when there is a discrepancy between the output voltages of the converters.

There are two basic techniques for controlling the micro-network. One of the most popular control techniques to share correctly is the tilt control method. This document focuses mainly on voltage control and power sharing of the converters through the speed of fall and also the detection of the maximum power point for better performance.

Master & Slave Control Method

It is classified as centralized controller, master-slave controller, and circular chain controller.

In Master-slave controller: In this case one of the converters acts as master, to regulate DCMG voltage. It operates in voltage source converter mode, whereas other converter acts as current source converter. The role of master converter may be dedicated, rotary, and high-crest current. Mod-M and Mod-S are master and slave converter respectively.

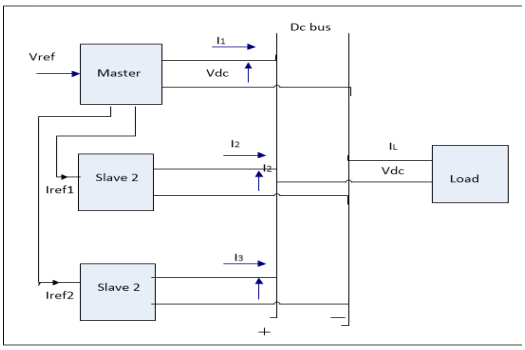


Fig. – 1: Master slave Control method

Droop Control Method

The droop control method is a decentralized control technique in which each converter is controlled based on the output current. This document explains the importance of cable resistance in the shared load. In existing methods, the fall used for voltage control is fixed, which a serious inconvenience is. An instantaneous fall is calculated to overcome this drawback which can improve the voltage control to a greater extent.

ISSN 2394 - 7780

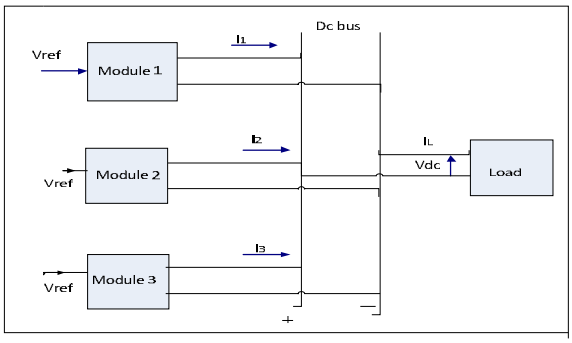


Fig.- 2: Droop Control method

The droop control method is a local control technique based on the external or internal aggregate resistance of the modules connected in parallel to maintain a relatively equal current distribution. It is shown in fig. 2, the droop method is easy to implement and requires no communication system.

However, the fixed droop method also achieves the equivalent current exchange precision, but the main drawback is its poor voltage regulation, while in the case of the instantaneous droop produced, it can adaptively control the reference voltage of each module. This will improve the tension regulation and the current exchange of the traditional method. Figure 2 shows the block diagram of the voltage drop control scheme. Each fall controller emulates an impedance behavior that reduces the output voltage of the converter with the increase in current supplied. This strategy promotes the current sharing between parallel converters connected in the DC micro-network without the need for central control [9].

The droop check does not require any communication between the converters. Instead, the DC bus voltage is measured at the source converter terminals. All origin converters help to balance the total power absorbed by the loads and losses of the DC power supply system. In the common voltage drop control, the DC bus voltage decreases linearly as the converter's output power increases, to ensure stable operation. This, of course, produces a stationary error in the DC bus voltage. In the common voltage drop control, the bus voltage decreases linearly as the output current increases or, in some cases, the converter power, to provide stable operation.

The structure of the controller for DC bus voltage control, a proportional controller (P) is used for the release scheme, similar to the derived PI controller for controlling the intermediate circuit voltage of the back-to-back converter. This control structure is implemented in all converters, intended for the flow of energy in the DC bus. The reason for this is to be able to distribute the total load between the sources when using fall control. A low-pass filter is used to cut harmonic frequencies and fast oscillations of the DC bus voltage.

$$Pref = G(s)\left[Vref - \left(\frac{W_{LP}}{S + W_{LP}}\right)Vdc\right]vdc \quad (1)$$

$$Iref = \frac{P_{ref}}{V_s} \quad (2)$$

The voltage droop scheme can be viewed as a negative slope in the converter characteristics in the P-V plane. In this work three types of controllers, proportional (P), proportional-integral (PI) and proportional-integral-derivatives will have their investigated to control paralleled converters connected to dc microgird.

COMPARISON OF VOLTAGE CONTROL DC MICROGRID

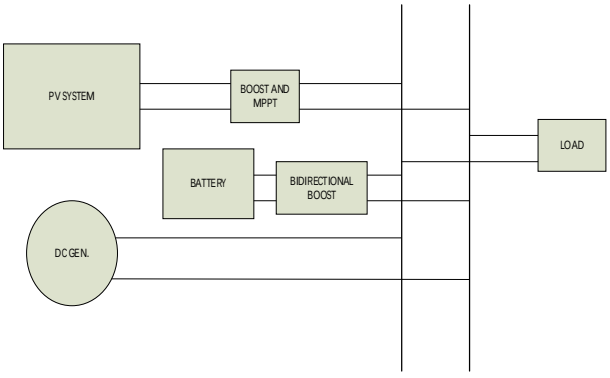


Fig. – 3: DC microgrid with dc sources

ISSN 2394 - 7780

1. Proportional Controller

The proportional controller used droop on the operation characteristics of the converter in similar way as it happens when a dc source has a series resistance $R_{d,n}$. Thus the gain K_p of the transfer function. Where n is no. of sources. Disadvantages it has steady state error.

$$G(s) = K_p = \frac{1}{R_{d,n}} \quad (3)$$

$$P_{rated} = \frac{\delta_n (1 - \delta_n) Vref^2}{R_{dn}} (4)$$

$$\delta_n = \left(1 - \frac{V_{dc}}{V_{ref}}\right) (5)$$

δ_n= nominal droop, define P_{rated}n, V_{ref}n and δ_n for each source. Total capacitance at the source converters side of the dc bus can be calculated by,

$$C_{dc\,conv} = \left(\frac{4}{R_d \times W_{LF}}\right) (6)$$

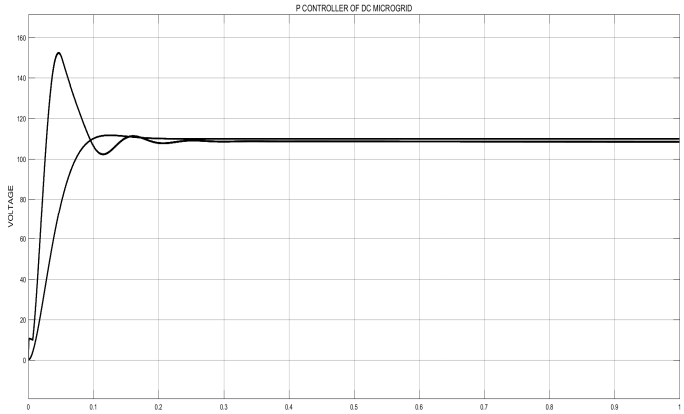


Fig. – 4: P Controller for DC Microgrid

2. Proportional Integral Controller

A PI controller given by [9] used to cancel steady state error.

$$G(s) = K_p = [1 + \frac{1}{sT_i}] \quad (7)$$

Introduce Ti is the integral time constant of the controller. The gain of the PI can be determined applying the methodology used in the P-controller. The PI time constant by $T_I = \frac{4}{W_{LF}}$ (8)

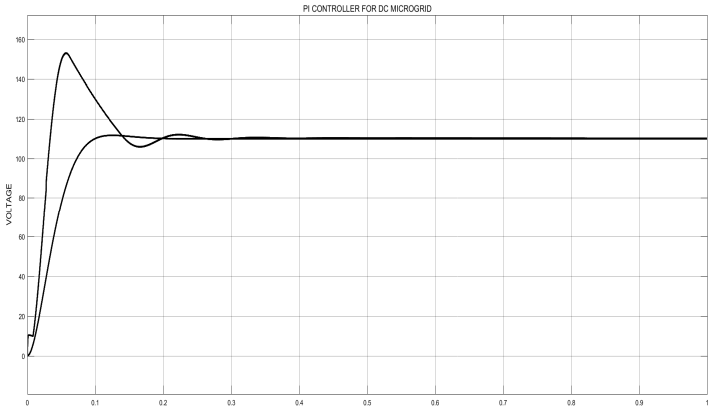


Fig.- 5: PI Controller for DC Microgrid

3. Proportional Integral Derivative controller

A PID controller is given by [13] used to cancel short circuit current between parallel converters. The performance of proportional integral derivative controller (PID) can be analyzed by three factors. The proportional gain K_p, integral gain K_i and derivative gain K_d.

ISSN 2394 - 7780

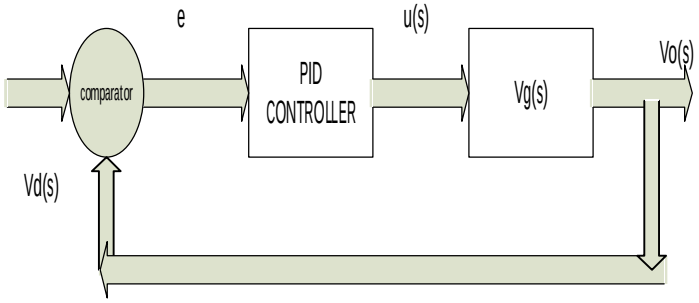


Fig. – 6: PID Controller

The output of the PID controller can be expressed as

$$u(S) = K_p\ e(S) + K_i\ \frac{1}{S}\ e(S) + K_d\ S\ e(S) \quad \_(9)$$

And transfer function given as

$$G(S) = \frac{u(S)}{e(S)} = K_p + K_i \frac{1}{s} + K_d\ S \quad \_\_ (10)$$

K_p will reduce the rise time, but it will never eliminate or cancel the steady state error. The K_i will eliminate or cancel the steady state error but it make transient response. Now introduce K_d. It will have the effect of increasing stability and reducing the overshoot and improving the transient response.

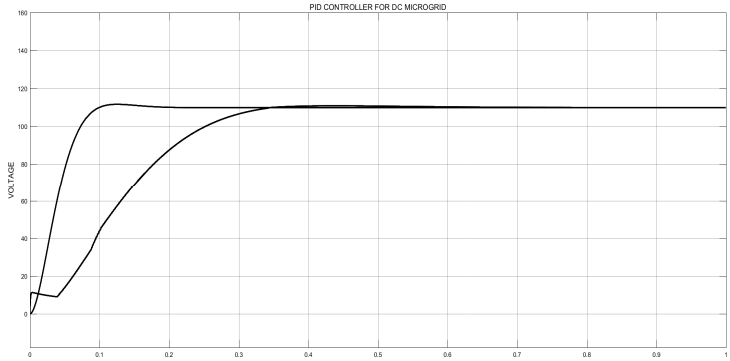


Fig. – 7: PID Controller for DC Microgrid

In this case that P, PI and PID controller is applied for the dc microgrid which has three sources are connected. One is the PV system, second bidirectional battery and the third one is the dc-dc generator which gives the constant output 110V dc.

Typical steps for designing PID controller

1. Determine characteristics of the system
2. Use K_p to decrease the rise time.
3. Use K_d to reduce the overshoot and settling time.
4. K_i to eliminate steady state error.

P, PI and PID Parameters from the Ziegler-Nichols Tuning rule Table:

These parameters will give the response with an overshoot about 25% and good settling time. The Ziegler-Nichols tuning rule is suitable when initial estimate of parameters are known. The proportional and integral gain control is determined by using the formulae as shown in table no.1.

Table – 1: Ziegler-Nichols Tuning rule

Controller	K_p	K_i	K_d
P	$\frac{T}{L}$	0	0

ISSN 2394 - 7780

PI	$0.9 \times \frac{T}{L}$	$0.27 \times \frac{T}{L^2}$	0
PID	$1.2 \times \frac{T}{L}$	$0.6 \times \frac{T}{L^2}$	$0.6\ T$

Where *T* is time constant and L is the delay time constant. As per given curve the value given in table no.2

Table – 2: Data Obtained by the calculation

Controller	K_p	K_i	K_d
P	4	0	0
PI	3.6	72	0
PID	4.8	160	0.009

Table – 3 :PID controller rules

Response	Rise-time	Overshoot	Settling time	Steady state error
K_p	Decrease	Increase	No change	Decrease
K_i	Decrease	Increase	Increase	Eliminate
K_d	Decrease	Increase	Increase	No change

CONCLUSION

This work presented simulation results of a dc microgrid with droop voltage regulation. Three types of voltage controllers were presented. The P-Controller exhibited a faster response while the PI controller gives better voltage regulation and finally, the PID controller has better voltage control of the dc microgrid. The fluctuation in the dc microgrid voltage with the fluctuation in the microgrid power due to variation demand and PV generation PID controller control with lower overshoot and small settling time.

REFERENCES

[1] Ali, Amjad, et al. "A Review: DC Microgrid Control and Energy Management System." *energy sources (RES)* 7 (2015): 10.

[2] Ali, Y. Gu, C. Xu, W. Li and X. He, "Comparing the performance of different control techniques for DC-DC boost converter with variable solar PV generation in DC microgrid," *2014 9th IEEE Conference on Industrial Electronics and Applications*, Hangzhou, 2014, pp. 603-609.

[3] R. Kadri, J. P. Gaubert and G. Champenois, "An Improved Maximum Power Point Tracking for Photovoltaic Grid-Connected Inverter Based on Voltage-Oriented Control," in IEEE Transactions on Industrial Electronics, vol. 58, no. 1, pp. 66-75, Jan. 2011.

[4] "Design and Analysis of a 24 Vdc to 48 Vdc Bidirectional DC-DC Converter Specifically for a Distributed Energy Application" Ambrosio B. Cultura II, Ziyad M. Salameh, published by Energy and Power Engineering, Vol.4 No.5, 2012

[5] T. Dragičević, X. Lu, J. C. Vasquez and J. M. Guerrero, "DC Microgrids—Part II: A Review of Power Architectures, Applications, and Standardization Issues," in *IEEE Transactions on Power Electronics*, vol. 31, no. 5, pp. 3528-3549, May 2016.

[6] F. Katiraei, R. Iravani, N. Hatziargyriou and A. Dimeas, "Microgrids management," in *IEEE Power and Energy Magazine*, vol. 6, no. 3, pp. 54-65, May-June 2008. doi: 10.1109/MPE.2008.918702

[7] M. Lonkar and S. Ponnaluri, "An overview of DC microgrid operation and control," *IREC2015 The Sixth International Renewable Energy Congress*, Sousse, 2015, pp. 1-6. doi: 10.1109/IREC.2015.7110892

[8] Vineeth Kumar P. K. and Sreenivasan M. K., "Hardware implementation of high efficient and high voltage gain dc-dc converter for dc microgrid applications," *2015 IEEE International Conference on Electrical, Computer and Communication Technologies (ICECCT)*, Coimbatore, 2015, pp. 1-5.

[9] R. A. F. Ferreira, H. A. C. Braga, A. A. Ferreira and P. G. Barbosa, "Analysis of voltage droop control method for dc microgrids with Simulink: Modelling and simulation," *2012 10th IEEE/IAS International Conference on Industry Applications*, Fortaleza, 2012, pp. 1-6.

ISSN 2394 - 7780

[10] R.J. Pereira, R. Melício, V.M.F. Mendes, and A. Joyce, "PV System with Maximum Power Point Tracking: Modeling, Simulation and Experimental Results," Conference on Electronics, Telecommunications and Computers – CETC 2013.

[11] Ratna Ika Putria, Sapto Wibowob, and Muhamad Rifa, "Maximum power point tracking for photovoltaic using incremental conductance method," 2nd International Conference on Sustainable Energy Engineering and Application, ICSEEA 2014.

[12] Jeneena Babu, Bobin K Mathew "Decentralized Control Method for Load Sharing and Circulating Current Minimization in Stand-alone DC Microgrid" International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering (An ISO 3297: 2007 Certified Organization) Vol. 5, Issue 9, September 2016.

[13] Chauhan, R. K., Rajpurohit, B. S., Hebner, R. E., Singh, S. N., & Longatt, F. M. G. (2015, November). Design and analysis of PID and fuzzy-PID controller for voltage control of DC microgrid. In Innovative Smart Grid Technologies-Asia (ISGT ASIA), 2015 IEEE (pp. 1-6). IEEE.

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

AUTONOMOUS OUT-BAND DEVICE-TO-DEVICE COMMUNICATION USING BLOCKCHAIN

Aditya Gurbaxani[1], Ashish Sharma[2] and Sandeep Tayal[3]
Student[1] and Assistant Professor[2], Computer Science and Engineering Department, Maharaja Agrasen Institute of Technology, New Delhi
Assistant Professor[3], Maharaja Agrasen Institute of Technology

Abstract
To create an autonomous D2D communication on a peer-to-peer network we propose a distributed register containing each subscriber's identity and location information. By incorporating blockchain into the system, the device information can be updated in realtime. This enables a D2D multi-hop system with dynamic routing allowing reduction in infrastructure costs as devices can communicate even without the infrastructure. In remote areas this can also allow users within the area to communicate within their own network. Including the Base Station towers to the blockchain can allow the user devices to function as relay stations to extend coverage to dead zones. By increasing coverage area of Base Station can reduce the density of BS towers in the area. The small cell networks use mmWave transmission which can be easily obstructed by any object in the line of sight between BS and UE. This problem is solved by using the outband D2D to relay the signal via device having unobstructed line of sight with the BS.

Index Terms: Device-to-device communication, peer-to-peer network, blockchain, outband D2D

INTRODUCTION[1]

The telecom operators are facing challenges with the rapidly increasing number of user devices having data intensive applications. The fourth generation (4G) networks have now reached maturity and can no longer service the massive data requirements by the mobile users [4]. This calls for the development of the next generation networks,

i.e. the fifth generation (5G) networks.

The major part of the spectrum allocated for the 5G networks is the high frequency bands (24GHz and above), also known as the Millimeter Wave (mmWave) [3]. The mmWave provide many advantages such as resistance to noise, high bandwidth to fulfill the data needs of the mobile users and good quality of service (QoS) with low latency. However, the mmWave has a major drawback when it comes to range and energy consumption. With the increase in frequency more power is required at the transmitters. The high frequency mmWave has lower transmission range, creating the need to setup small cell networks. Also mmWave has low penetration capability, i.e. any object in the line of sight (LoS) such as walls, buildings and trees can obstruct the signal transmission.

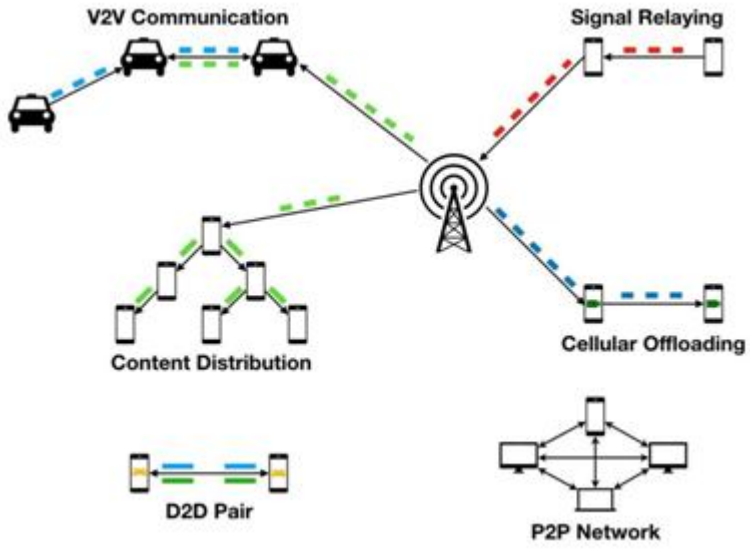


Fig. 1: Possible use-cases for D2D communication in cellular networks.

We propose a solution the this problem by using device-to-device (D2D) in the outband spectrum. The use of outband D2D shall allow the use of frequencies with better penetration and hence effectively extend the range of the backhaul network [5]. Also the use of an autonomous peer-to-peer network would allow mobile users the

ISSN 2394 - 7780

facility to have applications such as calling and messaging, which do not involve any third party, to be available without using any infrastructure.

LITERATURE REVIEW

In this section we will be discussing the existing literature regarding D2D communication in cellular networks. Based on the spectrum used for D2D communication we can categorize D2D communication as shown in Fig. 2 [1].

Inband D2D: Inband D2D implies that the same spectrum is used for both cellular network and D2D communication. The use of licensed spectrum allows better control over the spectrum. Incase of unlicensed spectrum, the interference cannot be controlled and can impose constraints on the QoS of the network [2]. The inband D2D can further be segregated as underlay and overlay. Inband D2D can allow more efficient utilization of the licensed spectrum by incorporating reuse of spectrum (i.e., underlay) or allocating dedicated resources for D2D communication (i.e., overlay). A major challenge for inband D2D is the interference between the signals from cellular communication and D2D communication [1]. To overcome this challenge, high complexity resource allocation methods need to be introduced which will inturn increase the overhead computation at the base station (BS) or D2D user equipment (UE).

Outband D2D: This technique aims to exploit the unlicensed spectrum for D2D communication. Use of unlicensed spectrum for D2D links removes the interference between the cellular links and D2D links, this is an important benefit of outband D2D. Additional interfaces such as Wifi Direct, Zigbee or bluetooth technology are applied to utilize to unlicensed spectrum [1]. Some of the work suggests that the cellular network should command the secondary interface while some work suggests to keep the control of the secondary interface to the users (i.e. autonomous).

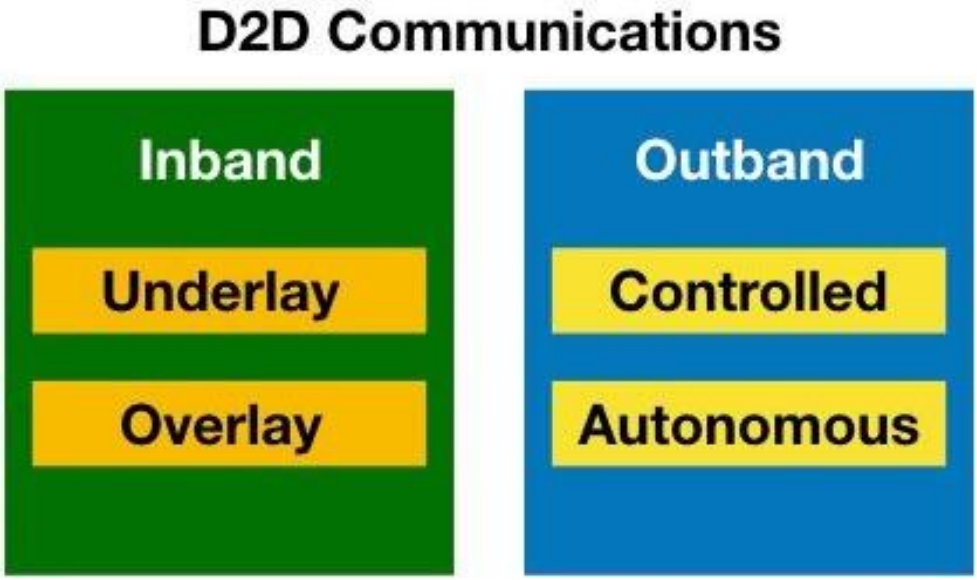


Fig. 2: Classification of device-to-device communications

EXISTING IMPLEMENTATION

A. Mobile Ad hoc Networks (MANET)

The mobile ad hoc network (MANET) is an unplanned network consisting of a collection of mobile nodes without any infrastructure [8]. The nodes are located in such a manner that the interconnections between them are liable to change dynamically and arbitrarily [6]. In order to facilitate communication in such a network, routing protocols to locate intermediate nodes to relay signals are used in the network. A D2D network is very similar to a MANET. Several problems associated with a MANET are likely to occur in a D2D network as well.

B. BitTorrent

BitTorrent is an application level protocol used for creating peer-to-peer (P2P) connections. BitTorrent is a hybrid network as a combination of peer-to-peer architecture and client-server architecture. It is used for P2P file sharing. The tracker servers help to peer nodes to connect to other peers, the actual file transfer takes place in the P2P network. Incase of a trackerless torrent session, BitTorrent uses *Distributed Hash Table (DHT)* to shore peer contact information [7]. The use of DHT essentially makes each peer a tracker. The use of blockchain in D2D networks is intended to provide a similar service, i.e. create autonomous P2P network.

ISSN 2394 - 7780

PROPOSED MODEL

A. Blockchain Components

Each node in the D2D network is expected to dynamically change its position and hence any multi-hop D2D connection will need the capability to adaptively reroute the signal to maintain connection. To provide this capability we propose the use of blockchain. The use of blockchain shall ensure that the attributes of each node are updated in the network for all devices and also ensure security against spoofing or man in middle attacks.

The various components of the blockchain have been shown in Fig. 3 [9]. The each component has its own specific function within the model.

Ledger: Each message can be considered as a single transaction and each phone call can be considered as two transactions, i.e. call start and call end. Similarly multiple transactions for the data services. The blockchain ledger will be used to record all user activity on the network. Call history, data usage, web browsing history, etc. shall be recorded for all users here. Each area will have its own ledger, hence a localized D2D network. In order to communicate with user in different D2D network signal shall have to be routed through nodes connected to neighbouring network.

Events: Actions performed by the users such as phone calls, browsing web pages, changing location, joining or leaving network etc. are the network events. Each event shall reflect as an entry in the ledger.

Wallet: Blockchain chain wallets contain user credentials. In the model this can be considered to perform the role of the subscriber identity module (SIM).

Peer Network: This is the collection of network nodes participating in the D2D communication. This includes all UEs, small cell backhaul and Macro Cells. By having BS participate, service providers can use the blockchain records to track subscriber usage and also use D2D to extend the backhaul network. This can also allow service providers to employ various power saving techniques in the small cell network.

Membership Services: This component will perform the task of user authentication, authorization and identity management. At the time of joining the network, this component shall play a crucial role to ensure security.

Smart Contracts: Protocols and algorithms for signal routing will be implemented using this component. This component shall contain the main driver program for updating and maintaining the ledger.

System Management: Provides capability to create system components, modify and monitor existing system components. This is to make the model long-living since the communication technology is constantly evolving.

System Integration: To provide integration of the blockchain with the backhaul network and other external systems.

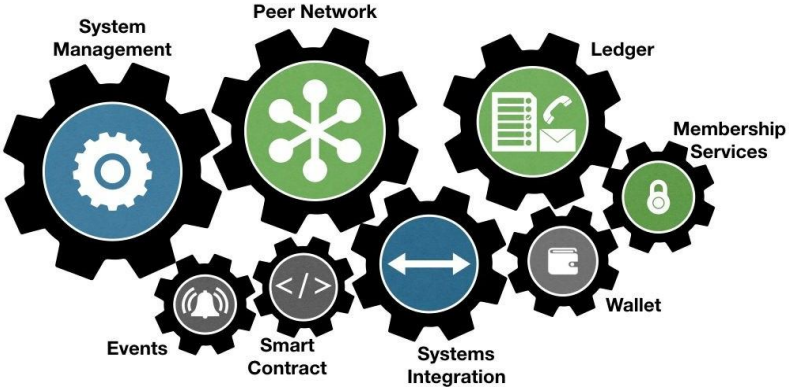


Fig. 3: Blockchain components

B. Distributed Device Register

The home location register (HLR) and visitor location register (VLR) are used in GSM networks to record the subscribers connected to the network. We propose the use of a distributed device register for the same purpose. Every cluster of devices can work autonomously using this register in way similar to a trackerless torrent. Each node will have a copy of the register allowing it to consider an optimal path to route the signal.

The proposed structure of this register has been represented in Fig. 4. The combination of phone number and the network key taken as input for hash function will give the *hash key*. The network key is generated by *smart contract* and stored in the ledger. When a new device requests to join the network, after successful authentication the network key is shared to the device. The *hash key* shall serve as the subscriber's ID within a

ISSN 2394 - 7780

D2D network. The list of *network ID* shall indicate which all the networks a device is participating in D2D communication. This shall allow inter-network D2D communication. The *location* attribute shall give the user's physical location allowing more efficient and shorter routing. The list of *connected devices* will contain the *hash key* of all devices within the network that can be reached by a device using single hop. Since this information will available to all devices in the network and updated dynamically, by using optimized heuristic algorithm signals can be routed using multi-hop D2D.

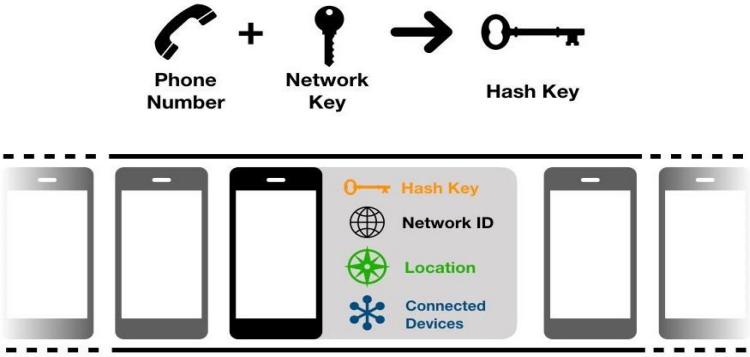


Fig. 4: Distributed device register

C. Implementation

We propose to implement the model using hyperledger blockchain and NS-3. To ensure D2D communication does not have drawbacks similar to MANET, certain device parameters have been introduced. Using triggered updates these parameters are updated by each device. The *BS hop count* is calculated independently by each device using a memonized breadth first search (BFS) to locate the nearest BS. The nodes having the *BS hop count* parameter as one can be considered as aggregation nodes. Taking the *BS hop count* parameter into consideration, each device will compute its *max D2D hop count* parameter. This is essential to ensure that signal does not get routed through long chain of D2D hops when it can be relayed using BS in few hops. Also this is essential to control the size and coverage area of a D2D network. A large size D2D network will require high computation overhead. For better efficiency several small D2D networks are desired.

CONCLUSION

The implementation in itself requires significant computational overhead. Specialized D2D modules would be required to implement the proposed model in a real world scenario. With the rise in IoT, number of devices using the data services has been predicted to rise steeply. Small cell networks will not be able to service all users efficiently enough. The proposed D2D model can remove various barriers and allow better coverage with less infrastructure.

An *autonomous* D2D network does not completely eliminate the need for infrastructure. It mostly extends the backhaul network. The use of mmWaves requires line of sight for signal transmission, D2D communication can remove this barrier by relaying signals through and around obstacles. For running applications requiring access to *backbone* network, service providers will have to setup the required infrastructure for backhaul network. In today's world most applications are running on the client-server architecture and hence devices will require access to backbone network. Also for long distance communication, network infrastructure will be required. Existing devices do not have sufficient processing power to support large scale blockchains autonomously.

FUTURE WORK

The proposed model can be used in combination with various energy saving techniques [4]. During low traffic certain BS in the small cell network can be turned off to conserve energy and the remaining BS can serve the users by using D2D to extend the backhaul.

Using of heuristic routing algorithm [3] to minimize energy consumption, maintain QoS and increase spectral efficiency by using Outband D2D communication. To route the signal within the network the algorithm shall consider all devices as nodes connected to each other using wireless links. Each link will be associated with attributes such as power consumption occurred on transmission, transmission capacity and max capacity. For each node the attributes shall be power consumed when active, active status, demand, current links and mobility information.

Several web applications are now shifting from a centralized to decentralized platform. These decentralized applications can be deployed on peer-to-peer networks including D2D networks.

ISSN 2394 - 7780

REFERENCES

[1] Asadi, Arash, Qing Wang, and Vincenzo Mancuso. "A survey on device-to-device communication in cellular networks." Communications Surveys & Tutorials, IEEE 16.4 (2014): 1801-1819.

[2] P. Gandotra and R. Jha, "Device-to-Device Communication in Cellular Networks: A Survey", *Journal of Network and Computer Applications*, vol. 71, pp. 99-117, 2016. Available: 10.1016/j.jnca.2016.06.004.

[3] M. Mowla, I. Ahmad, D. Habibi and V. Phung, "Energy Efficient Backhauling for 5G Small Cell Networks", *IEEE Transactions on Sustainable Computing*, pp. 1-1, 2018. Available: 10.1109/tsusc.2018.2838116.

[4] P. Gandotra, R. Jha and S. Jain, "Green Communication in Next Generation Cellular Networks: A Survey", *IEEE Access*, vol. 5, pp. 11727-11758, 2017. Available: 10.1109/access.2017.2711784.

[5] F. Shaikh and R. Wismuller, "Routing in Multi-Hop Cellular Device-to-Device (D2D) Networks: A Survey", *IEEE Communications Surveys & Tutorials*, vol. 20, no. 4, pp. 2622-2657, 2018. Available: 10.1109/comst.2018.2848108.

[6] R. I. Ansari , C. Chrysostomou, S. A. Hassan, M. Guizani, S. Mumtaz, J. Rodriguez, and Joel J. P. C. Rodrigues, "5G D2D Networks: Techniques, Challenges, and Future Prospects," *IEEE Systems Journal*, submitted for publication.

[7] R. Toole and V. Vokkarane, "BitTorrent Architecture and Protocol", 2006. Available: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.114.4974& rep=rep1&type=pdf. [Accessed 17 April 2006].

[8] S. Habib, S. Saleem and K. Muhammad Saqib, "Review on MANET routing protocols and challenges", *2013 IEEE Student Conference on Research and Developement*, 2015. Available: 10.1109/SCOReD.2013.7002647.

[9] "Blockchain Components: Systems Management, Systems Integration | Blockchain | Pinterest | Blockchain and Wallet", *Pinterest*, 2019. [Online]. Available: https://www.pinterest.com/pin/802344489840736561/. [Accessed: 27- Mar- 2019].

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

ESTIMATION OF GROUND EFFECT FACTOR BY USING FLIGHT DATA DRIVEN REGRESSION METHOD

A. Srivastava[1] and A. K. Ghosh[2]
[1]Transport Aircraft Research and Design Centre, Kanpur
[2]Indian Institute of Technology, Kanpur

ABSTRACT
This paper outlines the application of the data-driven methodology for practical non-linear aerospace applications. The aircraft flight in the presence of ground effect is one of the non-linear application of practical importance. The paper presents a novel effort towards estimation of ground effect factor through a data-driven method namely Gauss Process Regression (GPR) method. The GPR based model is employed to estimate the ground effect factor during the constant angle of attack ground effect manoeuvre at the time of take-off and landing. The comparison of ground effect factor estimates obtained from GPR based model with the estimates from McCormick's empirical relation and conventional method assesses the accuracy and consistency of the GPR method for the present application. The application of the GPR method based model to flight data of two types of aircraft helps in assessing the versatility of the methodology. The results obtained are reasonably accurate to establish GPR based method as an alternate method for the estimation of ground effect factor with an advantage of no requirement of the prior mathematical model.

Keywords: Data-driven method, Gauss Process Regression (GPR), Ground Effect factor, McCormick empirical relation, and Regression model

1.0 INTRODUCTION

The present section focuses on providing information about the ground effect phenomenon, importance, background, motivation behind the work and the significant contribution of this work.

The academic understanding of 'Aerodynamics' dictates that any aircraft flying in the air be encountered by upwash and downwash all along the leading edge and trailing edge of lifting surface respectively. Figure 1 [1] shows a schematic of the flow field around an aircraft.

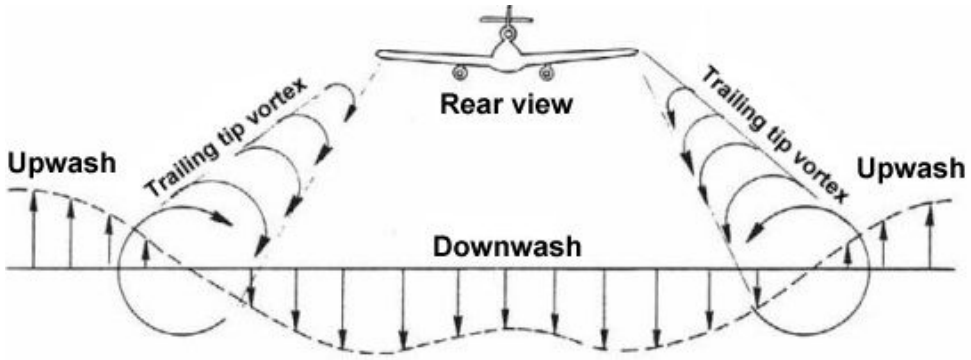


Figure-1: Flow Field around an aircraft

There had been numerous attempts in the past for the modelling of solid-fluid interface interaction like 'Ground Effect' by using analytical methods, wind tunnel method and even by using closed-form expressions [(2-13)]. Weiselberger [14] has developed the basic theory on ground effect through a model derived from Prandtl's lifting line theory. The substantial decrement in downwash, wingtip vortices and up-wash characterise the ground effect in its true principle. A noticeable trait of ground effect aerodynamics is an escalation in lift-to-drag (L/D) ratio [15]. During take-off, the ground effect may cause the aircraft to lose altitude abruptly and prone to stall, if the flight speed is less than the necessary one.

Moreover, if the pilot attempts to correct aircraft pitch through pilot controls, then aircraft may confront a situation of the nose up pitching moment. During landing when aircraft reaches close to the ground, especially below a distance of one wing chord, ground effect causes the aircraft to float, as the speed of the aircraft fails the to reduce with a higher gradient. Any surplus in speed will make this flaring effect stronger leading to augmented landing distances. The aircraft is even prone to pitch oscillations in the event of the using the excessive pilot control at the time of take-off and landing in the presence of the ground effect. The aerodynamic response of aircraft during ground effect obliges careful consideration, and any unexpected variation in flight

ISSN 2394 - 7780

behaviour seek due acknowledgement and prediction to thwart any hazard of catastrophe. The aircraft experiences ground effect at nearly one wing span but negligible~ 1 .4, which increases to ~ 9% at half wing span and becomes ~47% at one-tenth of wing span [16].

The ground effect is of critical concern for all high-performance aircraft, i.e. with very short take-off and landing capability and especially for Wing-In-Ground (WIG) aircraft. The ground effect has a direct impact on longitudinal aerodynamic characteristics and thus overall longitudinal controllability of aircraft. The height at which a WIG aircraft flies in order to optimise fuel efficiency and cruise speed is a direct outcome of ground effect characteristics. The high-performance aircraft and WIG have multifaceted flight vehicle system dynamics, which is often intricate for mathematical modelling and maybe even impossible to model mathematically.

The ground effect prediction has been a challenging problem for many reasons. The ground effect factor can be estimated by using a variety of methods viz. analytical method, i.e. a method derived from geometrical details of aircraft and simulation of the practical phenomenon through the classical aerodynamic equations. The analytical methods are based upon superposition of steady-state flow and engineering methods viz. panel codes [17,18]. The classical aerodynamic equations seek the solution through simplified assumptions which are likely to introduce approximations in the estimates of ground effect factor. The Computational Fluid Dynamics (CFD) is also extensively used in the study of aerodynamics in the presence of the ground effect. The governing equations which are solved range from potential equations to Euler equations and Navier-Stokes equation of various forms. The simulation through CFD lacks the simulation of practical flying conditions and the assumptions made for solution introduce error in the estimated result. The experimental method provides a more comprehensive approach towards understanding ground effect and estimation of ground effect factor [(19,20)]. Wind tunnel method provides a good approximation of practical phenomenon, but wind tunnel estimates inherit the inevitable error due to scale effect, model inaccuracies and difficulty in the simulation of dynamically similar flows. There is a mandatory requirement of a moving ground belt or other devices to remove impractical boundary layer [21.] There are some closed-form expression or empirical relations coined by various researchers in the past which are capable of estimating ground effect factor. The closed-form expressions for the estimation of ground effect factor does not encompass the effect of all parameters and assumptions made during the formulation may introduce a substantial error in the estimates of ground effect factor.

The flight test methods are of two types; the first one requires prior knowledge of the flight vehicle system and an exhaustive understanding of physics involved in the phenomenon, i.e. conventional method. The development of the exact mathematical model and its solution for complicated flight vehicles in ground effect is very intricate and involves extensive computational burden.

The second category of flight test method does not require any prior information about the system and yet is capable of predicting accurate estimates. The flight test method of the second category provides the benefit of simulating real flying conditions of ground effect phenomenon for any complicated flight vehicle with no prior requirement of the exact mathematical model and computational burden. The development of advanced computing capability for handling a large amount of data, high quality and precision sensors for measuring low noise flight data and non-requirement of complete knowledge of flight vehicle system are some of the features which make flight data-driven methods, a more convenient choice of method of solution. The only requisite for flight test method is the proper conduct of flight manoeuvre and appropriate recording of flight data. There are many flight data-driven methods, which belong to the second category.i.e.,Neural Networking, Gaussian Process Regression (GPR), Classification and Regression Tree (CART) method and many more.

Gaussian Process Regression (GPR) method is one of the flight data-driven method, which focusses on training a regression model with the appropriate quantum of recorded/derived flight data as input-output. The trained model uses the rest amount of flight data for the prediction of the output parameter. Gaussian Process method finds its application in many areas including aerospace applications. The GPR method addresses many aerospace applications like System identification and control system design problem of an autonomous blimp [22] and optimal path planning, wind estimation of a precision airdrop, i.e. time-critical cargo drops [23]. The GPR method also finds its application to the estimation of the aircraft centre of gravity location of a fixed wing [24] with fuel weight property data and even in the exploration of the wind field of a gliding aircraft [25] for generating energy gain path. In order to append the above mentioned prime aerospace applications, the present work for estimating ground effect factor employs the GPR method.

The present work is an attempt towards the prediction of ground effect factor for two common types of fixed-wing aircraft in ground effect. The intention is to demonstrate that data-driven methods can also be alternative

ISSN 2394 - 7780

methods for the prediction of ground effect characteristics with excellent accuracy and least computational effort. The results obtained post application of GPR method in ground effect (a non-linear phenomenon), indicate that the GPR method can be a viable alternative method for other non-linear aerospace applications also.

The original contributions of this paper are:

i) Development of a regression model based on Gaussian Process Regression (GPR) method for the estimation of ground effect factor during take-off and landing.

ii) Comparison of GPR predicted ground effect factor with estimates of ground effect factor from the conventional method and renowned McCormick's empirical relation. The comparison will establish GPR as a viable alternative method for ground effect factor estimation.

The following sections will provide information about the aircraft used for performing flight test manoeuvre, the manoeuvre which simulates the ground effect, the different methodology used for estimating ground effect factor followed by results and conclusions.

2.0. FLIGHT TESTING

This section will provide the information about, the aircraft used for simulating the ground effect, the manoeuvre performed for generating flight data, flight data (measured and derived) and their behaviour during the entire manoeuvre, and the handling of errors in the methodology followed.

2.1 Aircraft used

The two aircraft used for gathering flight data during ground effect simulation are:

The first aircraft is a twin turboprop, high wing monoplane with aspect ratio ~ 9.0 and it is a FAR 23 certified aircraft under medium All Up Weight (AUW) commuter category which performs various roles for different customers. The aircraft is known for its excellent Short Take Off and Landing (STOL) capability. This aircraft is referred to as 'Aircraft 1' in this paper. The second aircraft is a single engine, low wing monoplane with aspect ratio ~ 8.8 and primarily used for experimental work at Indian Institute of Technology (IIT), Kanpur. This aircraft is referred to as 'Aircraft 2' in this paper.

2.2 Ground effect manoeuvre

The flight manoeuvre for ground effect analysis in present work is the Constant –Alpha approach [26]. The Constant –Alpha approach involves aircraft flight at a nearly constant angle of attack and constant power setting during the approach to the runway. When flight vehicle experiences change in the flight path, sink rate, velocity and control surface position during landing then it is an indication of the onset of ground effect which ultimately leads to change in longitudinal aerodynamic coefficients, i.e. lift, drag and pitching moment characteristics of aircraft. During the entire manoeuvre, the aircraft maintains near a constant angle of attack and throttle settings for obviating the occurrence of an error in measurement. Any change in these parameters during the entire manoeuvre until the touch down will lead to the inappropriate prediction of ground effect and is one of the prime sources of error. Figure 2 [26] represents the force diagram of an aircraft under constant-alpha simulation of the ground effect

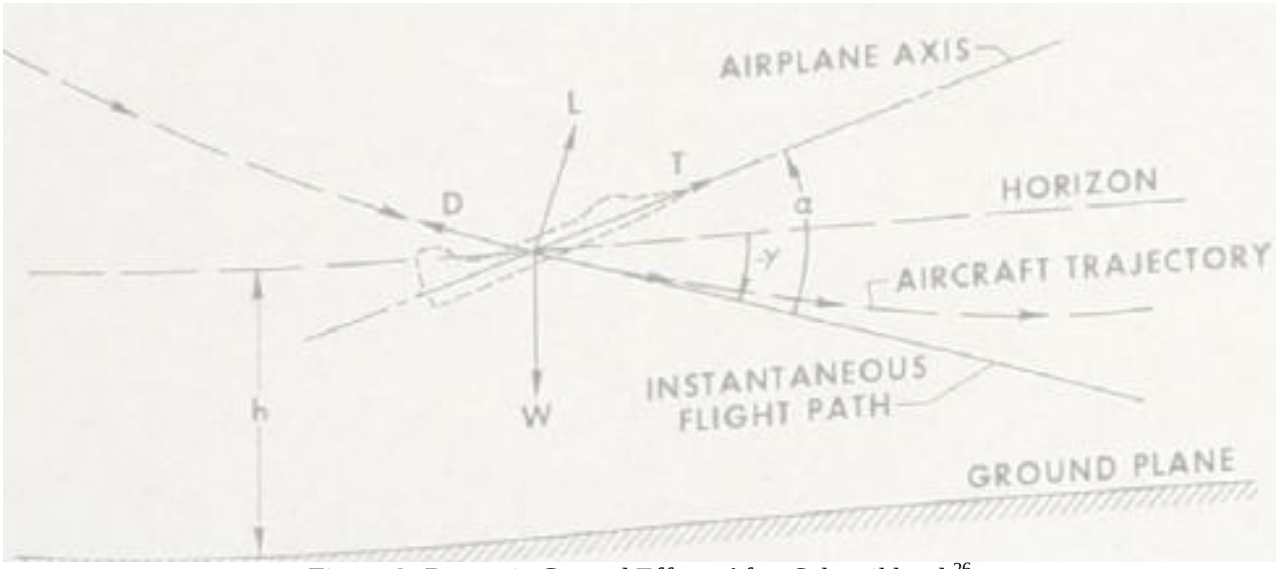


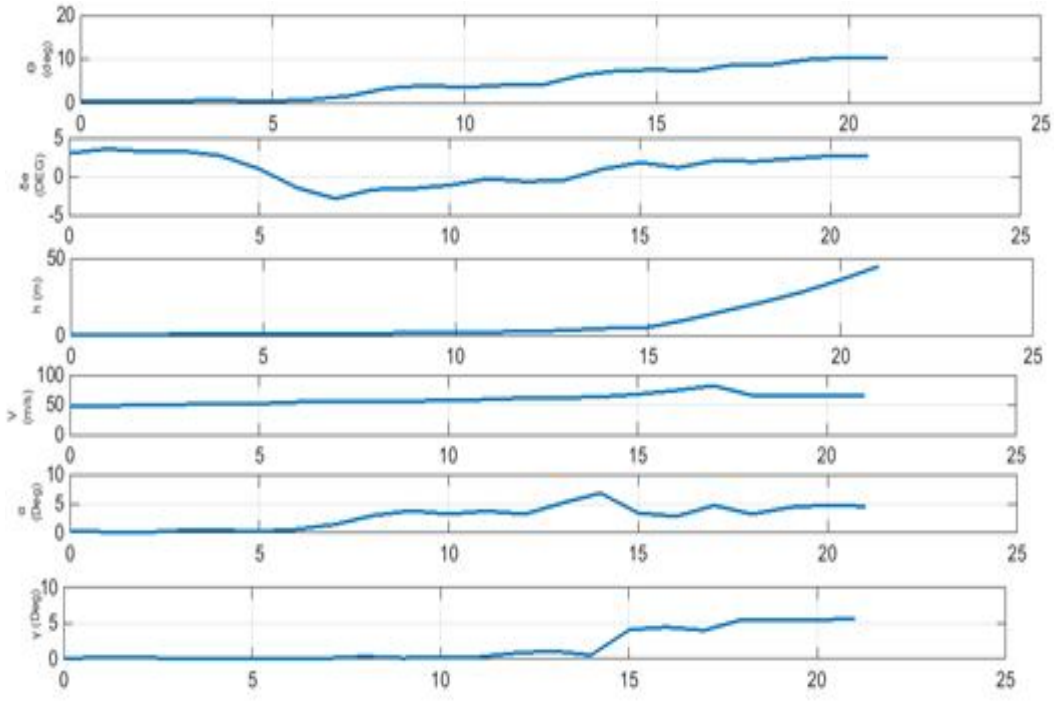
Figure-2: Dynamic Ground Effect, After Schweikhard [26]

ISSN 2394 - 7780

The entire constant-alpha manoeuvre comprises of two zones viz. the first zone is Outside Ground Effect (OGE) which is at the height of more than one wingspan above the ground whereas, the second zone is Inside Ground Effect (IGE) which is for all height below unit wingspan until touch down of aircraft. The initiation point of constant-alpha ground effect simulation is at a height above screening height,i.e. ~50 ft (Outside Ground Effect zone) and then the aircraft strictly adheres to the primary condition of maintaining constant alpha and throttle settings until the touch down of aircraft. However, due to the practical limitation of maintaining safe & acceptable limits of horizontal & vertical speeds, the available take-off and landing distances take the precedence. The range of AOA is maintained to ensure STOL characteristics of aircraft. The range of elevator deflection is also maintained to ensure that the elevator deflection available limit is strictly adhering to forward centre of gravity limit of aircraft. All the flight manoeuvres ensure that the aircraft weight and centre of gravity are as per the limitations of aircraft. The flight path simulates normal take-off and landing scenario during a routine flight. Moreover, the throttle settings and the rate at which aircraft is losing height in 'Out of Ground Effect' regime, is also established very carefully such that the aircraft is always in equilibrium glide and not in Phugoid type oscillations.

2.3 Measurements

The flight test data acquisition is through proper instrumentation and dedicated sensors for measuring control surface deflection, flow angles, aircraft speed, altitude and Outside Air Temperature (OAT). The parameters recorded are control surface deflections, attitude angles, airspeed, altitude, Outside Air Temperature (OAT), engine torque, engine rpm, linear acceleration along three axes, altitude. The angle of attack (AOA) derives its value from flight path angle and pitch attitude for 'Aircraft 1'. The angular accelerations & rates derive their values by numerical differentiation of attitude angle data. The thrust magnitudes during constant-alpha ground effect manoeuvre use engine parameters for its estimation after the flight. The onboard fuel quantity indicators determine the mass properties of aircraft. For 'Aircraft 2', the entire data acquisition includes the angle of attack also. The height above ground and TAS shows an increasing trend with the progress of time for take-off and vice versa for landing, the flight path angle has shown some scatter at all instants of outside ground effect, but at all instants within ground effect, flight path angle progressively increases during take-off and decrease during landing. The elevator deflection required during the entire take-off and landing flight phase maintains a trimmed flight. The AOA and flight path angle have shown a near uniform behaviour during the entire constant-alpha manoeuvre. The crosswinds will have an impact on data accuracy during ground effect so; there is a limit of cross winds less than 5 knots for better accuracy. Figure. 3-5 presents the time history plots of flight data for constant-alpha ground effect manoeuvre during take-off, and Fig 6-8 presents during landing respectively for 'Aircraft 1'. Figure 9 shows the time history plot of flight data for ground effect manoeuvre during landing for 'Aircraft 2'.



TIME (SEC)

Figure-3: Flight data for ground effect manoeuvre (Take-off)- FL# 01

ISSN 2394 - 7780

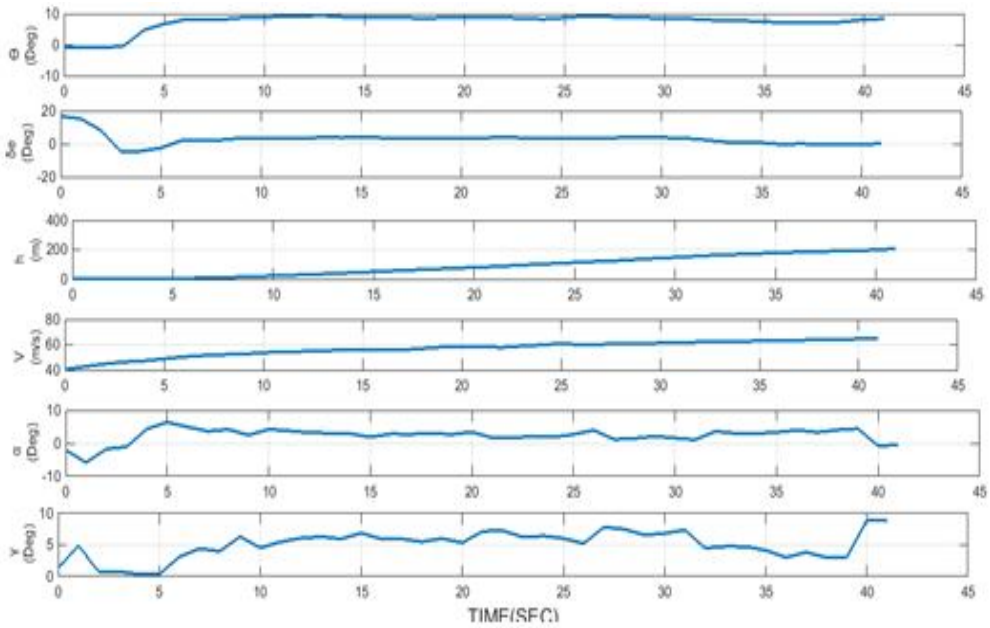
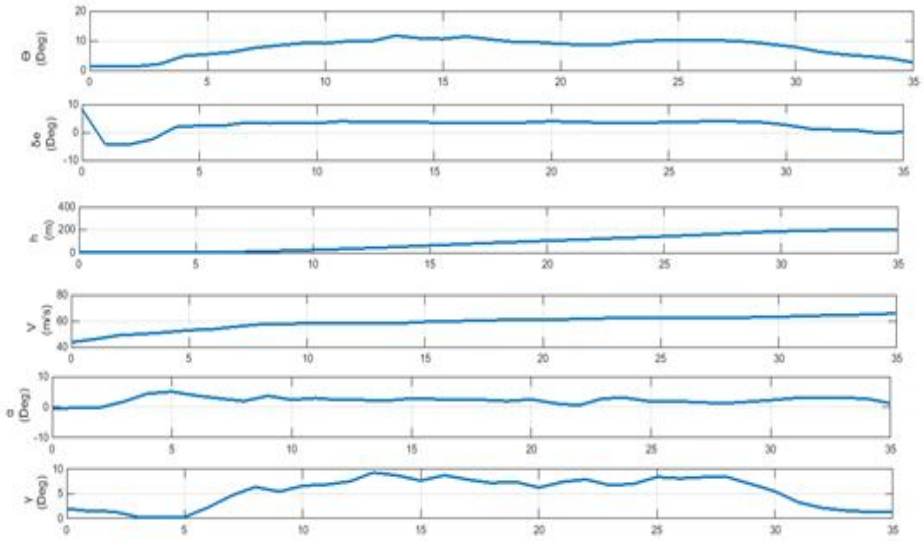


Figure-4: Flight data for ground effect manoeuvre (Take-off)- FL# 02



TIME (SEC)

Figure-5: Flight data for ground effect manoeuvre (Take-off)- FL# 03

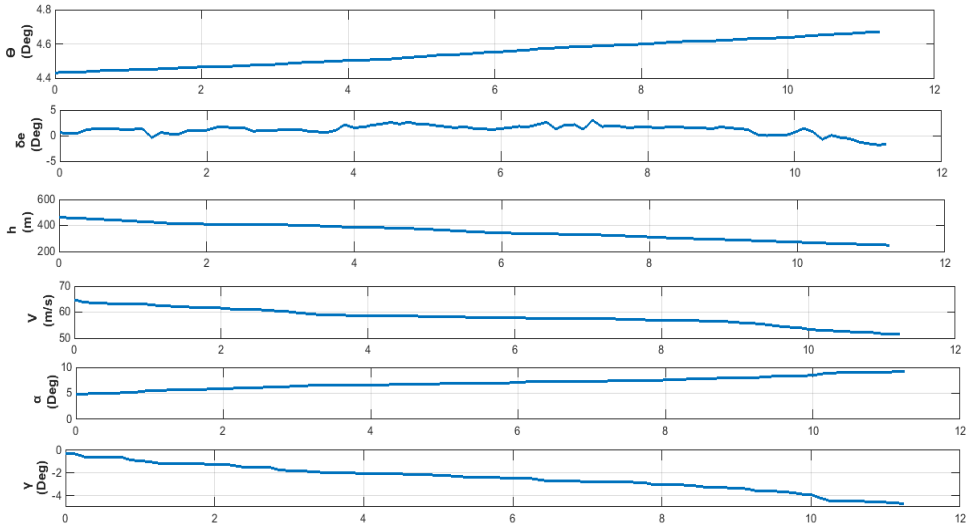


Figure-6: Flight data for ground effect manoeuvre (Landing)- FL# 01

ISSN 2394 - 7780

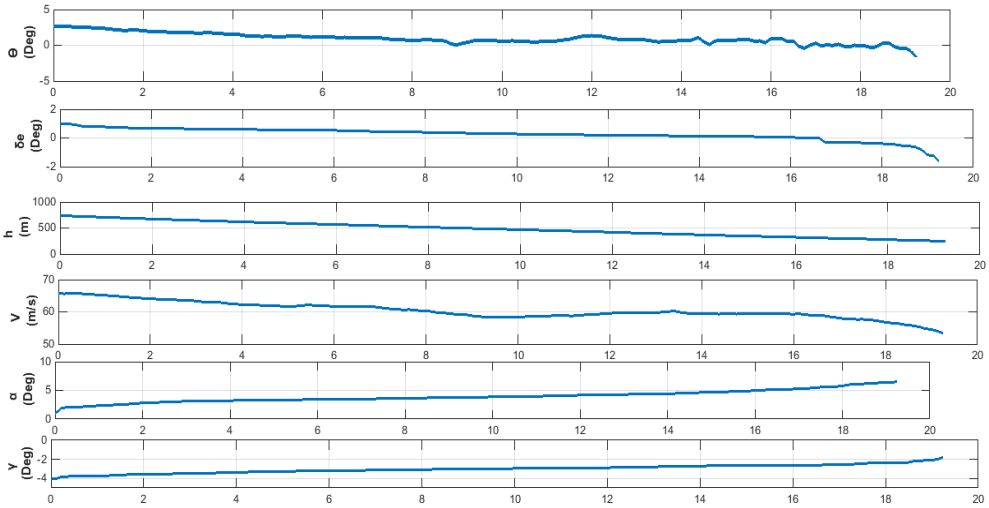


Figure-7: Flight data for ground effect manoeuvre (Landing)- FL# 02

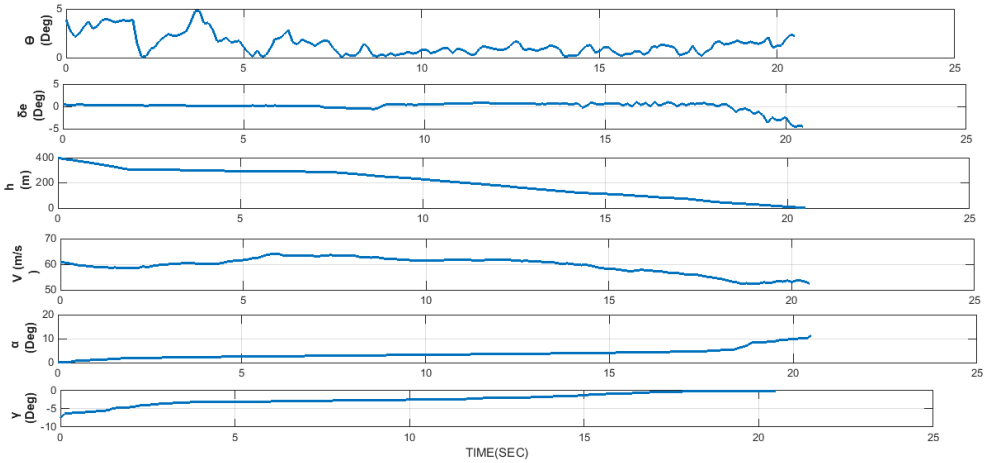


Figure-8: Flight data for ground effect manoeuvre (Landing)- FL# 03

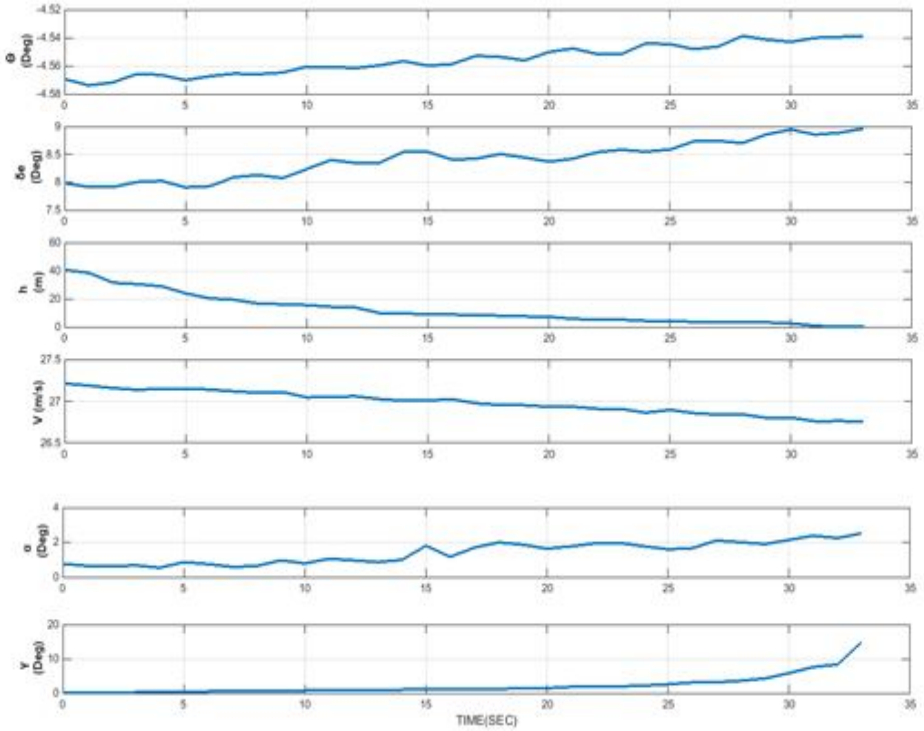


Figure-9: Flight data for ground effect manoeuvre (Landing)

ISSN 2394 - 7780

2.4. Experimental error

The solid-fluid interaction during ground effect is highly fluctuating due to transient flow-field around the aircraft and is expected to be the prime source of measurement noise. The most obvious way to avoid measurement noise is the utilisation of appropriate and calibrated sensors. The noise-related to the process of performing manoeuvres can be obviated by strictly adhering to the procedure for conducting manoeuvre. The statistical analysis of the results, obtained by using more than one flight data is instrumental in precluding the effect of the error. With this methodology, a large number of constant-alpha ground effect manoeuvre are carried out, and despite best piloting efforts, only a total of three flights each for take-off and landing with the low noise level were successful. The statistical analysis of results obtained by using different flight data is expected to cater to errors in experimental flights and deliver reliable information about the ground effect factor.

3.0 METHOD OF ANALYSIS

The section will provide information about the various methods and models for estimating ground effect factor in present work.

3.1 Conventional method

The first method for the estimation of ground effect factor during take-off and landing in present work is 'conventional method. The conventional method requires a prior postulation of a mathematical model using principles of flight physics during a particular flight condition. The mathematical model based on the conventional method is referred to as 'Physics model'. The 'Physics model' for simulating ground effect during take-off employs an equation of motion for climb flight. The 'Physics model' for simulating ground effect during landing utilises equation of motion for approach and descend flight. The conventional method for estimation of ground effect factor comprises of two steps, the first step is to determine Outside Ground Effect (OGE) values of the angle of attack, elevator deflection, flight path angle, and thrust. The estimation of outside ground effect values of lift and drag coefficients use the following equations. Equation 1&3 [27] and equation 2 [28]:

$$C_L = C_{L0} + C_{L\alpha}\,\alpha + C_{L\delta e}\,\delta e \quad (1)$$

$$C_D = C_{D0} + K C_L^2 \quad (2)$$

$$C_m = C_{m0} + C_{m\alpha}\,\alpha + C_{m\delta e}\,\delta e \quad (3)$$

The value of C_L, C_D & C_m obtained from equation (1) – (3) are designated as CL_{OGE}, CD_{OGE}, CM_{OGE}. The second step is to estimate aerodynamic coefficients (C_L, C_D & C_m) in Inside Ground Effect (IGE) zone by using 'Physics model' and inertial properties of aircraft, thrust magnitudes, and body axis accelerations. The values of aerodynamic lift and drag in Inside Ground Effect (IGE) are referenced to Outside Ground Effect (OGE) values in order to signify the effect of the presence of ground on the values of aerodynamic lift and drag. Both 'Aircraft 1' and 'Aircraft 2' employ the same model for simulating ground effect during take-off and landing.

The 'Physics Model' for take-off is depicted in Fig 10 [28] and presented in equation (4) - (6) [29]. Equation 6 represents the longitudinal aerodynamic drag coefficient involving ground effect factor (φ) [21].

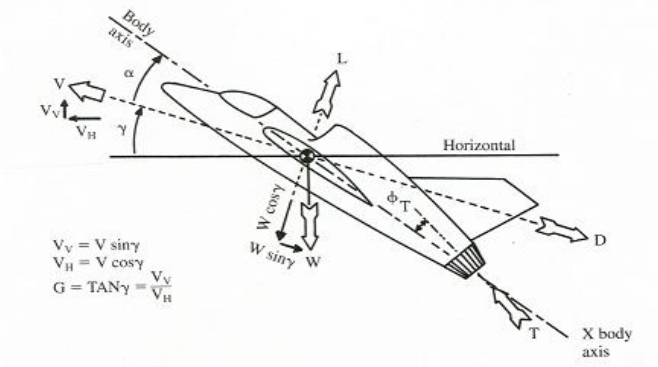


Figure-10: Simulation model for estimating ground effect factor during take-off

$$C_L = \frac{(W\cos\gamma + W a_z)}{S\,\bar{q}} \quad (4)$$

$$C_D = \frac{(W\sin\gamma - W a_x)}{S\,\bar{q}} \quad (5)$$

$$C_D = C_{D0} + K\phi C_L^2 \quad (6)$$

Where φ is known as ground effect factor.

ISSN 2394 - 7780

The longitudinal aerodynamic coefficients C_L & C_D and ground effect factor (ϕ) in the presence of ground effect are obtained using 'Physics model' based on equations 1-2, 4-5 & 6 for ground effect manoeuvre during take-off. These values are then referenced to Outside Ground Effect (OGE) values.

The 'Physics model' for simulating constant-alpha manoeuvre during landing is based on equations of motion during descent glide and are presented in equation (7) - (8) [30].

$$C_L = \frac{(W \cos\gamma + W\, a_Z)}{S\,\bar{q}} \quad (7)$$

$$C_D = \frac{(T + W \sin\gamma - W\, a_X)}{S\,\bar{q}} \quad (8)$$

The longitudinal aerodynamic coefficients C_L & C_D and ground effect factor (ϕ) in the presence of the ground effect are obtained using 'Physics model' based on equations 1-2, 7-8 & 6 for ground effect manoeuvre during landing. These values are then referenced with respect to Outside Ground Effect (OGE) values.

The aerodynamic lift during ground effect as predicted through equation (4) – (5) during take-off and equation (7) – (8) during landing for both types of aircraft exhibits progressive increment with the decrease in height above ground. The behaviour of aerodynamic lift is observed to follow power law formulation with the dimensionless height above ground, i.e. h/b for both take-off and landing. The plots of aerodynamic lift in the presence of the ground effect, i.e. $C_{L(IGE)}$ during take-off and landing for 'Aircraft 1'are presented at Fig.11 & 12. The practice of fitting a power law curve is understood to provide an effective process for deriving an outcome from statistics. The nature of variation of aerodynamic drag during the entire constant-alpha ground effect manoeuvre is of oscillating nature with dimensionless height above ground (h/b) and leads to no absolute conclusion. The plots of aerodynamic drag in the presence of the ground effect, i.e. $C_{D(IGE)}$ during take-off and landing for 'Aircraft 1'are presented at Fig.13 & 14. The oscillating nature can be attributed to the lesser magnitude of drag change due to ground effect as compared to the increase in lift coefficient. For 'Aircraft 2', the power law variation of aerodynamic lift and oscillating behaviour of aerodynamic drag are presented at Fig 15 & 16 respectively. The power law formulation of lift coefficient and oscillating behaviour of aerodynamic drag during ground effect is similar to the observations in earlier ground effect studies [33, 34,35] performed by different researchers with different methodologies. The matching behaviour of aerodynamic lift and drag obtained in this work to earlier ground effect studies has boosted the confidence towards the objective of predicting ground effect factor.

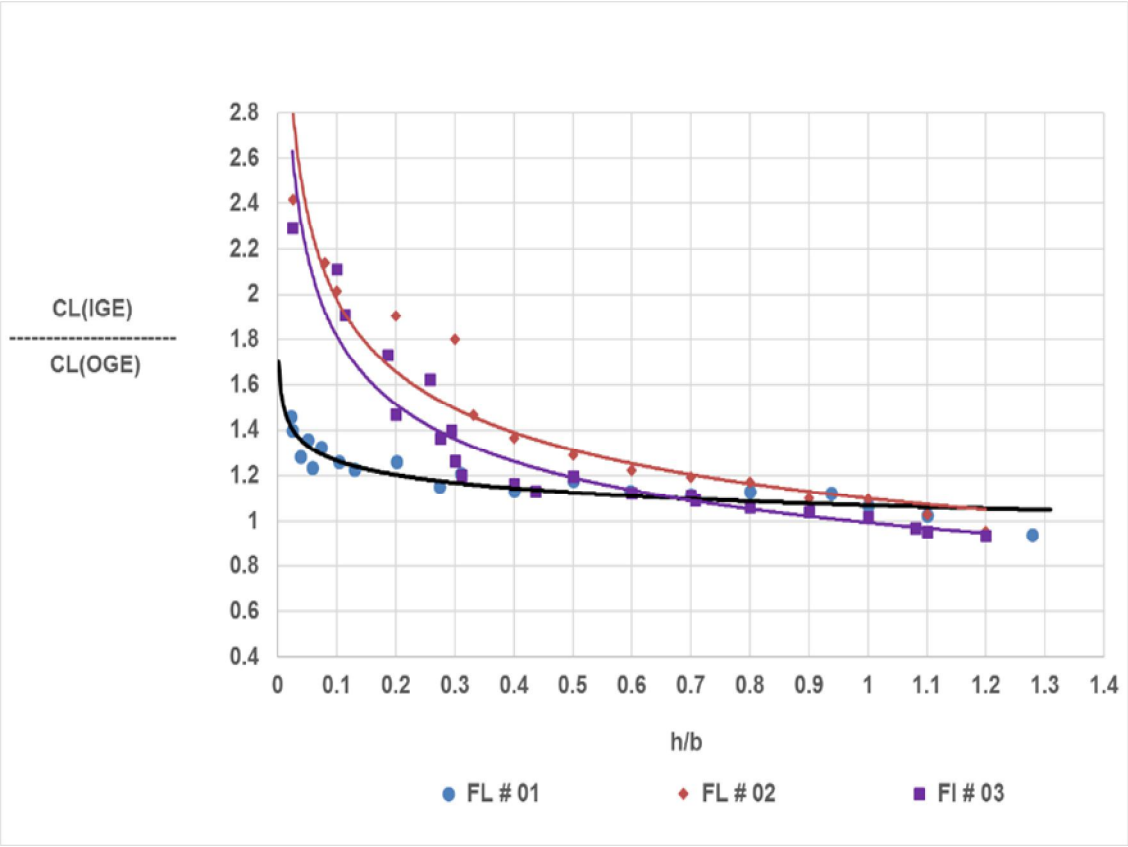


Figure-11: Power law variation of aerodynamic lift in the presence of ground effect (Take-Off)-Aircraft 1

ISSN 2394 - 7780

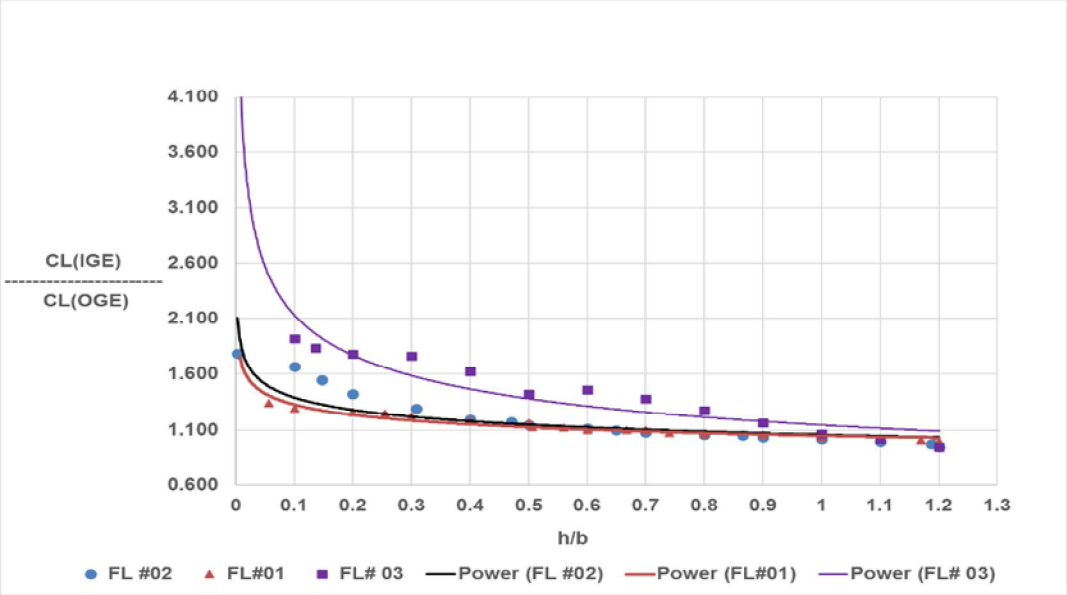


Figure-12: Power law variation of aerodynamic lift in the presence of ground effect (Landing)-Aircraft 1.

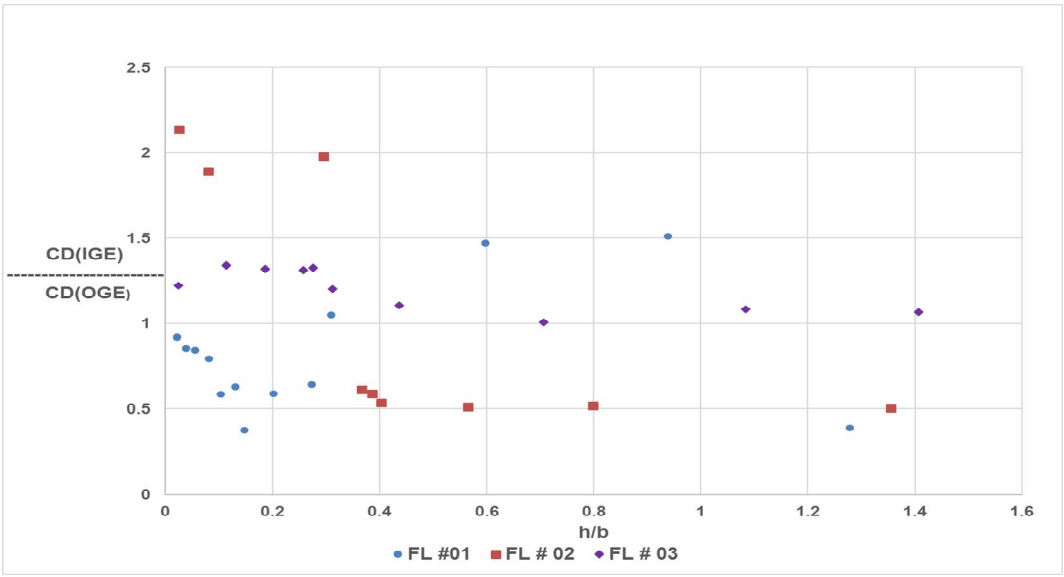


Figure-13: Variation of aerodynamic drag in the presence of ground effect (Take-Off)-Aircraft 1.

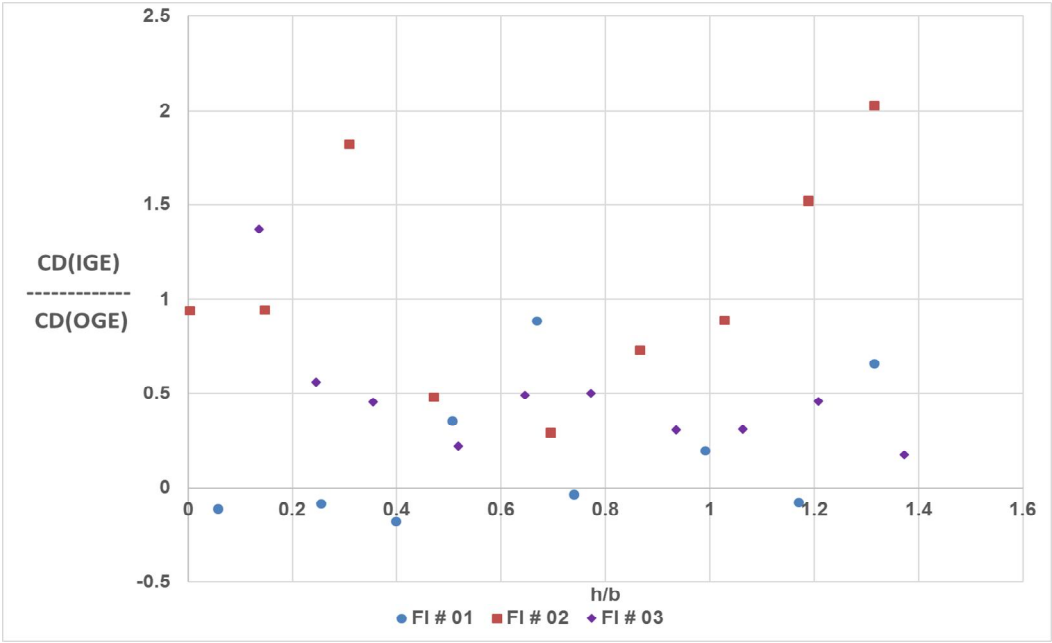


Figure-14: Variation of aerodynamic drag in the presence of ground effect (Landing)-Aircraft 1.

ISSN 2394 - 7780

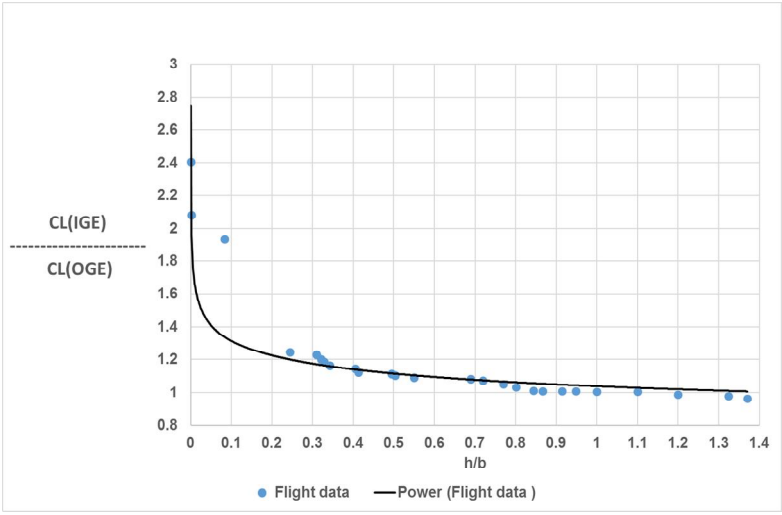


Figure-15: Variation of aerodynamic lift in the presence of ground effect (Landing)-Aircraft 2.

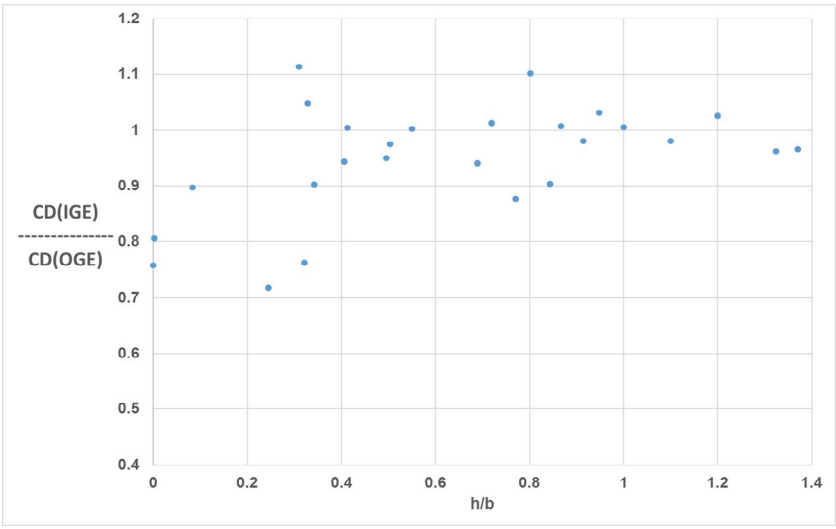


Figure-16: Variation of aerodynamic drag in the presence of ground effect (Landing)-Aircraft 2.

3.2 Empirical relation

There are some closed-form expressions available in aviation research which also enables the estimation of ground effect factor. Some of the closed-form expressions indicate that ground effect factor is a function of height above ground only whereas some of them indicate that it is a function of wingspan and aspect ratio also in addition to the height above ground. McCormick [31] has coined one of the most renowned empirical methods for ground effect factor estimation. This method indicates that the ground effect factor (ϕ) progressively decreases with a decrease in dimensionless height above ground.

$$\phi = \frac{\left(16\frac{h}{b}\right)^2}{1+\left(16\frac{h}{b}\right)^2} \qquad (9)$$

Where h/b = Dimensionless height above ground,

3.3 Gauss Process Regression (GPR) method

Gaussian process regression (GPR)[32] models are nonparametric kernel-based probabilistic models. The GPR model is probabilistic since it is possible to compute the prediction interval using the trained model itself and the presence of latent variable makes the GPR model a non-parametric one. The GPR model addresses the objective of predicting the value of a response variable (Y_n) by using new input vector X_n, and the training data. A linear regression model is of the form:

$$Y = X^T * \beta + \varepsilon \qquad (10)$$

Where, $\varepsilon \sim N(0, \sigma^2)$

The mean function and its covariance function define a Gaussian process in a true sense. The covariance function of the latent variables captures the smoothness of the response, and the basis function projects the inputs into a *p*- dimensional feature space. The error variance σ^2 and the coefficients β use the flight data for

ISSN 2394 - 7780

their estimation. A GPR model estimates the response by introducing latent variables from a Gaussian process (GP), and clearly defined basis functions. A Gaussian Procession (GP) is a set of random variables, such that any finite number of them have a joint Gaussian distribution. The major benefit of using a GPR model is that it is a databased approach explicitly tackling uncertainties caused by the quality and quantity of the data as well as sensor measurement noise.

The models based on Gauss Process Regression (GPR) method are known as 'Regression model'. In the present work of ground effect factor estimation, the regression model treats aerodynamic lift, drag and dimensionless height above ground as input parameters, and ground effect factor as an output parameter for training. Equations (4) -(8) provide the input and output parameters for training the regression model. The process of selection of the trained regression model was iterative, and every time the model uses a different percentage of input-output data for training. The trained model with a high correlation coefficient between measured and predicted values is selected for prediction with the rest amount of flight data. The regression model trained with 60% of flight data has a very high correlation coefficient between measured and predicted values. Both 'Áircraft 1' and Áircraft 2' use the same methodology of training regression models

4.0. RESULTS AND DISCUSSION

The estimation of ground effect factor uses GPR based regression model in this paper for constant-alpha ground effect manoeuvre during both take-off and landing. The aerodynamic lift, drag and dimensionless height above ground are used as input variables, whereas ground effect factor as output variable for training regression model. The results indicate that the regression model (GPR method) is effective in capturing the physical phenomenon of ground effect during both take-off and landing and for both the aircraft. The results establish that the regression model is a potential alternative method for the prediction of ground effect factor.

4.1 Correlation coefficient between measured and predicted values of ground effect factor in take-off and landing

The trained GPR model could estimate the ground effect factor which is in good agreement with measured values over the entire range of remaining data. The correlation coefficient between measured and predicted values of ground effect factor at the time of take-off is of the order of 0.95083- 0.996833 (Refer Table 1), and during landing, the correlation coefficient is of the order of 0.9850 -0.9999 (Refer Table 2) for 'Aircraft 1'. The value of correlation coefficient close to unity establishes a good agreement between measured and estimated values of ground effect factor. For 'Aircraft 2', the correlation coefficient between measured values and predicted values of ground effect factor at the time of landing is 0.993211, which is also very close to unity.

4.2 Root Mean Square Error (RMSE) between measured values and predicted values of ground effect factor in take-off and landing

The RMSE between measured and predicted values of ground effect factor at the time of take-off is of the order of 0.010564 - 0.00548 (Refer Table 1), whereas for landing, the RMSE between measured and predicted values of ground effect factor is 0.0164 - 0.0057 (Refer Table 2) for 'Aircraft 1'. For 'Aircraft 2', the RMSE between measured values and predicted values of ground effect factor at the time of landing is of the order of 0.05731.

Table-1: Correlation coefficient and RMSE for GPR model –'Aircraft 1'

Details of Flight data used	Flight phase	Correlation coefficient	Root Mean Square Error (RMSE)
Flight #01	Take-Off	0.950328	0.010564
Flight #02	Take-Off	0.996833	0.00548
Flight #03	Take-Off	0.989948	0.01824

Table-2: Correlation coefficient and RMSE for GPR model –Aircraft '1'

Details of Flight data used	Flight phase	Correlation coefficient	Root Mean Square Error (RMSE)
Flight #01	Landing	0.9988	0.0380
Flight #02	Landing	0.9850	0.0057
Flight #03	Landing	0.9999	0.0164

4.3 Comparison of GPR estimated ground effect factor with ground effect factor obtained by McCormick[31] relation and the conventional method.

The academic understanding of ground effect phenomenon enables the expectation that, the ground factor should progressively decrease (Strengthening ground effect) with a decrease in aircraft height above ground within unit wingspan due to a progressive drop in downwash.

ISSN 2394 - 7780

4.3.1 The ground effect factor predicted by regression model (GPR method), physics model (Conventional method), McCormick[31] relation (Empirical method) individually indicate similar behaviour of ground effect factor, i.e. ground effect factor progressively decreases from 1.0 at unit wingspan to values lesser than 1.0 for all the values of height above ground less than unit wingspan. Both the aircraft exhibit similar behaviour during ground effect manoeuvre in take-off and landing. The critical observation is that the GPR method prediction of the behaviour of ground effect factor is reasonably in line with the prediction from the other two methods and also as per the understanding of the phenomenon.

4.3.2 The regression model (GPR method) over-predicts the value of ground effect factor from the McCormick[31] relation for all the values of h/b < 0.3-0.4, and it remains valid for both the aircraft. The ground effect factor estimated is having a maximum deviation of ~ 15% with McCormick [31] predictions during both take-off (Refer Table 3) and landing (Refer Table 4) for 'Aircraft 1'. For higher values of dimensionless height above ground, i.e. 0.3-0.4 < h/b < 1.0, ground effect factor estimates by GPR method and McCormick [31] match well with each other. The probable reason for the deviation can be the necessary approximations made during the formulation of empirical relation and any inevitable measurement noise in the flight data used by the regression model.

4.3.3 The ground effect factor estimated by regression model (GPR method) and physics model (conventional method) are in good agreement with each other with a maximum deviation of ~ 10 % during both take-off (Refer Table 5) and landing (Refer Table 6) for 'Aircraft 1'. The probable reason for the deviation can be the simplifying assumptions made for solving equations of motion in the conventional method and any inevitable measurement noise in the flight data used by the regression model.

4.3.4 For 'Aircraft 2', Table 7 gives a comparison of GPR estimates with estimates from both McCormick [31] and the conventional method. The GPR estimated ground effect factor holds a similar deviation from McCormick[31] and as well as conventional method estimates as that for 'Aircraft 1'

Table-3: Comparison of ground effect (Take-Off) – 'Aircraft 1'

h/b	Ground effect factor (ϕ) (McCormick)	Ground effect factor (ϕ) (GPR)			% deviation (GPR & McCormick)		
		FL01	FL02	FL03	FL01	FL02	FL03
0	0	0	0	0	0	0	0
0.05	0.060903693	0.07172	0.07219	0.071521	15.08	15.63	14.85
0.1	0.205979953	0.23832	0.242592	0.22902	13.57	15.09	10.06
0.2	0.509240073	0.55873	0.568268	0.548653	8.86	10.39	7.18
0.3	0.700125324	0.748865	0.738343	0.750912	6.51	5.18	6.76
0.4	0.805848795	0.84871	0.84832	0.829933	5.05	5.01	2.90
0.5	0.866405733	0.8879	0.888636	0.879507	2.42	2.50	1.49
0.6	0.903277964	0.8886	0.918649	0.896345	-1.65	1.67	-0.77
0.7	0.927067393	0.918952	0.928651	0.919784	-0.88	0.17	-0.79
0.8	0.943189884	0.928959	0.948709	0.93806	-1.53	0.58	-0.55
0.9	0.954571344	0.94654	0.948797	0.94846	-0.85	-0.61	-0.64
1	0.96288241	0.962	0.958875	0.961765	-0.09	-0.42	-0.12
1.1	0.969125415	0.970205	0.968989	0.968896	0.11	-0.01	-0.02
1.2	0.973928203	0.972988	0.973621	0.973901	-0.10	-0.03	0.00

Table-4: Comparison of ground effect (Landing) – 'Aircraft 1'

h/b	Ground effect factor (ϕ) (McCormick))	Ground effect factor (ϕ) (GPR)			% deviation (GPR & McCormick)		
		FL01	FL02	FL03	FL01	FL02	FL03
0	0	0	0	0	0	0	0
0.05	0.060904	0.07201	15.42328	0.072245	15.42	15.70	14.47
0.1	0.20598	0.236843	13.03102	0.2432	13.03	15.30	13.27
0.2	0.50924	0.587161	13.27084	0.58886	13.27	13.52	9.80
0.3	0.700125	0.72291	3.1518	0.77936	3.15	10.17	6.79
0.4	0.805849	0.837852	3.819673	0.84948	3.82	5.14	2.91
0.5	0.866406	0.88872	2.510832	0.87955	2.51	1.49	1.15
0.6	0.903278	0.918093	1.613723	0.91567	1.61	1.35	0.92
0.7	0.927067	0.928132	0.114715	0.9257	0.11	-0.15	0.20

ISSN 2394 - 7780

0.8	0.94319	0.944185	0.105341	0.9482	0.11	0.53	-0.30
0.9	0.954571	0.955285	0.074727	0.9575	0.07	0.31	-0.42
1	0.962882	0.962386	-0.05158	0.9627	-0.05	-0.02	-0.09
1.1	0.969125	0.9685	-0.06458	0.969	-0.06	-0.01	0.00
1.2	0.973928	0.97855	0.472311	0.97397	0.47	0.00	0.00

Table-5: Comparison of ground effect (Take-Off) – 'Aircraft 1'

	Ground effect factor (ϕ) (GPR)			Ground effect factor (ϕ) (conventional			% deviation (GPR & conventional)		
h/b	FL01	FL02	FL03	FL01	FL02	FL03	FL01	FL02	FL03
0	0	0	0	0	0	0	0	0	0
0.05	0.07172	0.07219023	0.071521	0.06399	0.0648	0.064	10.78	10.24	10.52
0.1	0.23832	0.242591672	0.22902	0.217	0.22071	0.2172	8.95	9.02	5.16
0.2	0.55873	0.56826792	0.5486532	0.538	0.5381	0.5382	3.71	5.31	1.91
0.3	0.748865	0.73834321	0.7509124	0.71984	0.7184	0.7426	3.88	2.70	1.11
0.4	0.84871	0.84832	0.82993251	0.8267	0.835	0.828	2.59	1.57	0.23
0.5	0.8879	0.88863561	0.87950675	0.878	0.875	0.88901	1.11	1.53	-1.08
0.6	0.8886	0.9186488	0.896345	0.879	0.9087	0.908	1.08	1.08	-1.30
0.7	0.918952	0.928651	0.919784	0.9095	0.9238	0.925	1.03	0.52	-0.57
0.8	0.928959	0.948709	0.93806	0.9198	0.9489	0.9375	0.99	-0.02	0.06
0.9	0.94654	0.948797	0.94846	0.939805	0.955	0.949	0.71	-0.65	-0.06
1	0.92	0.95887521	0.961765	0.91811	0.9588	0.9618	0.21	0.01	0.00
1.1	0.9205	0.968988752	0.9688957	0.917	0.969	0.96854	0.38	0.00	0.04
1.2	0.920876	0.973621	0.9739012	0.923	0.974	0.9735	-0.23	-0.04	0.04

Table-6: Comparison of ground effect (Landing) – 'Aircraft 1'

	Ground effect factor (ϕ) (GPR)			Ground effect factor (ϕ) (conventional			% deviation (GPR & conventional)		
h/b	**FL01**	**FL02**	**FL03**	**FL01**	**FL02**	**FL03**	**FL01**	**FL02**	**FL03**
0	0	0	0	0	0	0	0	0	0
0.05	0.07201	0.07224	0.07121	0.0648	0.064578	0.064273	10.01	10.61	9.74
0.1	0.2368	0.2432	0.2375	0.217145	0.227678	0.217234	8.32	6.38	8.53
0.2	0.587	0.58886	0.56458	0.548	0.558245	0.54405	6.67	5.20	3.64
0.3	0.72291	0.77936	0.7511	0.7082234	0.74889	0.7381	2.03	3.91	1.73
0.4	0.8378	0.84948	0.83	0.815342	0.83885	0.825	2.69	1.25	0.60
0.5	0.88872	0.87955	0.8765	0.871898	0.86912	0.873	1.89	1.19	0.40
0.6	0.9180	0.91567	0.9117	0.90832	0.915	0.91857	1.06	0.07	-0.75
0.7	0.9281	0.9257	0.92889	0.9189532	0.925	0.92875	0.99	0.08	0.02
0.8	0.9441	0.9482	0.94034	0.93723	0.94	0.9439	0.74	0.86	-0.38
0.9	0.9552	0.9575	0.95054	0.951344	0.955	0.951	0.41	0.26	-0.05
1	0.96238	0.9627	0.962	0.956201	0.963	0.9625	0.64	-0.03	-0.05
1.1	0.9685	0.969	0.969123	0.96421	0.9691	0.9689	0.44	-0.01	0.02
1.2	0.97855	0.97397	0.9739	0.975035	0.9744	0.9739	0.36	-0.04	0.00

Table-7: Comparison of ground effect (Landing) – 'Aircraft 2'

h/b	Ground effect factor (ϕ) (McCormick)	Ground effect factor (ϕ) (GPR)	% deviation (GPR & McCormick)	Ground effect factor (ϕ) (conventional)	% deviation (GPR & conventional)
0	0	0	0	0	0
0.05	0.060903693	0.0718	15.18	0.0645	10.17
0.1	0.205979953	0.2364	12.87	0.2223	5.96
0.2	0.509240073	0.5703	10.71	0.5527	3.09
0.3	0.700125324	0.726	3.56	0.7089	2.36
0.4	0.805848795	0.82	1.73	0.81	1.22
0.5	0.866405733	0.871	0.53	0.86289	0.93
0.6	0.903277964	0.91171	0.92	0.90483	0.75
0.7	0.927067393	0.928849	0.19	0.92348	0.58
0.8	0.943189884	0.9489	0.60	0.943888	0.53

ISSN 2394 - 7780

0.9	0.954571344	0.95312	-0.15	0.95156	0.16
1	0.96288241	0.9613	-0.16	0.9631	-0.19
1.1	0.969125415	0.9645	-0.48	0.965156	-0.07
1.2	0.973928203	0.9716	-0.24	0.971987	-0.04

5.0 CONCLUSIONS

In the present work, an attempt is made to use a data-driven methodology, i.e. regression model based on (GPR) method for capturing aircraft flight in the presence of ground effect (a non-linear phenomenon). The ground effect is very critical for all high-performance aircraft, i.e. aircraft with very short take-off and landing capability and specifically for Wing-In-Ground (WIG) aircraft. The data-driven methods do not require a prior mathematical model and do not involve an enormous computational burden like other methods. The present work outlines the following observations:

1. The ground effect factor estimated for two types of aircraft during take-off and landing through regression model and the subsequent comparison with ground effect factor estimates by the conventional method and McCormick [31] establishes that the GPR method is a potential alternative method for estimating ground effect factor. The advantage mentioned above will be especially useful for flight vehicles in ground effect which has very complex system dynamics and thus a complicated mathematical model to solve.
2. The advantages through the application of the GPR method (data-driven methodology) for the estimation of ground effect characteristics (a non-linear problem) has given way forward for seeking the solution of the other non-linear aerospace problems through flight test method.

The recommended future work is to determine the effect of varying descent rates during constant-alpha manoeuvre on the aerodynamic lift and drag characteristics and the consequent effect on ground effect factor for both heavy and light transport category aircraft. The future work may also have a focus on the determination of methodology/approach which provides consistency even at shallow heights above ground.

6.0 NOTATIONS

The paper uses the following symbols:

b Full wingspan, m

$C_{L(OGE)}$ Dimensionless lift coefficient outside ground effect

$C_{L(IGE)}$ Dimensionless lift coefficient inside ground effect

C_{L0} Dimensionless lift coefficient at zero angle of attack

C_{D0} Dimensionless drag coefficient at zero angle of attack

C_{m0} Dimensionless pitching moment coefficient at zero angle of attack

$C_{L\alpha}$ Dimensionless slope of lift Vs angle of attack curve

$C_{m\alpha}$ Dimensionless slope of pitching moment Vs angle of attack curve

$C_{L\delta e}$ Dimensionless slope of lift coefficient Vs elevator deflection curve

$C_{m\delta e}$ Dimensionless slope of pitching moment coefficient Vs elevator deflection curve

C_X Dimensionless force along X- axis (Forward, + Ve)

C_Z Dimensionless force along Z - axis (Downwards, +Ve)

h/b Dimensionless height above ground

K Induced drag coefficient

$\bar{q}$ dynamic pressure, N/m^2

S Wing reference area, m^2

T Thrust from both engines, N

V True airspeed, m/s

W Gross weight, Kg

ISSN 2394 - 7780

γ Flight path angle

α Angle of attack, deg

Φ Ground effect factor

Θ Pitch angle, deg

δe Elevator deflection angle, deg

7.0. REFERENCES

1. https.// www.gstatic.com/images
2. PHILIPS, D., JAMES," Downwash in the Plane of Symmetry of an Elliptically Loaded Wing", NASA Technical Paper 2414, January 1985.Curry, E. Robert., and Owens, R. Lewis. (2003). "Report on Ground-Effect Characteristics of the Tu-144 Supersonic Transport Airplane", NASA/TM-2003-212035
3. MILLS, N., LANDLEY," Calculation of Air Displaced by a Wing", Journal of Aeronautics and Aerospace Engineering, Volume 6 Issue 4 1000204, 2017.
4. TANI, I., TAIMA, M., AND SIMIDU, S.," The Effects of Ground on the Aerodynamic Characteristics of a Monoplane Wing," Tokyo Imperial University, Japan, Aero Research Institute Rept.156, Sept.1937.
5. RAY, C., CHANG, AND MUIRHEAD, U., VINCENT," Effect of Sink Rate on Ground Effect of Low Aspect Ratio Wings, "Journal of Aircraft Vol 24, No. 3,1986, pp 176-180
6. 6. COULLIETTE, C., AND PLOTKIN, A., " Aerofoil Ground Effect Revisited", The Aeronautical Journal, Vol 100, Issue 992, Feb 1996, pp 65-74.
7. MANTLE, P., J.," Induced Drag of Wings in Ground Effect", The Aeronautical Journal, Vol 120, Issue 1234, December 2016, pp 1867-1890
8. ZERIHAN, JONATHAN AND ZHANG, XIN," Aerodynamics of a Single Element Wing in Ground Effect", Journal of Aircraft, Vol 37, No 6, November-December 2000
9. LEE, PAI HUNG, LAN, C., EDWARD AND MUIRHEAD, U., VINCENT," Experimental investigation of Dynamic Ground Effect", Journal of Aircraft, Vol 26, No 6, June 1989.
10. LANGE, R., H., AND MOORE, J., W.," Large Wing -in -Ground Effect Transport Aircraft", Journal of Aircraft, Vol 17, No 4, October 1979.
11. CAMPBELL, J.P., HASSEL, J., L., JR., AND THOMAS, J.L., "Ground Effects on Lift for Turbofan Powered-Lift STOL Aircraft," Journal of Aircraft, Vol.15, No. 2, 1978, pp 78-84.
12. STAUFENBIEL, R.W.AND SCHLICHTING, U.-J., "Stability of Airplane in Ground Effect," Journal of Aircraft, Vol.25, No. 4,1988, pp 289-294.
13. STAUFENBIEL, R., "Some Nonlinear Effects in Stability and Control of Airplane of Wing-in-Ground Effect Vehicles," Journal of Aircraft, Vol.15, No. 8,1978, pp 541-544.
14. WEISELBEREGER, C., Wing Resistance Near the Ground, NACA TM-77,1922
15. CUI ERJIE AND ZHANG XIN, Ground Effect Aerodynamics, *Encyclopaedia of Aerospace Engineering* John Wiley & Sons Ltd, 2010
16. 16.HURT, H., H., *Aerodynamics for Naval Aviators*, Aviation Supplies & Academics, Page 379, Inc, Revised Edition 1965
17. ANDERSON, JOHN D., JR., *Fundamental of Aerodynamics*, McGraw-Hill Book Company,1984.
18. HEDMAN, SVEN G., Vortex Lattice method for Calculation of Quasi-Steady State Loadings on Thin Elastic Wings in Subsonic Flow, The Aeronautical Research Institute of Sweden, Report 105,1966
19. CHEN, YEN-SEN AND WILLIAM G. SCHWEIKHARD, "Dynamic Ground Effects on a Two Dimensional Flat Plate," Journal of Aircraft, Vol.22. No.7,1985, pp 638-640.
20. NUHAIT, A.O., "Unsteady Ground Effects on Aerodynamic Coefficients of Finite Wings with camber," Journal of Aircraft, Vol. 32, No.1,1995, pp 186-192.
21. KEMMERLY, G.T., J.W. PAULSON, JR., Investigation of a Moving-Model Technique for measuring Ground Effects, NASA TM-4080, Jan 1989

22. KO JONATHAN, KLEIN J., DANIEL, FOX DIETER AND HAEHNEL DIRK," Gaussian Processes and Reinforcement Learning for Identification and Control of an Autonomous Blimp", ID 9552903, IEEE Xplore Digital Library, May 2007
23. YANG SHIYI, WEI NAN, JEON SOO, BENCATEL RICARDO AND GIRARD ANOUCK, "Real-time optimal path planning and wind estimation using Gaussian process regression for precision airdrop", ID 16997867, IEEE Xplore Digital Library, July 2017
24. YANG XIAOKE, LUO MINGKIANG, ZHANG JING AND YANG LINGIYU, "Aircraft centre of gravity estimation using Gaussian process regression models", ID 16485067, IEEE Xplore Digital Library, November 2016.
25. LAWERNCE R.J. NICHOLAS, SUKKAREIH SALAH, "Autonomous Exploration of a Wind Field with a Gliding Aircraft", Journal of Guidance, Control and Dynamics, Vol 34, No3, May-June 2011.
26. SCHWEIKHARD, WILLIAM "A Method for In-Flight Measurement of Ground Effect on Fixed- Wing Aircraft". Journal of Aircraft, Vol 4, No2, March April 1967, pp 101-104.
27. NAPOLITANO R. MARCELLO, *Aircraft Dynamics from Modelling to Simulation*,1st edition, Wiley November 2011.
28. RAYMER, P., DANIEL, *Aircraft Design: A Conceptual Approach*, Third Edition, AIAA Education Series 1999
29. OJHA, S.K., *Flight Performance of Aircraft*, American Institute of Aeronautics and Astronautics Education Series, 1995
30. LOWRY, T. JOHN, "*Performance of light Aircraft*", AIAA, 1935
31. McCORMICK, B.W., Ground Roll, *Aerodynamics, Aeronautics and Flight Mechanics*, 1st edition, Wiley, New York, 1979, pp 419-424.
32. RASMUSSEN, C. AND C. WILLIAMS, *Gaussian Processes for Machine Learning*. MIT Press 2006
33. CURRY, E. ROBERT, AND OWENS, R. LEWIS, Ground Effect Characteristics of TU-144 Supersonic Transport Airplane, NASA/TM-2003-212035, October 2003
34. CURRY, E., ROBERT, Dynamic Ground Effect for A Cranked Arrow Wing Airplane, NASA TM 4799, August 1997.
35. CORDA, STEPHEN, STEPHENSON T. MARK, BURCHAM W. FRANK, AND CURRY, E., ROBERT, "Dynamic Ground Effects Flight Test of an F-15 Aircraft", NASA TM-4604, Sept. 1994

LIST OF FIGURES

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019

ISSN 2394 - 7780

SUSTAINABLE APPROACHES FOR URBAN SPRAWL MANAGEMENT OF AHMEDABAD CITY, GUJARAT, INDIA

Saleem Ahmad Yatoo[1], Paulami Sahu[2] and Manik H. Kalubarme[3]
[1,2]School of Environment and Sustainable Development, Central University of Gujarat, Gandhinagar
[3]Bhaskarcharya Institute for Space Applications and Geo-Informatics (BISAG), Department of Science & Technology, Government of Gujarat, Gandhinagar

ABSTRACT
In present time, uncontrollable intensive urban sprawl and haphazard expansion of cities are a serious threat as well as challenge for sustainable development. Urban sprawl has negative impacts on environment and human society. Like other parts of India, Ahmedabad also has witnessed a large growth in population and commercial development and it has resulted in expansion of the city. Improper/ineffective implementation of drafted urban plans may result in unexpected expansion. However, a large gap exists between documented urban planning and actual development. The aim of this study is to analyse urban land use earlier policies and to suggest some better management plans for Ahmedabad city. Multi-temporal Landsat data of 1997, 2007 and 2017 has been taken to study the sprawl of Ahmedabad City of AMC area. Built-up area change map has been developed to show the decadal changes in the study area from 1997 to 2017. Urban built-up has increased 19.28% from 1997 to 2017. Study of decadal landuse/land cover of AMC area from the year 1997 to 2017 reveals that built-up area has increased by many folds with the expenses of agricultural land. We proposed an outline for a sustainable management of the city through comprehensive study and analysis. For Ahmedabad City fallowing necessary recommendation may be beneficial: regulations regarding land conversion, redistribution of unused land under government control, sufficient infrastructure development to contain new population, laws to accommodate poor sections of population, abolishing of long land tenure system, controlling land market to stop rises in the price of land, urban containment boundary, use of vacant lands/waste lands for housing development, incorporating modern and scientific smart growth concepts, use of Remote Sensing and Geographic Information System to monitor the urban expansion changes, enhancing urban attraction by increasing aesthetic value in urban environment are appropriate measures to control urban sprawl and better functioning of urban management. And above all steps, sustainable urban master planning is most important process. These steps would be enough for a sustainable city if established through proper urban planning which will keep balance of social and ecological health of city. Thus, for the present study, with the emerging problem of the urban sprawl, the challenges at local level; it is necessary to review and reevaluate the existing policies and plans and to establish an integrated sustainable planning system for sprawl control and urban growth management.

Keywords: Ahmedabad City, Landuse/land cover change, Sustainable Development, Urban Planning, Urban Sprawl

1. INTRODUCTION
United Nations (2012) report on population statistics reveals that the global population is predicted to reach 8.3 and 9.1 billion by 2030 and 2050 respectively and of this population 4.9 billion people are expected to live in urban areas in 2030 and 6.3 billion in 2050, (Poyil and Misra, 2015). For the year 2010 only, out of the total 6.9 billion population, 71% population were urban dwellers in Asia (1.7 billion), Africa (0.4 billion), Caribbean and Latin America (0.4 billion), Northern America (0.3 billion) and Oceania (0.02 billion) (United Nation, 2007; Poyil and Misra, 2015). Urbanization is taking place in an unprecedented scale and creating problem of urban sprawl that resulted in negative impacts on environment at local and regional level (Sun et al. 2013; Poyil and Misra, 2015). Uncontrollable intensive urban sprawl and haphazard expansion of cities are a serious threat for sustainable development of urban areas (Sudhira et al. 2007). Inappropriate policy and improper implementation can fuel the urban sprawl in cities (Sudhira et al. 2007). The earlier studies show that spatial development patterns are not necessarily complete and environment friendly; this may provide a way to effective planning (Carruthers and Ulfarrson, 2003). An exponential growth in urbanization in past five decades has been witnessed in all over the world. Spatial growth in megacities at global level in last three decades has led a major spatial change in cities dimensions which resulted in evident growth in urban sprawl (Kumari and Joshi, 2015). Increase of natural population pressure has triggered the rates of slum habitants and below poverty line populations in rapidly growing economies (Kumari and Joshi, 2015). However, it has been observed that necessary steps and plans at local and regional levels should be made mandatory to avoid unplanned and unsustainable built-up growth.

ISSN 2394 - 7780

In India, urban growth has gradually increased since 1950's but it showed an evident increase from 1991 onwards (Census, 2001). During 1991 census, the growth in urban population was 25.5% and it increased to 25.8% in 2001 census. As a matter of fact, urban areas are driving engines of economic growth and development. Urban areas are increasing in number with every passing year and since 1901 to 1991, they have doubled than earlier. Moreover, in India population growth has mushroomed and increased by eight-fold. Therefore, it resulted in heavy urban infrastructure growth. Rapid urbanization phenomenon has been intensified by rapid economic growth. On the other hand, rapid globalization in past few decades have shown much effect on economic growth and will continue to increase with urbanization (Gurumukhi, 2003). With growing population in India, million plus cities has increased in number, size and area expansion. In the year 1901, only Kolkata was having million plus population in the country and the number of million plus increased to 5 in 1951. With increasing population in country this number increased to 12 in 1981 than 23 in 1991. In 2001, there were 35 million plus cities which were comprising of about one third of India's urban population (Gurumukhi, 2003). After 2011 it is documented that there are 46 million plus cities and 8 are metropolitan cities or mega cities which includes Mumbai, Delhi, Bangalore, Chennai, Hyderabad, Ahmedabad, Kolkata and Surat in India. Besides this, there are many urban agglomerations, which comprises of 43 % of total population (Census, 2011) and the number of cities is projected to increase 85 by 2051 (Taubenbock et al. 2009). It has been predicted that urban population would reach 820 million by 2051 which may constitute about 48 % of the entire population of India.

Cities can be centre of hope but could be congested areas of poverty and environmental degradation as well (Poyil and Misra, 2015). By 2051, 1.70 billion population would be present in India and possibly it could be the most populous country in world with 0.19 ha/capita land availability. Therefore, increasing population will impact the natural resources and their exploitation will increase rapidly. Also, at city level ecology will be affected and local microclimatic condition may change accordingly (Taubenbock et al. 2009). In modern times urban sprawl is major and serious challenge for sustainable urban land use and it has negative impacts on environment (Wu, 2017; Martinuzzi, et al; 2007; Sudhira et al. 2007 and Hammer, et al. 2004). Presently, there are challenges to manage urban growth and improve our cities in India as they continue to grow and expand. It has been analysed that large gaps exist between development planning and actual development. Urban planning is a better solution to guarantee sustainable urban development and efficient use of resources (Wu, et al. 2017; Desjardins, 2016). Hence, infrastructure growth and its sustainable management will be necessary to carry out at all management levels.

1.1 Review of Urban Growth and Urbanization in Ahmedabad

Urbanization has led a drastic change in the environment of the cities. Ahmedabad has shown a tremendous growth in the industrial sector as well as economic development since 1950's. This resulted in large migration from surrounding areas population (rural) to the Ahmedabad City as well as from other states. This migration for job and better life standard has changed the spatial dimension of the city which resulted in its expansion. Migration has brought leap-frog built-up development in many areas within a short period of time that has led to urban sprawl which consequently lead to more conversion of agriculture land, open spaces, vacant lands and water bodies to built-up areas in the form of towns and societies. Built-up area has developed faster since 1980's and rapidly increasing with every passing year. Due to the rising growth of population in AMC area and continuous migration, there is rising needs of urban infrastructure development in Ahmedabad City and its suburbs. As many plans and policies has been undertaken by AMC as well as Gujarat Government, still there is need of revision of development plans to be more scientific and sustainable. Revision of the master draft development and effective implementation of that through Government and urban planning bodies are needed. Also, there is need to study the case studies of successful planning schemes and failed urban schemes, thoroughly to understand their pros and cons before finalizing the Master Plan.

India has undertaken a major plan to make Smart Cities under the flagship of 'Smart Cities Mission'. Sustainable city will be established through urban planning and proper management plans which will keep balance of social and ecological health of city. Therefore, it is necessary to work for a well-planned strategy to make Ahmedabad City a smart city. Consideration of Public opinions; discussions and debates with urban planners and other experts in the relevant field are required for better planning of a smart city. After primary survey, future development plans or a road map should be worked out to introduce a master plan for smarter urban growth as well as to control urban sprawl in future. After a comprehensive study, some suggestions and recommendations have been chalked out for the AMC area to curb unplanned urban growth and rapid rate of urbanization are given below:

ISSN 2394 - 7780

1.2 Objectives

Present study is attempted to identify the problems associated with urban sprawl in Ahmedabad City as well as Ahmedabad Municipal Corporation (AMC) area and to find out possible management options to solve or at least mitigate the problems. The fallowing objectives have been taken to carry out this study:

a) To chalk out some theoretical policies, plans and methods to make urban growth management more efficient and sustainable in AMC area, and

b) To suggest possible solutions to the problems of local urban sprawl.

1.3 Study Area

Ahmedabad City lies in the western part of India. It is a semi-arid region. It is one of the fastest growing city in India and a major commercial hub of Gujarat. It is located around the banks of Sabarmati River (Fig. 1). Historically, it is called 'Manchester of East' and recently it is declared Heritage City of India by UNESCO. It is under the control of Ahmedabad Municipal Corporation (AMC). It is located at latitude 23°03′ N---range and longitude 72°58′ E---range. The elevation is about 56 m above Mean Sea Level (MSL). Ahmedabad has a hot, semi-arid climate with average annual rainfall of about 800 millimeters (31 in) annually. The population of the Ahmedabad increased from 2.76 million in 1971 to 7.21 million in 2011 (Table-1) (Census of India, 2011) and population of Ahmedabad city is projected to be 9.78 million by 2021 (2)**.** Density of the population is about 11948/sq.km. Intensive growth of population is always a potential threat for a city's proper development. Therefore, it is necessary to protect its heritage and culture through some more strategic sustainable plans to make it better in national and international levels.

Table-1: Census population data from 1971 to 2011 of the Ahmedabad area

Class	1971	1981	1991	2001	2011
Urban	1899974	2723436	3516890	4663533	6063047
Rural	859595	968725	1032184	1152986	1151178
Total	2759569	3692161	4549074	5816519	7214225

2. MATERIALS AND METHODS

2.1 Remote Sensing and GIS Data Used

For urban growth monitoring, Landsat multi-temporal data were used to identify the urban sprawl of Ahmedabad City of AMC area. For this study, data has been downloaded from USGS website https://earthexplorer.usgs.gov. Multi-temporal data consists of the years 1997, 2007 and 2017 (fig. 2a, b and c). This data after geometric correction were projected in Trans Mercator with World Geographic System (WGS-1984) datum. For this study, administrative boundaries like district and AMC boundaries were generated and used for analysis.

Table-1: Satellite data used for Urban Sprawl assessment of AMC

S. No.	Satellite	Sensor	Path/Row	Spatial Resolution (m)	Date of Pass
03	Landsat-5	TM	148/044	30	October-1997
04	Landsat-5	TM	149/044	30	September-2007
05	Landsat-8	OLI	149/044	30	August-2017

2.2 Field Survey

A random survey or ground truthing was under taken to study the pattern of land use and infrastructure development in the Ahmedabad City. Many land use types were observed and types of development in the study area were also observed. Some photographs obtained from Times of India are shown in the figure 3.

Figure-1: Location Map of study area (AMC).

ISSN 2394 - 7780

2 RESULTS AND DISCUSSION

2.1 Land use/ Land cover Change

The table 2 clearly depicts that the built-up area was 151.53 km in 1997which increased to 237.03 km in 2017 (Figure 3). 85.50 km^2 (19.28%) increase in built-up area is observed from 1997 to 2017. Similarly, agricultural land has decreased from 225.60 km^2 in 1997 to 147.24 km^2 in 2017 i.e. an increase of 78.36 km^2 (17.66%) during 20 years' time-period (Fig. 4). Table also depicts that mostly agricultural land has been converted to built-up area, with only 1.62% to other uses.

3.2 Urban Sprawl

Urban sprawl has gradually increased from 1997 to 2017 in the study area. Agricultural land is more utilized for built-up development as population has increased in AMC area. This built-up increases the urban sprawl of the AMC area. Urban sprawl has been mostly occurred in west, east, and north-west directions and in future more towards west, northwest and south-west (Fig. 5). The built-up development (%) has increased more than double from 2007 to 2017 (13.46%) than from 1997 to 2007 (5.82%).

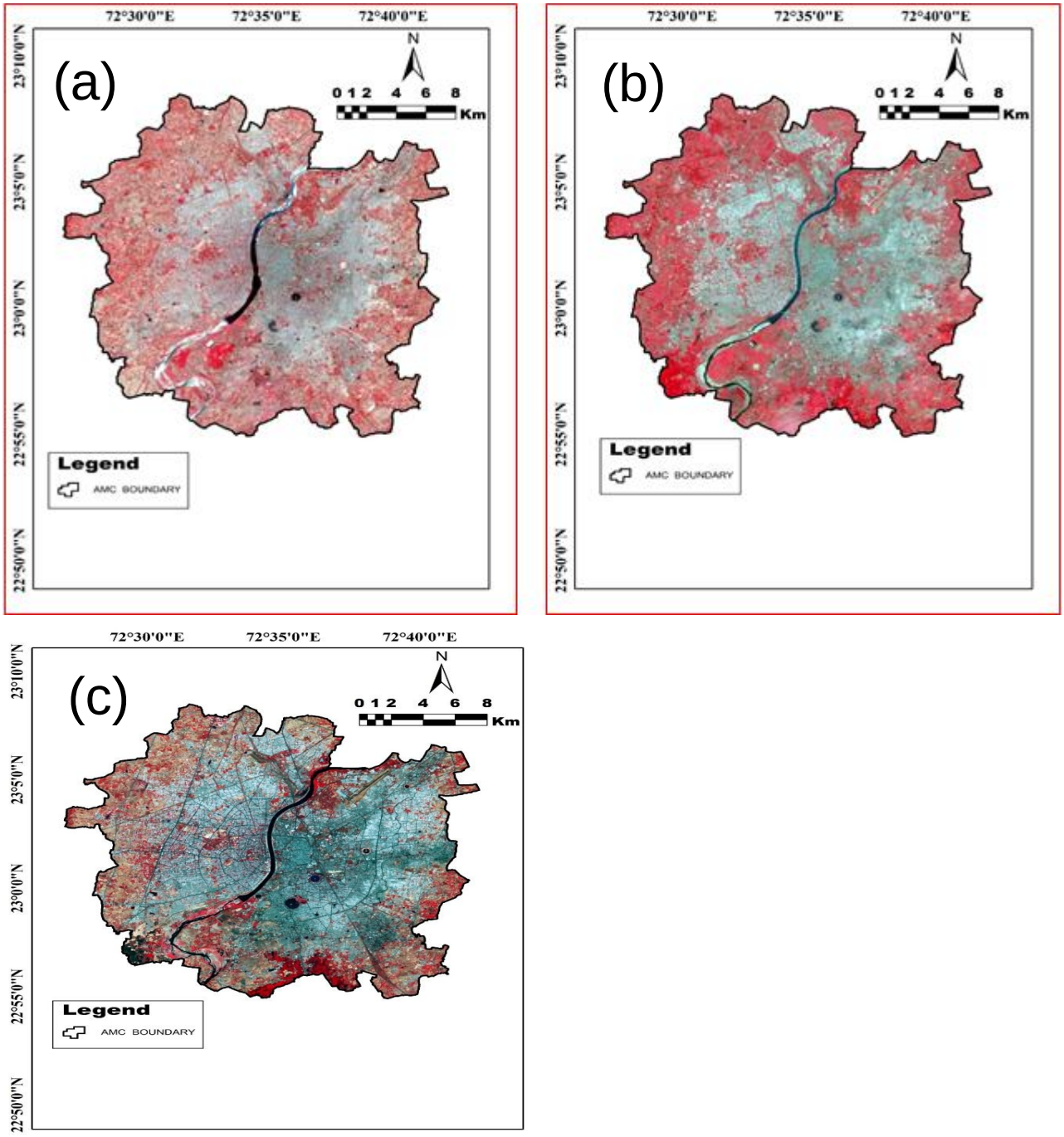


Figure-2: (a) Landsat 5 TM Satellite data of 1997 (b) Landsat 5 TM Satellite data of 2007

(c) Landsat 8 OLI Satellite data of 2017

ISSN 2394 - 7780

Figure-3: Photographs of Ahmedabad City with different urban density Classes
(Photo Courtesy: Times of India)

Table-2: Area under Land use classes in AMC area from 1997, 2007 and 2017.

Land Use Class	Area under land use classes (Km^2)			Area under land use classes (%)			Total Change Initial year- Final Year	
	1997	2007	2017	1997	2007	2017	(Km^2)	%
Built-up	151.53	177.29	237.03	34.16	39.98	53.44	85.50	19.28
Agriculture Veg.	225.60	192.74	147.24	50.86	43.45	33.20	78.36	17.66
Total	443.52	443.52	443.52					

4. RECOMMENDATIONS AND SUGGESTIONS FOR URBAN SPRAWL MANAGEMENT

4.1 Protocols for Preventing / Slowing Down the Land Conversion

Although, land conversion will be a lengthy process while going through legal procedures, due to anthropogenic pressure, fringe areas are being continuously formed from conversion of agricultural areas to built-up areas through human illegal capture (MUD, 2007). Therefore, it is compulsory to prevent such sprawl by making laws and regulations and implementing them.

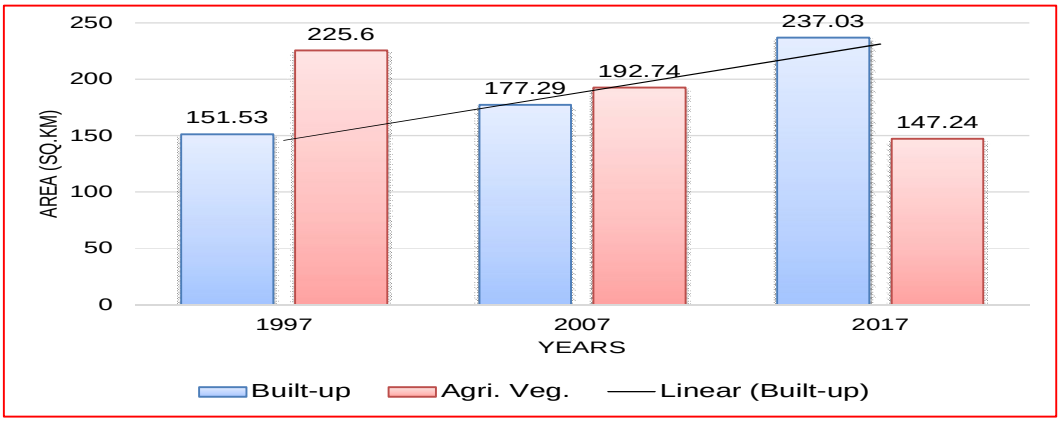


Figure-4: Change in built-up and Agricultural vegetation in AMC area.

4.2 Master Plans /Building Bye Laws

Master plan is a good development concept in modern era as population is growing fast and expanding rapidly. There is growing need of master plans for better infrastructure development so as to reduce the extra floor space utilized for built-up development. Through efficient master plans/building bye laws a smaller space of land can be efficiently used for many purposes than an unplanned development (Gurumukhi, 2003). Basic necessities of

ISSN 2394 - 7780

society can be well planned through the use of master plans as there are many examples of cities in India like Gandhinagar, Chandigarh, Jamshedpur, etc. In India, master plan has main focus on the town planning so as to provide for zoning and proper landuse. Also, master plans have on control of ribbon development, location of industries, clearance of slums, civic and diagnostic surveys etc. They have particular plan on each area development. It has been estimated hardly 20% of the urban centres have some sort of an updated master plans, which in many cases is merely a policy document. A decrease in density corresponding to an increase in Floor Space Index (FSI) is actually counterproductive and it could be a better choice if we go for vertical building development (MUD, 2007). In modern cities of well-developed countries master plans essentially have efficient FSI. So, more floors have to be built on same area of land which is already developed. For progressive development in infrastructure in urban areas many countries revive their urban policies regarding floor space (FSI). In AMC area increase in FSI can have beneficial results like it will help to reduce the city expansion in the peripheral parts of urban areas, decrease in population movement to other places, reduces transport costs and pollution due to transport. Urban planners can have better options to increase FSI during extreme engineering construction work. Hence, it is suggestive to formulate a policy for AMC to increase FSI with time.

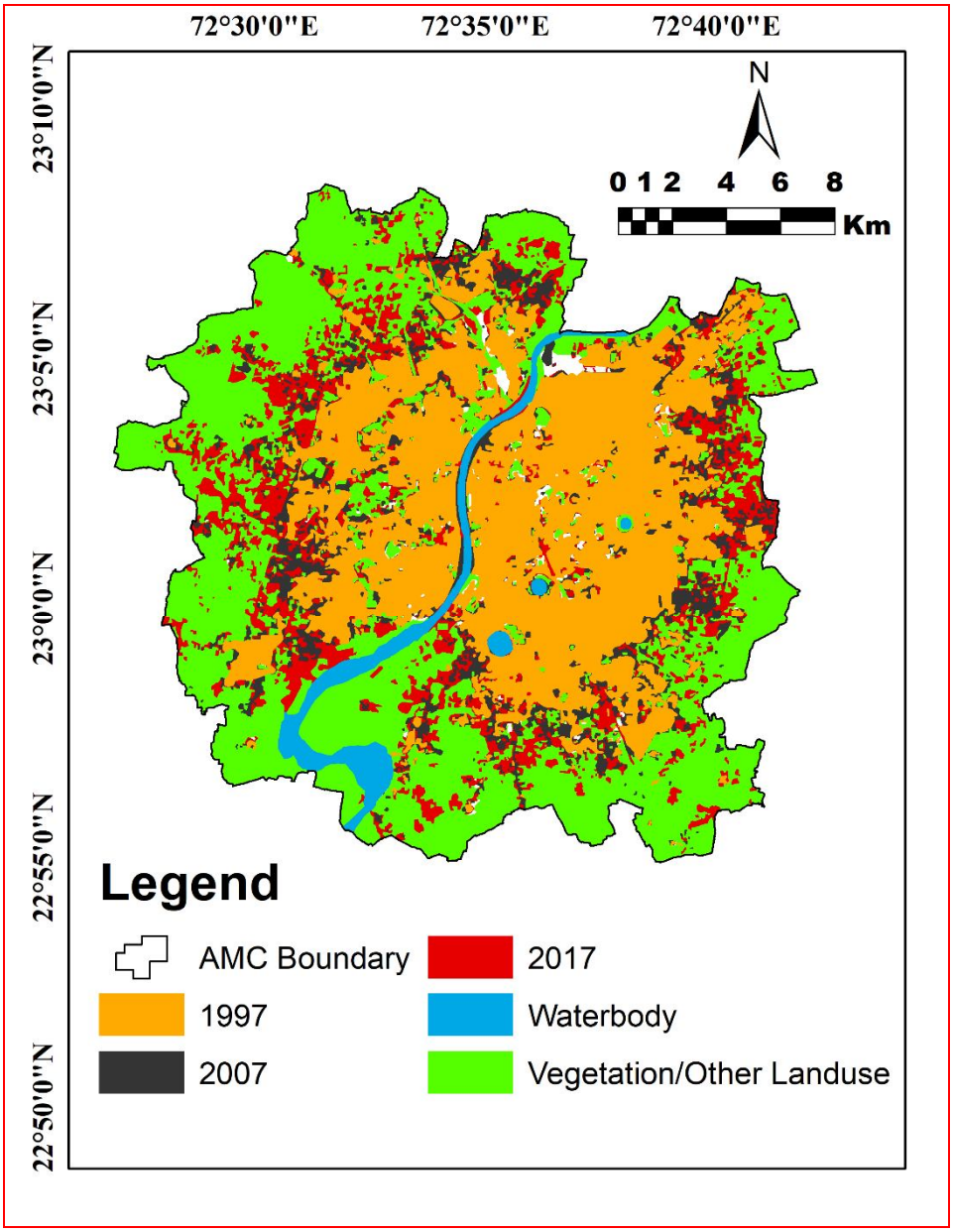


Figure-5: Built-up Change in 1997, 2007 and 2017 in AMC area.

4.3 High Stamp Duty

Imposing a heavy stamp duty as land transaction fee can consequently reduce the supply or transfer of land for new construction in city outskirts. As a fact, there exist a direct link between registration during land transaction and stamp duty because stamp duty as a legal process needs to be paid on registered documents though it varies from state to another state. In Delhi, 13% stamp duty has been kept, whereas it is 14.5% in Uttar Pradesh. India

ISSN 2394 - 7780

is rated among most high stamp duty countries in world. In countries like Singapore or Europe stamp duty is 1-2%. Avoid stamp duty or registration is basically is to avoid payment towards government. In 2005, National Housing Policy of India, also recommended a minimum of 2-3 %. High stamp duty can also lead to increase in expansion of city at peripheral regions as stamp duty is low for peri-urban areas than urban areas. So, it increase expansion towards peripheral parts of urban areas/cities. It can be concluded that imposing high stamp duty is not necessary will decrease land transactions in urban areas. Our opinion is to impose less stamp duty in urban areas so that people may not move to new lands. Therefore, it can be said new built-up development can be reduced to new lands.

4.4 Redistribution of Large Tracts of Land of Institutional Land Holdings

In India many big government parastatals like Railways, CPWD and PWD have occupied large land area particularly in city areas. So, selling such a land in market is not possible because it has not practically individual owner, which usually remains unused or misused. Therefore, government should made surveys to find out unused land and document full inventory of their land holdings. After a legal process, such government entities and parastatals should permit to decide to sell or make profit from such land holdings. For example, one survey made by informal agency had been reported (reference year) Chennai indicated that government institutions (excluding housing boards or development authorities) holds more than 30% of the urban land in the state. Moreover, in Mumbai and Ahmedabad, cotton mills are still having large area under them in central locations which is unused. Although, it is a general public opinion that neither it is environmentally desirable, nor it is economically feasible to once again operate these mills. Therefore, it will be more appropriate to utilize such lands for urban development and to control/reduce conversions at peripheral regions in AMC area.

4.5 Increase in the Property Taxes

Presence of very low taxes rather than actual land values create an opportunity to hold vacant or underused land and thus decreasing the amount of land in the market. This issue prevails in core of city areas because the property rates have been sky rocketing. This gradually leads to the migration of population from the city centre to peri-urban areas and form the urban sprawl. Therefore, a balanced tax and land value should be maintained by urban authorities to control such nuisance.

4.6 Improvement in Insufficient Primary Infrastructure

The weakness in providing primary infrastructure facility in city areas with a capacity consistent with demand is often cited an explanation for limiting development intensity, particularly low Floor Space Index (FSI). This inadequate infrastructure compels the population to migrate towards city limits for better life. Therefore, better infrastructure development needs better planning for redeveloping high density areas. In urban areas, development authorities often do follow arterial infrastructure. Secondary and tertiary development pressure have been put on individuals or private infrastructure developers without much regulations and pressure, which creates special development causing ribbon or corridor types of development particularly along roads. Corridor development often results in patchy built-up growth sprawl and this development is often seen at peripheral parts of the city.

4.7 Abolishing Land Tenure system

Land tenure system in India is an old system of land holding particularly in urban centres. It can be in the form of lease-hold and free-hold. This system of land tenure by individuals or corporate entities can go up to 99 years (MUD, 2007). Gradually, lease change into free-hold. Land holding, or lease system is not conducive to the land market in cities because it creates problems of holding land where large population can be settled or housing development can be developed to accommodate the new population on rent basis. This tenure system in city area can cause new expansion in peripheral areas of cities.

4.8 Government Intervention regarding Land Regulations

Role of government in setting of regulations, and taxation can directly affect urban land supply and demand for land. Land regulation by government implementation are important as a controlling mechanism for efficient market functioning but should be strongly developed and coordinated. Various factors and issues create shortage of land in urban areas like combined effect of municipality of central, state and municipal regulations (MUD, 2007). Consequently, urban land prices are unreasonably high when compared to household income. Therefore, household consume limited floor space than their need. By making land recycling difficult, some regulation tends to 'push' urban development towards the periphery. The result would be in difficulty in operating transport network in urban areas. Therefore, increase in road networking and encroachment should be removed to make Ahmedabad city better. Government should keep citizens importance first that will work in long run and will meet basic amenities of land and housing development for inclusive growth and development.

ISSN 2394 - 7780

The interest of low-income families/poor should be protected while framing such policies. Such policies would result in efficient management and would lead to: (i) Availability of land for urban use may significantly increase, (ii) Government interventions should pave way to efficient use of vacant land or lease lands in core areas, (iii) resource mobilization in urban areas, (iv) maximize benefits from land resources (v) would result in increase in the availability of service land and (vi) it would protect the rights of poor people or low income families in terms granting land and property rights.

4.9 Avoiding Sprawl through Land Assembly

Review of land policies from time to time regarding land assembly is important. The increase in value of land particularly in urban India is influenced mainly by economic or commercial activities in commercialized cities which creates supply and demand for land. As economy of urban areas or economic activities accelerates, it needs more land to grow which directly or indirectly affects basic resources like new lands for development (Gurumukhi, 2003; MUD, 2007). As a result, demand for land increases especially for built-up area development like residential, commercial and industrial to accommodate new population. For fulfilling such need more rural lands/agricultural areas are occupied. Therefore, to avoid unplanned built-up development state government should make land available for development or developed a large area of land for built-up development so that leap-frog built-up development can be controlled. Land policy should be framed to control sprawl, check speculation, balanced check on land values, avoiding concentrated urban land development and ensure land allotment as per need for urban development. Large area of land is suitable for built-up development around cities, but limited quantity is available for development because of many issues and restrictions.

4.10 Assessment of Land Market

Assessment of land should be ensured to control land market. Updated information related to land market functioning like price rise and fall, supply of already allotted land, projects to be taken in future by Urban Land Boards shall be made accessible in the interest of public domain. It will help stakeholders to understand the availability of urban land to meet growing requirements of land for future residential, commercial and industrial developments through decisions (CGG, 2004). Moreover, it will also help to identify which non-urban areas to be explored first, assessment of price variation and would provide information regarding percentage of population deprived from serviced lands, carrying capacity of the city land i.e, whether we have available land to sustain the future growth of population or not etc. The above information would form the bases of ideal working of urban land market. Hence, the aim of Model Guidelines would be efficient, equitable, and environmentally sound and sustainable for urban land market operation.

4.11 Efficient use of Vacant Land

For built-up area development, presence of vacant lands in urban and surrounding areas is an asset. There are unused, vacant or abandoned lands in urban and near urban areas that can be utilized for urban area development particularly in cities. Urban Bodies / Urban Development Authority can better utilize this land for generating revenue that in turn can be used for financing its inadequate infrastructure development. Urban Land Policy can facilitate in this process for effective and sustainable exploitation of vacant or unutilized land which are government owned. Other central and state lands which are inefficiently used or environmentally unhealthy like industrial units, and polluting units. Dumping sites should be shifted away from city centres and in such places new urban areas should be developed. A cost-benefit analysis of such lands should be done and much better revenue generating principles should be adopted.

4.12 Role of Urban Development Authorities/ Housing Boards towards Poor sections/EWS

Urban Development Authorities / boards which have one of the functions for proper disposal of housing in urban/city area while drafting plans must take care of urban poor and provisions/relaxation must be made separately for Economically Weaker Sections (ECW's) of the society (Gurumukhi, 2003). Moreover, homeless category of people must be taken into consideration while framing Master Plan for towns and cities. Also, reservation should be framed in Master Plan/ Housing Boards for poor sections/ EWS people living in urban areas/cities. It will result in reduction / relocation of slum areas and unauthorized occupation or formation of new slum areas. Modern principles like Smart Growth Policies which will address housing opportunities for middle class and low-income/Weaker Sections in core city areas as well as close to peripheries while creating more affordable housing near the job centres must be taken into considerations. It is said that 'the denser the better' is one of the chief ideas behind the initiative.

4.13 Use of better and modern public transit to avoid urban congestion

For better infrastructure development and to avoid sprawl and encroachment in Ahmedabad city, road and or railway should be more modernized and convenient along with new built-up areas. Moreover, there is an

ISSN 2394 - 7780

important need for densification along the major transport roads/corridors as a better step towards land use and transport integration.

Sometimes, in cities or urban areas a poor transit system can have more dependence on private means of transport than to government provided transport system because of poor quality service, maintenance, road congestion, traffic jams, etc. This increase of private vehicle transport system may create the problems of pollution and decreases the life standard of the city dwellers. Therefore, it is necessary to increase better and modern transport system to avoid traffic jams and aware the people about the benefits of using public transport system. In Europe, such as Stockholm is a good example of mass transport culture where people use more public transport than private vehicles. This will result into overall sustainability of transport system and also will decrease the personal vehicle use for transport.

4.14 Building land and Property Information System

Traditional system of land records like revenue records should be changed into more updated appropriate system like surveys, remote sensing mapping, etc. Hence, more importance should be given to digitalize/computerization of the land records and property records maintenance which will benefit the general public. Also, this system will bring it much close to e-governance at a grass root level (CGG, 2004).

Cadastral surveying should be computerized and land titling system must be framed so that land market system may function efficiently without much land price speculation. Also, to avoid un-authorization of land; a systematic information on land registration should be made mandatory for efficient urban land management because it will reduce urban sprawl in cities. It will also help in proper zoning of lands for industrial, commercial and residential use depends on type of and. The registration will also bring inventory of publicly-held land.

4.15 Need for Latest Technology: Remote Sensing and GIS for Sprawl Management

For proper urban growth management study, the Urban Authority should adopt latest remote sensing (RS) and Geographic Information System (GIS) for spatially assess the developments taking place in the urban areas. Secondly, a database of building land and property information system can be efficiently managed through GIS (Taubenbock et al. 2009). This technology will bring updated information on roads, railways, residential areas, commercial areas, industrial areas, institutions, water bodies, vegetation, and vacant lands without using much resources as required in traditional system. This technology will bring in efficient management of urban sprawl in AMC area.

4.16 Management of Illegal / Fringe / Squatter Settlements

Illegal residents in the form of slum areas are living in Ahmedabad, many other cities of India. To manage it, there is need to undertake a redevelopment policy for slum areas which are located in central / peripheral areas to improve the quality of life of the illegal households and to bring such land to intensive use. These slums have occupied either the land owned by individual or of government so to redevelop slums, land sharing method can help to reach a compromise between two parties i.e. landowners and the squatters but both should be keen to negotiate (CGG, 2004). To make this issue resolved, major part of the land should be retained by landowner and the rest should be given to occupants/slum dwellers as this initiative was initially taken by Mumbai for housing the squatter population and this method can be used for Ahmedabad city also.

A second option to solve the problem of slum area is to bring such plans where a portion of land is earmarked for EWS at affordable price for housing. A certain percentage like 10-20% in new housing areas whether public / private sector should be kept while framing local plans / policies at local level or regional level. In an urban plan or local plan, a kind of tenurial rights to slum dwellers either at their present location or relocation of them at affordable prices and preference should be given to persons belonging to the SC/ST/Weaker sections/physically handicapped. Policies should frame in such a way that poor should not be dependent, but it should be empowered like providing housing security. It will result in better living condition of such people which in turn will help to reduce slum formation or to check the growth of slums.

4.17 Concentrating Growth

Concentrating growth, is a good measure against urban sprawl for sustainable city development as suggest by many urban planners. Redevelopment of old area which area under government control such as government quarters can be beneficial instead of using new lands for development in and outside the city. This will curb the problem of unplanned sprawl. Concentrating growth can be achieved by changing the traditional built-up growth to modern building architecture, where we can accommodate more population in a less space. Therefore, this will help by not pushing the existing population to new lands for development. Vertical development is a better option with help of modern technology rather than expanding horizontally.

ISSN 2394 - 7780

4.18 Idea of Smart Growth

Smart Growth is a similar term for sustainable development related to land use issues. Thus, it can be said, it is controlled and managed planning of urban growth. The idea is applied to more to existing infrastructure. In Smart Growth, land can be efficiently consumed for roads, houses as well as commercial buildings. Therefore, smart growth actually shows the way for smart management of resources in new and existing urban areas. Moreover, more modern smart growth principles are needed to conduct such projects. Consequently, among best policy formulation, smart growth can be effective solution for sprawl, in way by confining more people on existing urban lands (Wu, et al. 2017).

4.19 Containment of Urban Land

Containment of urban land has remained as a part in many urban growth management policies and plans and it mostly has taken place in the form of zone regulations like green belts, containment boundaries or urban service areas. The example of such a type where combination of urban containment and green belt exist are of Copenhagen city. Another example of Urban Containment Boundary (UCB) has been set up by US is Portland, Oregon where urban boundary was delineated/separated from rural area. In Leipzig city, UCB has been started in 1996 with 'Green Ring' strategy to preserve the cultural landscape around the city. Similar can be applied for Ahmedabad City also to preserve its heritage as it has been recently declared as first 'Heritage City' in India by UNESCO.

4.20 Enhancing Urban Attraction and Accommodation Capacities

Better improvements and attractiveness in quality of life in urban centres is necessary for better management. Urban renewal can accommodate urban population for longer period of time if aesthetic value is maintained properly. Otherwise people may move to better aesthetic environment and less polluted areas. Consequently, this unwillingness to live in core city centres because of pollution, dense built-up congestion and traffic problems may become reasons of urban sprawl in peripheral parts of city as population will try to move to better housing and good environment. Preserving heritage sites and increasing and maintaining parks and gardens in the city can also help to increase aesthetic value of the Ahmedabad city.

4.21 Planned Development Zoning

During draft development plan, zoning would be better management strategy for urban areas as it would be a planned unit area development (Archer and Ray, 1992). This kind of zoning would not be of intensive use like institutions, residential, commercial, etc. modern scientific methods and techniques should be framed to such kind of plans. New regulations / legislations should be framed to manage such kind of zoning. However, they require a great deal of law enforcement and commitment to be useful in growth management.

4.22 Sustainable urbanization through planned urban development

The most important factor in urban growth management is sustainable urbanization. The development plans at urban level by Urban Development Authority or Urban Boards should considered all factors like social, economic and environmental. Also, in long run and better development for sustainable urbanization fallowing indicators will have significant concern:

a) Process of urban planning

b) Components of sustainable urban environment

c) Definition and expected size of the city

d) Survey and assessment of the existing features of the city area

e) Development plan to serve national goals of sustainability

4.23 Co-ordinating and Co-operating across Administrative Boundaries

Boundaries are essential for urban growth management as it makes work easier. Although, urban growth pressure hardly stops at fixed boundaries. Therefore, inter-boundary/inter-jurisdictional communication and cooperation is compulsory in smooth growth management. The basis criteria for such cooperation must fulfil at least three conditions to carry out efficient planning and balanced development (Fertner et al. 2016): a formation of legal or government controlled regional body which can compete at higher levels and should be most powerful; best compliance between different levels of planning; a common consensus on a plan/policy framed and will to work on it. Ahmedabad Municipal Cooperation in cooperation with Ahmedabad Urban Development Authority (AUDA) can efficiently manage the Ahmedabad City and its suburbs through coordination and consensus. Communication between different zones, associated municipalities, municipal corporations, statutory bodies, notified areas, etc. will be successful step for urban growth management and master plan development.

ISSN 2394 - 7780

5 CONCLUSIONS

At global level urban sprawl has become a challenge for sustainable development in cities. Urban sprawl has negative impacts on environment as well as human society. Urban built-up growth has increased 19.28% from 1997 to 2017 in AMC area and if this trend will continue for next two to three decades. AMC area will contain more settlements than agricultural land. Built-up area has increased (85.50 km^2) and agricultural land of the area has decreased (78.36 km^2) from 1997 to 2017. So, these classes are directly proportional to each other and there are only 7.14 km difference in built-up development and agriculture area which are converted to other classes like gardens and parks. Expansion of Ahmedabad City can be restricted by establishing hard rules and regulations. Financial penalties can be imposed for violating the rules and regulations within city boundary. Moreover, Government should continuously do surprise inspections of new built-up projects to check whether they are maintaining to rules and regulations of governing bodies. Urban bodies should try to adopt modern policies and methods which should be based on scientific and sustainable approach. The study has tried to find out major and important policy implications for sustainable urban planning for urban growth management and urban sprawl control. Local urban bodies/government should not have all the powers vested to them to convert particularly all agriculture land to urban purpose. Reallocation of underutilized or waste lands or government occupied large unused lands should be given the primary importance for further urban development to control urban sprawl in city area. Zoning will be more modernized method for better management of urban growth at city level. A red line between urban development and ecological protection of wildlife, forest area, and prime agriculture lands should be framed to control sprawl or unplanned urban development.

ACKNOWLEDGEMENT

The first and second authors are very much thankful to Honorable Vice Chancellor of Central University of Gujarat, Prof. S.A. Bari and Prof M. H. Fulekar, Dean, School of Environment and Sustainable Development (SESD), Central University of Gujarat (CUG), Gandhinagar for providing the infrastructure to carry out the research. We acknowledge the help of Dr. T.P. Singh, Director, Baskaracharya Institute of Space Applications and Geoinformatics (BISAG), Department of Science & Technology, Government of Gujarat, Gandhinagar, for providing laboratory facility and technical assistance.

REFERENCES

- Archer, Ray W. (1992): 'Land Pooling/Readjustment Versus Plot Reconstitution for the Planned Development of Indian Cities' HSD Working Paper-29, HSDP, Asian Institute of Technology, Bangkok, Thailand.
- CGG (2004), Urban Reforms and Municipal Services in Andhra Pradesh: Urban Land use and Regulatory Audit Study, Centre for Good Governance, Hyderabad.
- Desjardins, C. (2016). How can we slow down urban sprawl? *University of Concordia*, retrieved from: http://www.concordia.ca/cunews/main/stories/2016/07/06/urban-sprawl-western-world-research-jochen-jaeger.html
- Dhingra, M. (2014). Urban Sprawl and its Smart Management. International Journal of Research (IJR) Vol-1, Issue-5, June 2014 ISSN 2348-6848.
- Diwan, G R (2000): A paper 'Evolution of Town Planning Schemes in Maharashtra - meeting the current Challenges' presented at the seminar conducted by ITPI, Mumbai Regional Chapter in 2000 on the subject of Town Planning Schemes.
- ESCAP/CITYNET (1995), Municipal Land Management in Asia: A Comparative Study ST/ESCAP/1539, United Nations, New York.
- Geoffrey Payne (1999) (ed): "Making Common Ground - Public Private Partnerships in land for housing", Intermediate Technologies Publications, UK, 1999.
- Golam Rahman, Deanna Alam and Sirajul Islam (2008). City Growth with urban Sprawl and Problems of Management, 44th ISOCARP Congress 2008.
- Government of Andhra Pradesh (1984): *The Andhra Pradesh Town Planning Act, 1920*, Housing, Municipal Administration and Urban Development Department, Government of Andhra Pradesh, Hyderabad.
- Gurumukhi, P T (2003), Land Pooling: A tool for plan implementation – An Indian Experience, Paper presented in the Map India Conference 2003 (Paper available online at http://www.gisdevelopment.net/ application/ urban/products/pdf/215.pdf)

ISSN 2394 - 7780

- Kshirsagar J.B. (2007). Model Guidelines for Urban Land Policy, town and country planning organisation Government of India Ministry of Urban Development.
- Managing Urban Growth using the Town Planning Schemes in Andhra Pradesh, Final Report July 2010.
- Wu, Y., Fan, P., Li, B., Ouyang, Z., Liu, Y., & You, H. (2017). The effectiveness of planning control on urban growth: Evidence from Hangzhou, China. *Sustainability*, *9*(5), 855.
- "Urban Agglomerations/Cities having population 1 lakh and above" (PDF). Census India. The Registrar General & Census Commissioner, India. Archived (PDF) from the original on 13 November 2011. Retrieved 18 October 2011.
- "How India's cities have grown and shrunk over the last 116 years". Archived from the original on 6 May 2017.

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

A STUDY ON FINANCIAL PERFORMANCE EVALUATION OF SMALL SCALE ENTERPRISES-A CASE STUDY OF LIMENAPH CHEMICALS PRIVATE LIMITED

Dr. Subba Rayudu Thunga[1] and Dr. N. Y. Raju[2]
Associate Professor[1], Andhra Loyola Institute of Engineering and Technology, Vijayawada, Andhra Pradesh
Associate Professor[2], RK College of Engineering, Vijayawada, Andhra Pradesh

ABSTRACT
Small scale sector emerged as a highly vibrant and dynamic sector of the Indian economy over the last five decades. This sector has become an important segment for developing nations like India and has assumed the most important role in providing employment with low capital requirement. The present study is an attempt to scrutinize the economical efficiency of small scale enterprises-a case study of Limenaph Chemicals Private Limited based on selected key financial efficiency indicators. The study is based on financial statements of the enterprise. The study covers a period of five years from 2012-13 to 2016-17. Ratio analysis, mean and chi-square tests are used to evaluate the financial efficiency. The overall profitability and financial efficiency of the enterprise is not up to the mark. This study would be useful to the existing and upcoming entrepreneurs as well as government to make more initiatives and strategies to strengthen small scale sector.

Keywords: Financial Performance, Small scale sector, Financial Performance Indicators.

INTRODUCTION
Small scale industry was considered as a backbone to the Indian Economy. This sector plays a key role in the economic development and uplifting of the nation. The development of small scale sector has been receiving a significant priority in India in the last three to four decades. This sector has become an important segment for developing nations like India and has assumed the most important role in providing employment opportunities, Industrialization, reducing regional imbalances and eradicating poverty. Finally small scale sector is a very significant sector to reduce economical and social imbalances in the economy.

OBJECTIVES OF THE STUDY
1. To study the current financial performance of Limenaph Chemicals Private Limited.
2. To examine the profitability and overall financial performance of the company.
3. To assess the solvency and efficiency of the company with the help key financial Indicators.

RESEARCH METHODOLOGY
Methodology of the study describes sources of data collection, period of the study, tools and techniques for analysis. The key sources of data used for the study is secondary, derived from the annual statements of Limenaph Chemicals Private Limited. The present study covers a period of five financial years i.e. 2012-13 to 2016-17. Data collected from different sources is analyzed by using the financial and statistical techniques like ratio analysis, mean and chi-square tests.

RESULTS AND DISCUSSION
Current Financial Performance: Table-1 represents the current financial performance, which is measured with the help of current and quick ratios. The current ratio is 1.46 during 2012-13. It has increased to 1.62 during 2013-14; it has shown a consistent trend during the next two years with a ratio of 1.53. Finally it has reached to 1.61 during 2016-17. The average current ratio over the period of study was 1.55 which is below the standard i.e. 2:1.

HYPOTHESIS
H_0 = Current financial performance do not differ significantly between the years.

H_A= Current financial performance differ significantly between the years.

Table-1: Analysis of Current Financial Performance (Figures in lakhs)

Year	2012-13	2013-14	2014-15	2015-16	2016-17	Average
Current Assets	1335.74	1589.04	2056.68	1988.67	1958.44	1785.72
Current Liabilities	916.57	979.88	1347.83	1301.53	1216.84	1152.53
Current Financial Performance	1.46	1.62	1.53	1.53	1.61	1.55

Degrees of freedom = 4, Level of significance = 5 %

ISSN 2394 - 7780

From the analysis it is clear that the critical value of chi-square test (9.49) is larger than the calculated value (0.01). Hence, the null hypothesis is accepted. We may conclude that current financial performances do not differ significantly between the years.

Liquidity Position: Table-2 represents liquidity position of the company, which is measured with the help of quick assets to current liabilities. The quick ratio is 1.11 during 2012-13; it has increased to 1.21 during 2013-14. It has shown a decreasing trend during 2014-15 and 2015-16 with a ratio of 1.04 and 1.03. It has shown increasing trend for the year 2016-17 and the average quick ratio for the study period was 1.09, which is a good sign for the company.

HYPOTHESIS

H_0 = Liquidity position do not differ significantly between the years.

H_A= Liquidity position differ significantly between the years.

Table-2: Analysis of Liquidity Position (Figures in lakhs)

Year	2012-13	2013-14	2014-15	2015-16	2016-17	Average
Quick Assets	1017.79	1184.96	1395.79	1342.07	1331.09	1254.34
Current Liabilities	916.57	979.88	1347.83	1301.53	1216.84	1152.53
Liquidity Position	1.11	1.21	1.04	1.03	1.09	1.09

Degrees of freedom = 4, Level of significance = 5 %

From the analysis it is clear that the critical value of chi-square test (9.49) is larger than the calculated value (0.02). Hence, the null hypothesis is accepted. We may conclude that liquidity position do not differ significantly between the years.

Profitability Performance: Table-3 represents profitability performance of the company, which is examined with the help of net profit ratio. The net profit margin is Rs. 0.19 lakhs during 2012-13; it has shown a decreasing trend and uniformity for the next three years from 2013-14 to 2016-17 with Rs. 0.07 lakhs. The average net profit margin for the study period was Rs.0.09 lakhs.

HYPOTHESIS

H_0 = Profitability performance do not differ significantly between the years.

H_A= Profitability performance differ significantly between the years.

Table-3: Analysis of Profitability Performance (Figures in lakhs)

Year	2012-13	2013-14	2014-15	2015-16	2016-17	Average
Net Profit	520.09	174.19	195.30	222.41	219.81	266.36
Net Sales	2778.81	2389.71	2917.18	3109.88	3117.46	2862.60
Profitability Performance	0.19	0.07	0.07	0.07	0.07	0.09

Degrees of freedom = 4, Level of significance = 5 %

From the study it is clear that the critical value of chi-square test (9.49) is larger than the calculated value (0.13). Hence, the null hypothesis is accepted. We may conclude that Profitability performance do not differ significantly between the years.

Efficiency of Total Assets: Table-4 represents the efficiency of total assets, which is measured by using a ratio of sales to total assets. The return on total assets is Rs.1.76 lakhs during 2012-13. It has shown a decreasing trend for the next two years with Rs. 1.32 and 1.29 lakhs. For the next two years i.e. 2015-16 & 2016-17 showed an increasing trend with Rs. 1.44 and Rs.1.48 lakhs. Hence, the average return on total assets over the period of study was Rs. 1.44 lakhs.

HYPOTHESIS

H_0 = Efficiency of total assets do not differ significantly between the years.

H_A= Efficiency of total assets differ significantly between the years.

ISSN 2394 - 7780

Table-4: Analysis of Total Assets efficiency (Figures in lakhs)

Year	2012-13	2013-14	2014-15	2015-16	2016-17	Average
Net sales	2778.81	2389.71	2917.18	3109.88	3117.46	2862.60
Total Assets	1582.80	1806.46	2252.82	2162.86	2109.82	1982.95
Efficiency of Total Assets	1.76	1.32	1.29	1.44	1.48	1.44

Degrees of freedom = 4, Level of significance = 5 %

From the study it is clear that the critical value of chi-square test (9.49) is larger than the calculated value (0.10). Hence, the null hypothesis is accepted. We may conclude that Efficiency of total assets do not differ significantly between the years.

Solvency capacity: Table-5 represents solvency capacity, which is measured with the help of debt to equity. The debt equity is 0.35 during 2012-13. It has shown an increasing trend for the next two years i.e. 2013-14 & 2014-15 with 0.46 and 0.70. It has shown uniformity during the next two years i.e. 2015-16 and 2016-17 with 0.42. Hence, the average solvency ratio for the period of study was 0.47.

HYPOTHESIS

H_0 = Solvency capacity do not differ significantly between the years.

H_A= Solvency capacity differ significantly between the years.

Table-5: Analysis on Solvency Capacity (Figures in lakhs)

Year	2012-13	2013-14	2014-15	2015-16	2016-17	Average
Debt	172.22	262.26	374.04	255.24	264.91	265.73
Equity	494.00	564.32	530.95	606.09	628.07	564.69
Solvency Capacity	0.35	0.46	0.70	0.42	0.42	0.47

Degrees of freedom = 4, Level of significance = 5 %

From the analysis it is clear that the critical value of chi-square test (9.49) is larger than the calculated value (0.15). Hence, the null hypothesis is accepted. We may conclude that Solvency capacity do not differ significantly between the years.

FINDINGS AND CONCLUSION

Financial performance of the Limenaph Chemicals Private Limited was evaluated with the help of current ratio, quick ratio, net profit ratio, total assets turnover ratio and debt-equity ratio. Current financial performance, liquidity position, profitability performance, efficiency of total assets and solvency capacity do not differ significantly between the years. Current financial performance, liquidity position, efficiency of total assets and solvency of the company is slightly fluctuating over the period of study where as the profitability is stable. Hence, the overall financial performance of Limenaph Chemicals Private Limited is not up the mark. The company has to make appropriate initiatives financial strategies to improve profitability and financial performance.

REFERENCES

1. Alhassan Musah (2018). Financial Management Practices, Firm Growth and Profitability of Small and Medium Scale Enterprises (SMEs). Information Management and Business Review. ISSN: 2220-3796. Vol. 10, Issue 3. pp.25-37.
2. Ashish Kumar, Vikas Batra and S.K.Sarma (2009), Micro, Small and Medium Enterprises in India: Challenges, Issues in the current scenario. International Conference on Technology and Business Management. Vol.5, Issue.2.
3. Garg, Ishu and Walia, Suraj (2012), Micro, Small and Medium Enterprises (MSMEs) in post reform India: status and performance, International Journal of Latest Trends in Engineering and Technology, Vol.1, Issue 3, pp.134-141.
4. Hemanta Saikia (2012). Measuring Financial Performance of Small Scale Industries Some Evidences from India. Journal of Applied Economics and Business Research. ISSN: 1927-033X. Vol. 2, Issue 1. Pp.46-54.
5. Kinyua, A (2014),), Factors Affecting Financial Performance of Small and Medium Enterprises in the Jua Kali Sector in Nakuru Town, Kenya. IOSR Journal of Business and Management. Vol.16, Issue.1. pp.80-93.

ISSN 2394 - 7780

6. Priscilla Nyanchama Ombongi and Wei Long (2018), Factors Affecting Financial Performance of Small and Medium Enterprises (SMEs): A case of Manufacturing SMEs in Kenya. International Journal of Research in Business Studies and Management, Vol.5, Issue.1. pp.37-45.
7. P. Hari Kumar, (2015), Financial Performance of small scale Enterprises: A case study of Bangalore rural district of Karnataka. Abhinav International Monthly Referred Journal of Research in Management & Technology. ISSN: 2320-0073. Vol.4, Issue 8.
8. P.Prakash Babu, Murugan Ramu (2018), A study on Financial Performance Evaluation of Small Scale Industry. International Journal of Pure and Applied Mathematics. ISSN: 1314-3395. Volu.119, Issue 17.pp.467-476.
9. Rufo R. Mendoza, (2015), Financial Performance of Micro, Small and Medium enterprises (MSMEs) in the Philippines, International Journal of Business and Finance Research Vol. 9, Issue . 4, ISSN: 1931-0269 (print) ISSN: 2157-0698 (online). pp. 67-80.
10. Selvarani,C (2013), Financial Performance of Sundaram Clayton Limited. International Academic Research Journal of Economics and Finance. Vol.2, Issue.2. pp.30-35.

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

EFFECT OF CADMIUM ON SEED GERMINATION AND EARLY SEEDLING GROWTH OF TWO DIFFERENT GENOTYPES OF CHICKPEA (*CICER ARIETINUM* L.)

Sayyada Bushra, Zeenat Mushtaq and Shahla Faizan
Environmental Physiology laboratory, Department of Botany, Aligarh Muslim University, Aligarh

ABSTRACT
An experiment was performed to evaluate the Cadmium toxicity on seed germination and seedling growth of chickpea (Cicer arietinum L.) The ecotoxicological effects of four experimental concentrations of cadmium (25, 50, 75 and 100 mg/L) and control (Deionized water) were evaluated. The inhibition in germination and growth parameters caused by cadmium concentration was concentration dependent. Moreover, the reduction in seedling length, seedling biomass and seedling fresh weight were also recorded with increasing cadmium concentration. The increasing cadmium concentration resulted in progressive increase in percent phyto-toxicity and seed vigour index (VI). Herein, the outcome of this study was that chickpea genotype BG-1053 proved tolerant and BG-372 proved sensitive to cadmium stress.

Keywords: Stress; tolerance; inhibition rate; cadmium concentration; chickpea; seed vigour index.

INTRODUCTION
Cadmium (Cd) is one of the most toxic heavy metal that has no known function. Presence of Cd in agricultural soil affects the plant by inducing complex changes at biochemical and physiological level. General symptoms of Cd stress are stunted growth, leaf chlorosis and necrosis. Presence of excess amount of Cd can stimulate the formation of free radicals and reactive oxygen species, and causes oxidative stress in plants. Cd is highly carcinogenic which is reaches to the human diet through the food chain and affect the health (Wagner GJ, 1993). Contamination of land with Cd is increases due to sludge of urban composts, fertilizers, Zink batteries and metal smelting industries (McGrath et al., 2001; Ravees et al., 2000).

Chickpea is one of the important legumes which is grown for its high nutritional value due presence of large amount of dietary proteins along with proteins chickpea also contain good amount of fibres, carbohydrates and fats. It is the second main source of protein in vegetarian diets.

In the present study we have studied the performance two chickpea genotypes under Cd stress, and to select the tolerant genotype over Cd stress because it is a reasonable approach.

METHOD AND MATERIAL
Seeds of 2 cultivars BG-372 and BG-1053 of *Cicer arietinum* L. were collected from IARI Pusa New Delhi, India. The germination test to verify seed viability was performed during the winter season. Seeds are disinfectified by treating with a solution of sodium hypochlorite (0.5%) for 10 minutes and then washed with distilled water. Three replicates with 25 seeds each were seeded in 150 mm Petri plates with two sheets of germitest paper moistened with 6 mL of distilled water. Before seedling seeds are treated with different concentrations of Cd. Seed were sown in 150 mm diameter Petri plates to germinate on double layer germination paper (germitest, sterilized in an autoclave at 120ºC for 20 min.). The paper was moistened with cadmium solution at concentrations 25, 50, 75 and 100 $CdCl_2$ (mg $CdCl_2$/kg soil). Cadmium solutions were prepared from $CdCl_2$. A Petri plate with only deionised water for paper moistening was used for the variance control.

Measurements are taken after 15 days, from sowing. Laboratory studies were performed under controlled conditions.

STUDIED CHARACTERS
After 15 days ten seedlings were selected from each replicates and then seedlings were evaluated as follows:

1. Germination Percentage (GP): according to the following equation

(GP) = Number of germinated seed / Total Number of seed tested 100.

2. Percent Phyto-toxicity: Percent Phyto-toxicity was calculated by using the formula of Ray and Banerjee [1981].

Percent Phyto-toxicity = Root length of control – Root length of test x 100 / Root length of control.

3. Vigour index (VI): Seedling vigour index was calculated, according to the formula used by Hossein and Kasra (2011):

ISSN 2394 - 7780

(VI) = Germination % × Seedling dry weight.

4. Seedling length (cm).

5. Seedling fresh weight (mg).

6. Shoot dry weight (mg).

Statistical Analysis
All obtained data were statistically analyzed according to the technique of analysis of variance (ANOVA) by using SPSS computer package. Least significant different (LSD) was used for multiple comparison at $p<0.05$ level of probability.

RESULTS AND DISCUSSION

An inhibitory affect of Cd was observed on seed germination and on seedling growth as compared to control with increasing Cd concentration. Germination percentage of chickpea was adversely affected by the Cd, and both the genotypes showed reduction but BG-1053 showed minimum reduction of 48.4% while BG-372 showed maximum reduction of 81.74%, at highest level of Cd i.e. 100mg/kg soil (Fig.1), whereas level of percent phyto-toxicity was increased with increasing concentration of Cd. Maximum increase 79.24% was showed by BG-372, while BG-1053 showed minimum increase of 69.44 highest level of Cd i.e. 100mg/kg soil (Fig.2).

Seed vigour index showed declined level on increasing Cd concentration. The seed vigour index of BG-1053 showed minimum reduction of 57.95%, while BG-372 showed the maximum reduction in seed vigour index, of 70% at highest level of Cd i.e. 100mg/kg soil (Fig.3).

The seedling length decreased with the increasing concentration of Cd. The seedling length of BG-1053 showed minimum reduction of 37%, while BG-372 showed the maximum reduction of 60% at highest level of Cd i.e. 100mg/kg soil (Fig.4).

The seedling fresh and dry weight showed the similar pattern of reduction, BG-1053 showed minimum reduction in seedling fresh and dry weight by 32.6%and 32% respectively while BG-372 showed maximum reduction in seedling fresh and dry weight by 53.6% and 56.4% respectively, at highest level of Cd i.e. 100mg/kg soil (Fig.5 & 6).

Seed Germination is critical phase of the plant life cycle [Vange et al., 2004]. We have investigated that Cd affected the germination and early growth stages of chickpea, maximum impact was found at highest level of Cd (100 mg/kg). This reduction is may be due to the presence of excess concentration of cadmium, which is responsible for producing toxic effects, and reduced the plant growth and development. Results of this study are supported from the previous studies by other researchers (Shafiq M, Iqbal MZ 2005; Jamal et al., 2006; Shafiq et al.; 2008; Rahman et al. 2010; Houshmandfar and Moraghebi, 2011; Faizan S. et al., 2013).

The reduction in seedling length is may be due to the reduced mitotic cell (Goldbold and Kettner, 1991; Lerda, 1992; Sharifah and Hishashi, 1992). Reduction in seedling length of Cd treated chickpea is may also due to reduction in meristematic cells and some enzymatic activities get affected, hence the food did not reach to the seedling, ultimately seedling growth were affected.

CONCLUSION

The results of this study indicated that the metals Cd had different effects on seed germination and early seedling growth of chick pea. This study also showed that a low Cd concentration had low reduction in seed germination and seedling growth of chickpea. However, the higher Cd concentration had more significant reduction in germination parameters. Among genotypes BG-1053 performed better as compare to BG-372, BG-1053 proved Cd tolerates genotype whereas BG-372 showed sensitiveness towards Cd stress.

ACKNOWLEDGMENT

The authors are deeply thankful to Prof. Nafees Ahmad Khan, Chairman, Department of Botany, A.M.U., Aligarh for providing necessary facilities for carrying out this research and to University Grant Commission (UGC), New Delhi India.

REFERENCES

1. Faizan, S., Haneef, I., Kausar, S., & Perveen, R. (2013). Germination and Seedling Growth of Coriandrum sativum L . Under Varying Levels of Mixed Cadmium and Copper Germination and Seedling Growth of Coriandrum sativum L . Under Varying Levels of Mixed Cadmium and Copper, (September). https://doi.org/10.5958/j.2231-1742.2.1.008.

ISSN 2394 - 7780

2. Goldbold DL, Kettner C [1991]. Lead influences on root growth and mineral nutrition of Picea abies seedling, Plant Physiology. 139: 95–99.

3. 33. Hossein AF, Kasra M (2011). Effect of Hydropriming on Seedling Vigour in Basil (Ocimum Basilicum L.) Under Salinity Conditions. Adv. Environ. Biol. 5(5):828-833

4. Houshmandfar A, Moraghebi F [2011]. Effect of mixed cadmium, copper, nickel and zinc on seed germination and seedling growth of safflower, Afr. J. Agric. Res. 6(5): 1182-1187.Iqbal MZ, Rahmati K [1992]. Tolerance of Albizia lebbeck to Cu and Fe application, Ekologia (CSFR). 11: 427–430.

5. Jamal SN, Iqbal MZ, Athar M [2006]. Effect of aluminum and chromium on the growth and germination of mesquite (Prosopis juliflora (Swartz.) DC), Internat Environ Sci Technol. 3: 173–176.

6. Kabir M, Iqbal MZ, Shafigh M, Faroogi ZR [2008]. Reduction in germination and seedling growth of Thespesia populnea L., caused by lead and cadmium treatments, Pak J Bot. 40(6): 2419–2426.

7. Lerda D [1992]. The effect of lead on Allium cepa, Mutation Research. 231: 80–92.

8. McGrath, S.P., Zhao, F.J., and Lombi, E., Plant and Rhizosphere Processes Involved in Phytoremediation of Metal? Contaminated Soils, Plant Soil, 2001, vol. 232, pp. 207–214.

9. Ray M, Banerjee S [1981]. Detection of phytotoxicity in irrigation water passing through an industrial belt of west Bengal, Proc.VI Int Conf Women Engineers and Scientist. 59–65.

10. Reeves, R.D. and Baker, A.J.M., Metal?Accumulating Plants, Phytoremediation of Toxic Metals Using Plants to Clean up the Environment, Raskin, I. and Ensley, B.D, Eds., New York: John Wiley and Sons, 2000, pp. 193– 230.

11. Vange V, Hevchand I, Vandvik V [2004]. Does seed mass and family affect germination and juvenile performance in Knautia arvensis? A study using failure time methods, Acta Oecol. 25(3): 169–178.

12. Rahman Khan M, Mahmud Khan M [2010]. Effect of varying concentration of nickel and cobalt on the plant growth and yield of chickpea, Australian J Basic and Appl Sci. 4(6): 1036– 1046.

13. Sharifah BA, Hishashi O [1992]. Effect of lead, cadmium and zinc on the cell elongation of Impatiens balsmina, Environ Experi Bot. 32: 439–448.

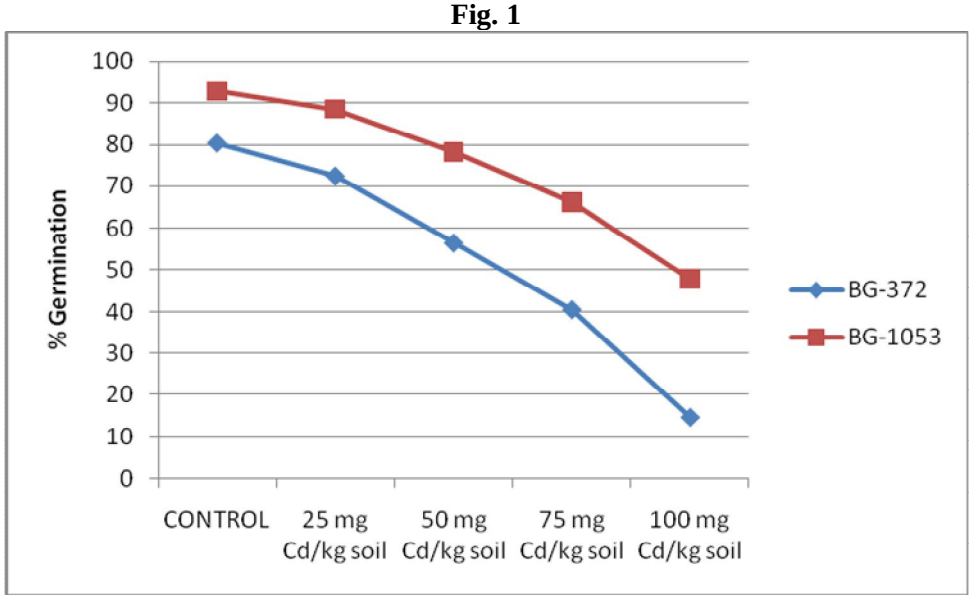
14. Shafiq M, Iqbal MZ [2005]. Tolerance of peltophorum pterocarpum D.C. Baker Ex K. Heyne seedlings to lead and cadmium treatments, Journal of New Seeds. 7: 83–94.

15. Shafiq M, Iqbal, MZ, Athar M [2008]. Effect of lead and cadmium on germination and seedling growth of Leucaena leucocephala. J Appl Sci Environ Manage. 12(2): 61–66.

16. Wagner GJ [1993]. Accumulation of cadmium in crop plants and its consequences to human health, Adv Agron. 51: 173–212.

FIGURES

Fig. 1



ISSN 2394 - 7780

Fig.2

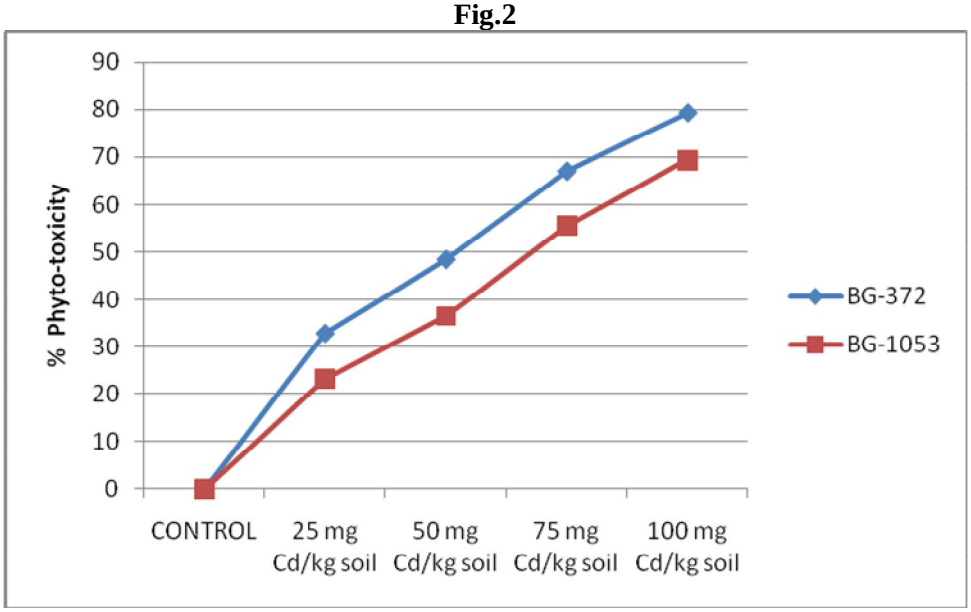


Fig.3

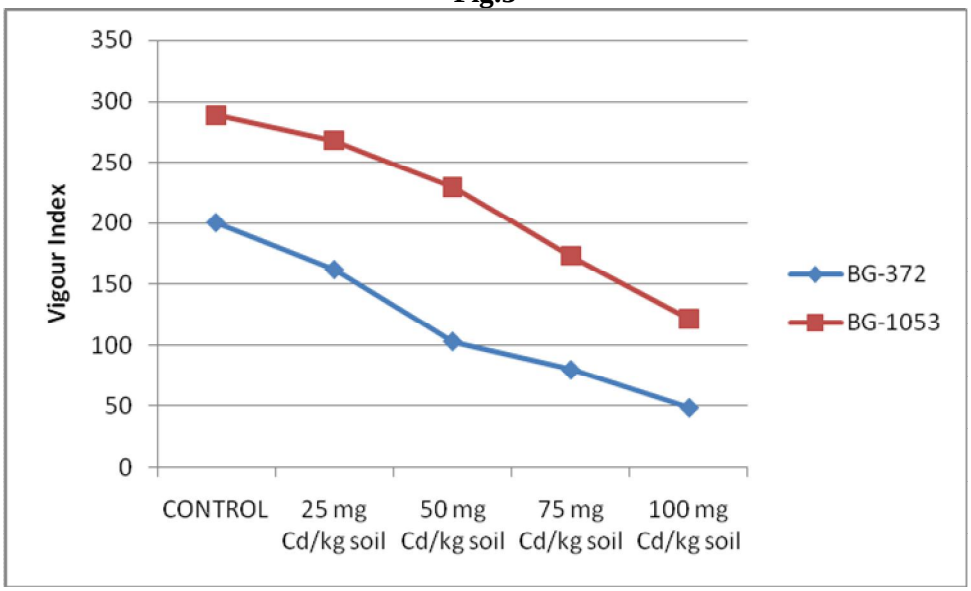


Fig.4

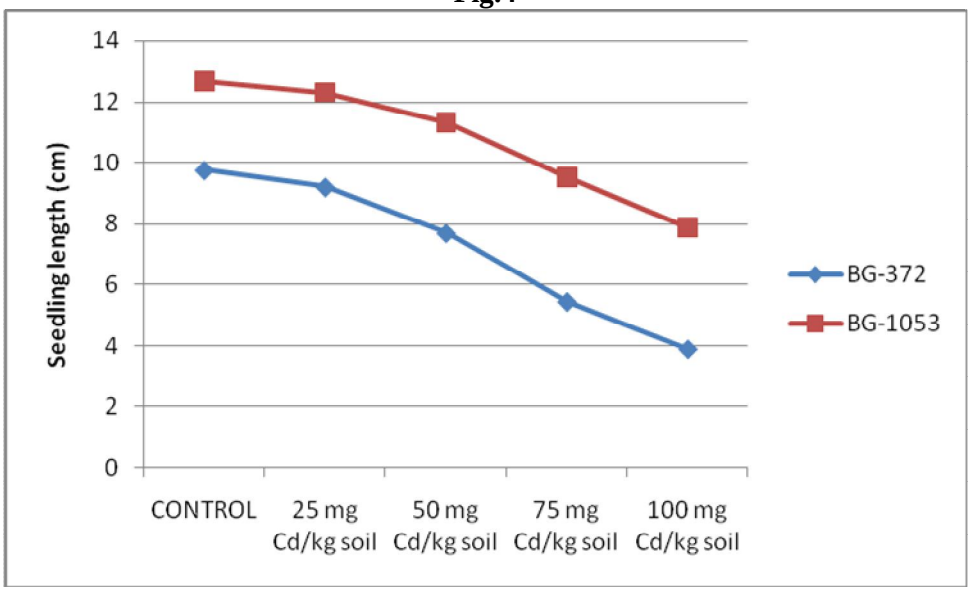


Fig. 5

ISSN 2394 - 7780

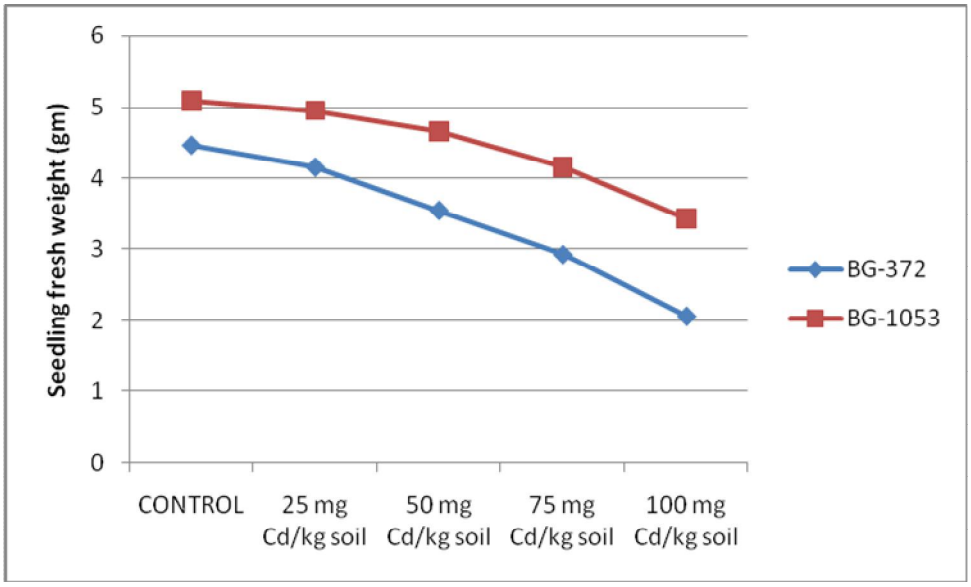


Fig. 6

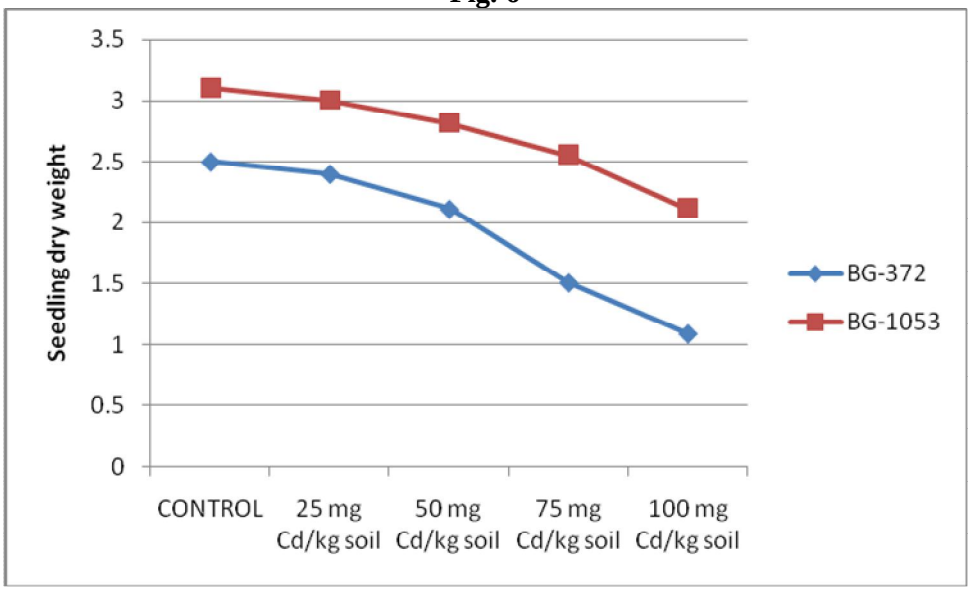


Figure 1: Shows the effect of different concentrations of Cd on germination percentage in two different chickpea genotypes.

Figure 2: Shows the effect of different concentrations of Cd on percent Phyto-toxicity in two different chickpea genotypes.

Figure 3: Shows the effect of different concentrations of Cd on vigour index in two different chickpea genotypes.

Figure 4: Shows the effect of different concentrations of Cd on seedling length in two different chickpea genotypes.

Figure 5: Shows the effect of different concentrations of Cd on seedling fresh weight in two different chickpea genotypes.

Figure 6: Shows the effect of different concentrations of Cd on seedling dry weight in two different chickpea genotypes.

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

GROWTH AND SPREAD OF TOURISM IN INDIA

Dr. P. Raja

ABSTRACT
The Tourism Industry of India Flourishes Because of her Rich Heritage, Mother India Hugs His childrens with Historical culture , Rich Flora and Fauna This article illustrates The various period where the Tourism Spread and It analyses the Government policies towards Tourism Development ,the Organisations involved in developing Indian Tourism, Flow of Foriegn Tourist Arrival in India it is The Most Important Factor which has been clearly Indicated In the article regarding Foriegn Exchange Earnings in India

Keywords: Tourism Development, Ancient Tourism, Cultural Tourism, Tourist Ngo's, FTA Arrivals, Foriegn Exchange Earning revenues, Government Policy, ITDC, Historical perspective, Growth Sector

India, because of its rich cultural traditions, historical growth and development is closely associated with our ancient background and variegated geographical condition, as one of the major tourists attractions in this part of the world. "Fortunately, India has been the nerve centre of world's civilization." India not only became the heart land of 'ARYAVARTA' and repository of Asian thought but the seat of mighty powers like Delhi, Agra and Jaipur. Some of these ancient cities had land route connecting with West and East Asia. From the mighty Mauryas to the Great Mughals, kingdom and empires usually grew rich.

Middle India (Madhyadesha) with Ganga and Yamuna as the corridor and the Plateau of Malwa has helped in resistance against the invaders. This has resulted in some of the world most popular religious monuments and temples which have become tourist's attractive sites not just inside India but also from other parts of the world.[1] *Besides, this has enriched culture the unique traditions, rituals and festivals constitute major tourism places. In fact, cultural tourism in India began long before commercial tourism which had its birth in European countries.*

In fact, tourism is growing rapidly throughout the world. It has become India's largest foreign exchange earning industry. With the progress of Science and technology, the likes and dislikes of the potential tourists have also undergone great change. So also for hotels and tourist lodges which provide accommodation and comforts to the tourists and for retail dealers who sell other items.

HISTORICAL PERSPECTIVE OF TOURISM

Indian tourism as an industry may be over 2000 years old.[2] The older form of tourism takes its character from the religion whereas the latter is an economic or socio-economic activity, born out of leisure civilization and a "by-product of Interaction of forces techno-logical and sociological." Though the India's overall backwardness, particularly in the secondary and territory sectors, has been a great deterrent to the promotion of tourism, yet her unique feature, historicity, rich heritage of culture and religion, provide a sound base for the growth of tourism.

Historically the development of tourism can be studied by classifying it into four major time periods;

- Development of Tourism in Ancient period
- Development of Tourism during Medieval period
- Development of Tourism during British Rule
- Development in the Post independence Era,

ANCIENT PERIOD

This period is from the beginning of the advent of the Aryan (and even before that) to the coming of early, Muslim: in India in the 11th century this long period of ancient time is full of religious and cultural renaissances and this witnessed an unprecedented growth of religious tourism, particularly Hindu, Buddhist and Jain. The early period marked the emergence of Brahamanical society, responsible for the institution of pilgrimage and rituals and Hindu way of life. It was in this period that India has become the main destination for pilgrims and devotees from all over Asia.

The second phase (6th century to 3rd century B.C.) marked the revolt against the rigid Brahamanical society. This intellectual and religious renaissance, however, synchronized with the great spiritual ferment in the world and culminated in the rise of Jainism and Buddhism in India.[3] This led to not only the growth of religious tourism but also the development of art and architecture which led to a new form of tourism which was more related to art and architecture and culture. Many historic and artistic places evoke the curiosity of the tourists to visit these places.

ISSN 2394 - 7780

MEDIEVAL PERIOD

The early Muslims period proved an era of set-back to tourism growth in Northern India, but it was however, substantially made up by the later Muslims, chiefly the Mughals, They were responsible for renaissance in literature, painting, architecture and handicrafts. Even Babar in his short reign constructed "Ornamental gardens, pleasances, mosque and well." The religious movement of Medieval India could be seen at its best in Delhi and Agra. The Taj of Agra is the masterpiece of Indo-Islamic architecture and it, indeed, formed the veritable culmination of artistic synthesis, Specially Akbar and Shahjahan who were prolific builders. This was a period of great dimensions for the development and growth of tourism in the country: Many rest houses were also built by the Mughals and transport also flourished. Sher Shah's construction of grand trunk high-way was a great land work in road-transport.[4] This period also witnessed brisk business and trade relations with neighbouring countries of Asia and Europe which encouraged mobility of the people, especially tourist traffic.

BRITISH PERIOD

This was also a period of industrial urbanization which was speeded up by the introduction and expansion of rail network. Establishment of cantonments and military bases stimulated urban growth, particularly at Delhi, Agra, Calcutta, Madras and Bombay. The period certainly revolutionised he pre-existing non-industrial cities in their land use patterns. At this time all types of journal and guides were available for the help of tourist. Most of the hill stations and sea resorts were modified for the entertainment of Tourist.[5] International tourism to India during British days was essentially confined to visitors from the United Kingdom and few from European countries.

The British people did not encourage the inflow of tourists from Afro-Asian countries. Tourism was completely neglected from the Gulf countries during British regime. It was in the beginning of the nineteenth century that tourist industry received considerable encouragement in this direction. But in the meantime both World War I and ll gave a great set-back in the movement of people, specially, from one country to another regarding tourism and holiday making. In this period first step was taken in 1945, when the government of India set up a Committee under the Chairmanship of Sir John Sargent, the then advisor to the Government. The Committee submitted its report in 1946 and suggested different guidelines for developing tourist traffic. However, after independence Indian Government formulated guidelines for the establishment of tourist organisation in the country.

The Indian tourism and hospitality industry has emerged as one of the key drivers of growth among the services sector in India. The third-largest sub-segment of the services sector comprising trade, repair services, hotels and restaurants contributed nearly US$ 187.9 billion or 12.5 per cent to the Gross Domestic Product (GDP) in 2014-15, while growing the fastest at 11.7 per cent Compound Annual Growth Rate (CAGR) over the period 2011-12 to 2014-15.[6] Tourism in India has significant potential considering the rich cultural and historical heritage, variety in ecology, terrains and places of natural beauty spread across the country. Tourism is also a potentially large employment generator besides being a significant source of foreign exchange for the country.

Government of India launched Tourist Visa on Arrival (TVoA) enabled by Electronic Travel Authorization (ETA), presently known as e-Tourist Visa scheme on 27th November 2014. At present e-Tourist Visa facility is available for citizens of 113 countries (including 36 countries for which the facility was extended on 15th August, 2015) arriving at 16 Airports in India (includes 7 airports added from 15th August, 2015). In the month of August, 2015 total of 22,286 tourist arrived on e-Tourist Visa as compared to 2,705 during the month of August, 2014 registering a growth of 723.9%.[7]

During January- August, 2015 a total of 1,69,976 tourists arrived on e-Tourist Visa as compared to 17,120 during January-August, 2014 registering a growth of 892.9%. This high growth may be attributed to introduction of e-Tourist Visa for 113 countries as against coverage of earlier TVoA scheme for 12 countries.[8]

The Indian government has realised the country's potential in the tourism industry and has taken several steps to make India a global tourism hub. Some of the major initiatives taken by the Government of India to give a boost to the tourism and hospitality sector of India are as follows: The Union Cabinet has approved the signing of Memorandum of Understanding between the Ministry of Tourism of India and the Ministry of Trade The Indian tourism and hospitality industry has emerged as one of the key drivers of growth among the services sector in India. The third-largest sub-segment of the services sector comprising trade, repair services, hotels and restaurants contributed nearly US$ 187.9 billion or 12.5 per cent to the Gross Domestic Product (GDP) in 2014-15, while growing the fastest at 11.7 per cent Compound Annual Growth Rate (CAGR) over the period 2011-12 to 2014-15. [9]

ISSN 2394 - 7780

Tourism in India has significant potential considering the rich cultural and historical heritage, variety in ecology, terrains and places of natural beauty spread across the country. Tourism is also a potentially large employment generator besides being a significant source of foreign exchange for the country. The industry is expected to generate 13.45 million jobs! across sub-segments such as Restaurants (10.49 million jobs), Hotels (2.3 million jobs) and Travel Agents/Tour Operators (0.66 million).[10] The Ministry of Tourism plans to help the industry meet the increasing demand of skilled and trained manpower by providing hospitality education to students as well as certifying and upgrading skills of existing service providers.

The number of Foreign Tourist Arrivals (FTAs) has grown steadily in the last three years reaching around 7.103 million during January–November 2015 (4.5 per cent growth). The number of FTAs in November 2015 was 815,000, registering an increase of 6.5 per cent over November 2014. Foreign Exchange Earnings (FEEs) from tourism during January-November 2015 were Rs 1, 12,958 crore (US$ 16.94 billion), registering a growth of 1 per cent over same period last year. The number of tourists arriving on e-Tourist Visa during the month of October 2015 reached a total of 56,477 registering a growth of 1987.9 per cent or ~21 times as compared to 2,705 tourists in October 2014. Online hotel bookings in India are expected to double by 2016 due to the increasing penetration of the internet and smart phones.[11]

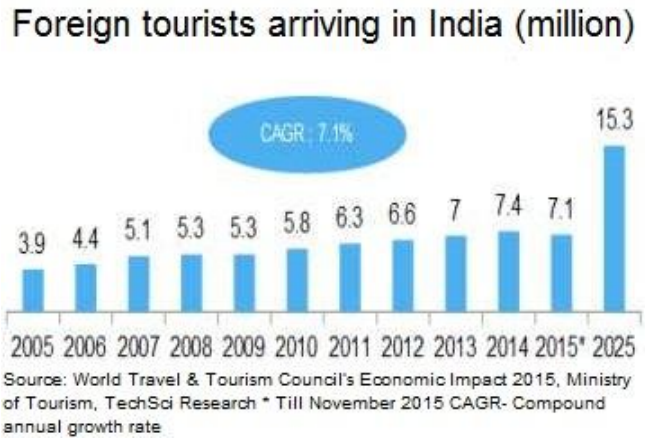


TABLE: FOREIGN TOURIST ARRIVALS (FTA) IN INDIA, 1998-2014

Year	FTAs in India (in millions)	Percentage (%) change over the previous year
1998	2.36	-0.7
1999	2.48	5.2
2000	2.65	6.7
2001	2.54	-4.2
2002	2.38	-6.0
2003	2.73	14.3
2004	3.46	26.8
2005	3.92	13.3
2006	4.45	13.5
2007	5.08	14.3
2008	5.28	4.0
2009	5.17	-2.2
2010	5.78	11.8
2011	6.31	9.2
2012	6.58	4.3
2013	6.97	5.9
2014	7.68	10.2
2015	8.02	4.5

Source:(i) Bureau of Immigration, Govt. of India, for 1998-2014 (ii) Ministry of Tourism, Govt. of India, for Jan-June, 2015.

GOVERNMENT POLICY TOWARDS TOURISM IN INDIA

Tourism in country really came of age when the national policy began laying stress on the sector from the Third Five Year Plan during which the plan outlay for developing tourism was raised to RS. 8.00 crores, from a mere Rs. 1.58 crores during the Second Five Year Plan. Increasing public sector 19 outlays have been allocated to

ISSN 2394 - 7780

tourism during the successive five-year plans, Rs. 195 crores during the Sixth Plan and Rs. 345 crores during the Seventh Plan. The outlay for the Eighth Plan period has been fixed at a substantially higher level of Rs. 804.10 crores. A tourism policy was formulated and presented to Parliament for the first time only In November 1982. This policy was, unfortunately, more a statement of purpose than a concrete plan, which was operationalised.

The Sixth Plan document spelt out the objectives of the tourism but it was far from being a comprehensive policy document or an action plan for the development or promotion of tourism in the country. The Seventh Plan outlined a long-term perspective on the development of tourism. It also advocated granting industry status to tourism, clear demarcation of the roles of the private and public sector and encouragement of investment in the public sector exploiting tourism potential to support the local arts and handicrafts sector and to promote national integration. A significant milestone in the evolution of a tourism policy was the comprehensive report presented by the National Committee on Tourism in May 1988, which provided the basis of a long-term perspective plan for tourism.

During the Seventh Plan several new policy initiatives were taken to develop the tourism sector on an accelerated growth path. Tourism was accorded the status of an Industry. At present, 15 states and 3 Union Territories have declared tourism as an Industry. In addition, four states have declared hotels as an Industry. Consequently, a number of incentives have been provided to private entrepreneurs for investment in tourism activities. The future growth, of tourism will be achieved through private initiative. The state can contribute to tourism by planning broad strategies of development, provision of fiscal and monetary incentives to catalyze private sector Investments and devising effective regulatory and supervisory mechanism to protect the interest of the industry, the consumer and the environment. In the Eighth Plan, the "Special Tourism Areas" concept is being adopted, wherein a few tourist areas with high tourism potential will be identified and provided with full-fledged infrastructure facilities.[12]

ORGANISATIONS INVOLVED DEVELOPING TOURISM

The various organisations engaged in the development of tourism are : Department Of Tourism It is responsible for promotion of India as a tourist destination, development of tourism Infrastructure and facilities in the country, and performing regulatory functions in the field of tourism. It has four regional offices at Delhi, Mumbai, Kolkata, and Chennai and a sub-regional office at Guhawati. The regional offices supervise the working of other tourist offices situated at different places throughout the country. Tourist offices are also located at various places abroad. [13]

India Tourism Development Corporation (ITDC). It was established In October 1966. Its activities include;

- Construction, management and marketing of hotels, restaurants and travelers lodges at various places in the country;
- Provision of tourist publicity materials;
- Provision of entertainment facilities in the shape of sound and light shows, music concerts, etc.,
- Provision of shopping facilities in the shape of duty free shops; and
- Provision of consultancy-cum-managerial service in India and abroad.

The Corporation had 31 hotels / travellers lodges with 3762 rooms at the end of 1990-91. Indian Institute of Tourism and Travel Management (ITTM). It was set up in January 1983 with registered office at New Delhi. It offers different level academic courses in tourism and travel management and related areas. It has embarked upon a series of alternative educational courses for supervisory and grass root-level workers of the Industry. Universities in 20 developing countries are sending their faculty members for being trained in ITTM courses. National Council for Hotel Management and Catering Technology. It acts as an apex body to coordinate training and research in hotel and catering management. Its head office is In New Delhi. It is the main agency for planning and monitoring the activities of 15 Institutes of Hotel Management and 15 Food Craft Institutes end ensures uniformity in academic standards 24 and procedure for selection and admission of candidates for various courses conducted by these institutes. Tourism Finance Corporation of India Ltd. (TFCI). This Corporation, sponsored by the Industrial Finance Corporation of India, was set up In April 1988 with Initial seed capital of Rs. 50 crores to provide institutional assistance to tourism projects other than those in the accommodation sector, as the Industrial Finance Corporation of India at concessional rate of Interest was financing these. It started its operations from l-2-1989. In addition to the above mentioned organisations at the Central level, the State governments and Union territories have their own Departments of Tourism, Tourism

ISSN 2394 - 7780

Development Corporations and other Institutions or organisations formed for the purpose of helping the development of tourism industry in their areas. Besides this institutional support, a large number of 25 other agencies, such as the Department of Archaeology, International Airport Authority of India, Indian Airlines, Vayudoot, Indian Railways, Customs Department, Reserve Bank of India, Forest Departments, Handloom and Handicrafts Boards and Corporations and Individual travel agents, hotels and tour operators are engaged in the promotion of tourism in India.[14]

The tourism and hospitality sector is among the top 15 sectors in India to attract the highest Foreign Direct Investment (FDI). The Central Government has given its approval for signing of a Memorandum of Understanding (MoU) between India and Cambodia for cooperation in the field of tourism with a view to promote bilateral tourism between the two countries. Ministry of Tourism has sanctioned Rs 844.96 crore (US$ 142 million) to States and Union Territories for developing tourism destinations and circuits during FY 2014-15, which includes projects relating to Product/Infrastructure Development for Destinations and Circuits (PIDDC), Human Resource Development (HRD), Fairs and Festivals & Rural Tourism. The Heritage City Development and Augmentation Yojana (HRIDAY) action plans for eight missions cities including Varanasi, Mathura, Ajmer, Dwaraka, Badami, Vellankanni, Warangal and Amaravati have been approved by HRIDAY National Empowered Committee for a total cost of Rs 431 crore (US$ 64.7 million). Government of India plans to cover 150 countries under e-visa scheme by the end of the year besides opening an airport in the NCR region in order to ease the pressure on Delhi airport. Under 'Project Mausam' the Government of India has proposed to establish cross cultural linkages and to revive historic maritime cultural and economic ties with 39 Indian Ocean countries. Road Ahead India's travel and tourism industry has huge growth potential. The medical tourism market in India is projected to reach US$ 3.9 in size this year having grown at a CAGR of 27 per cent over the last three years, according to a joint report by FICCI and KPMG. Also, inflow of medical tourists is expected to cross 320 million by 2015 compared with 85 million in 2012.[15] The tourism industry is also looking forward to the expansion of E-visa scheme which is expected to double the tourist inflow to India. Rating agency ICRA its estimates the revenue growth of Indian hotel industry strengthening to 9-11 per cent in 2015-16.[16]

TABLE: FLOW OF FOREIGN TOURISTS TO INDIA

Year	Tourists (Millions)
1964	0.02
1968	0.03
1978	0.15
1988	0.47
2003	0.84
2008	1.34
2010	2.12
2015	1.92
2016	1.96

Source: Report of tourist Development Corporation

It is observed from table that flow of foreign tourist to India during 1964 is 0.02 million. It has increased to 2.21 million during 2010. Using linear trend line, it is estimated that the flow of foreign tourists to India during the year 2015 will be 1.92 million and 1.96 million during the year 2016.

FOREIGN TOURIST ARRIVALS (FTAS) IN INDIA

If we try to analyse the countries from which India has most number of tourists, United States has about 14.5.% of the share while Bangladesh has about 12% and United Kingdom about 11% Srilanka, Canada, Malaysia, France , Australia and Germany have less than 4% of the share in percentage.[17]

TABLE: FOREIGN TOURIST ARRIVALS (FTAS) IN INDIA IN 2014

S.No	Source Country	FTAs (in Millions)	Percentage (%) Share
1	United States	1118983	14.57
2	Bangladesh	942562	12.27
3	United Kingdom	838860	10.92
4	Sri Lanka	301601	3.93
5	Russian Federation	269832	3.51
6	Canada	268485	3.50
7	Malaysia	262026	3.41
8	France	246101	3.20

ISSN 2394 - 7780

9	Australia	239762	3.12
10	Germany	239106	3.11
Total top 10 Country		4727318	61.56
Others		2951781	38.44
Grand Total		**7679099**	100.00

Source:- Bureau of Immigration, Govt. of India

MONTH –WISE FOREIGN TOURISTS ARRIVALS IN INDIA

It is interesting to note that there is a change in tourists arrivals in India month wise . There are two seasons where flow of tourist's arrivals is the greatest. The month between April May June which is general summer all over India and the next season being September, October November which can be categorized as the Autumn season in most of India. In the southern part this time is the winter monsoon time which showers and pleasant weather.[18] These two seasons may be the highest tourist flow seasons in India although this can vary state to state.

TABLE: MONTH-WISE FOREIGN TOURIST ARRIVALS IN INDIA, 2013-2015

Foreign Tourist Arrivals (FTAs) in India				
2013		**2015 (P)**	**Percentage (%) Change**	
2015/2014				
January	720321	790100	5.2	4.3
February	688569	761487	9.7	0.8
March	639530	729636	8.0	5.7
April	450580	539748	18.8	0.8
May	417453	510736	11.4	9.8
June	451223	513427	11.3	2.3
Sub total (Jan-June)	3367676	3845134	10.4 @	3.7

Source: (i) Bureau of Immigration, Govt. of India, for 2013 & 2014 (ii) Ministry of Tourism, Govt. of India for 2015.

FOREIGN EXCHANGE EARNINGS OF INDIA

India earns a sizeable foreign exchange due to the flow of foreign tourists to India. The actual foreign exchange earnings (1990 to 2010) is provided in the table .

TABLE: TOTAL FOREIGN EXCHANGE EARNINGS OF INDIA

Year	Foreign Exchange Earning in Rs (Crores)
1990	32.50
1991	189.60
1992	1166.30
1993	1663.90
1995	1225.00
1996	1300.00
1997	1189.10
1998	1606.60
1999	1866.10
2000	2054.00
2001	1386.00
2002	2612.50
2003	4892.00
2004	6060.00
2005	6070.00
2006	7423.60
2007	9185.90
2008	10417.60
2009	11540.30
2010	12495.60

Source: Economic Survey – 2011.

ISSN 2394 - 7780

From the table , it is inferred that foreign exchange earnings during the year 1990 is Rs.32.50 crores. It has increased to Rs.1663.90 crores during the year 1993. It has decreased to Rs.1130.60 crores during the year 1994; again it has increased to Rs.12495.60 crores during the year 2010. This shows that foreign exchange earnings have fluctuated from 1990 to 2010.[19]

MONTH WISE FOREIGN EXCHANGE EARNING FROM TOURISM IN INDIA

The earning in tourism also varies according to the season and months. November and December and January seem to be the most productive months in terms of foreign exchange earnings while although there is more number of tourists the earning in April, May June is less than that of most other months

TABLE: MONTH-WISE FOREIGN EXCHANGE EARNINGS (FEES) (IN US$ MILLION) FROM TOURISM IN INDIA, 2013-2015

Month-wise Foreign Tourist Arrivals in India, 2013-2015					
Month			Foreign Tourist Arrivals (FTAs) in India		
2013	2014		2015 (P)	Percentage (%) Change	
2014/2013			2015/2014		
January	720321	757786	790100	5.2	4.3
February	688569	755678	761487	9.7	0.8
March	639530	690441	729636	8.0	5.7
April	450580	535321	539748	18.8	0.8
May	417453	465043	510736	11.4	9.8
June	451223	502028	513427	11.3	2.3
July		506427	568871	12.3	
August		486338	575750	18.4	
September		453561	509142	12.3	
October		598095	668398	11.8	
November		733923	765497	4.3	
December		821581	885144	7.7	
Total	6967601	7679099	3845134	10.2	
Sub total (Jan-June)	3367676	3706297	3845134	10.4	3.7

P: Provisional , @ Growth rate over January-June of previous year. Source: (i) Bureau of Immigration, Govt. of India, for 2013 & 2014 (ii) Ministry of Tourism, Govt. of India for 2015.

REASONS FOR INCREASE IN TOURISM IN INDIA

Healthy economic growth and rising income levels: Favourable growth in the Indian economy, rise in middle class population (National Council of Applied Economic Research (NCAER) Study: number of middle class households expected to increase from 31.4 million in 2010 to 113.8 million by 2025-20268) and increasing levels of disposable income with increased affinity for leisure travel are some of the driving forces.

Changing consumer lifestyles: With more than 65 per cent of the Indian population falling in the age group of 15-64 years, Indian travelers are more open to holidays and are keen to explore newer destinations.

Diverse product offerings: Diverse tourism offerings in India such as rural, medical, pilgrimage, adventure and various other forms are driving tourism growth.

Easy finance availability: Increased adoption of credit culture and availability of holidays on Equated Monthly Instalments (EMI) is another growth driver.

Rich natural/cultural resources and geographical diversity: With 28 world heritage sites, 25 bio-geographic zones along with a 7000 km10 long coastline India abounds in natural resources and offers a rich cultural heritage through multiple religions, traditions, fairs and festivals.

Government initiatives and policy support: Rise in FDI in the tourism sector (sector attracted second highest FDI in 2013 at USD 3.2 billion10 as on Feb 2013) is providing fillip to its growth. Policy actions such as 100 per cent FDI, plans for extension of visa on arrival scheme to a larger number of countries and a five year tax holiday for 2, 3 and 4 star category hotels located around UNESCO World Heritage sites10 among others are expected to drive future growth.

Host nation for major international events: India is fast emerging as the preferred nation for hosting of major international events such as the Commonwealth Games held in 2010. Meetings, Incentives, Conventions and Exhibitions (MICE) tourism is on a rise on account of increased business travel in India.

ISSN 2394 - 7780

Visitor profile: With increasing number of women joining the Indian workforce, the number of women business travelers is on a rise (women business travellers approximated at 25 per cent of the total number of travellers in 2011 are set to witness a significant growth of 891 per cent by 2030). Population aged 65 years and above is emerging as an important category of Indian travellers (senior travellers approximated at 1.3 million in 2011, are set to rise to 7.3 million by 2030).

Purpose of travel: While religious and social travel has and is expected to remain the biggest contributor, increased travel has been witnessed in the form of weekend getaways and family visits to foreign destinations.[20]

Diverse offerings: New concepts such as medical, adventure, cruise, rural, golf, wellness, luxury & heritage tourism each with its distinct characteristics and offerings are increasingly playing a pivotal role in attracting tourists. In addition, customised tour packages with offbeat destinations and newer experiences are fast gaining ground.[21]

MAJOR TOURIST STATES OF INDIA BY NUMBER OF TOURISTS

Most states in India are tourists attractive states and have some distinct uniqueness about it. However, there are some states that have become more popular than the rest due to either natural reasons like weather, scenic beauty etc or cultural reasons like better facilities like safety, increase in hotels and restaurants and entertainment etc. The table below shows the rank of states according to the tourists visits and the percentage of the expenditure that the state proposes to increase tourism further.

TABLE: STATE WISE RANK IN TOURISM 2011-2013

State	Rank in 2012	Number of tourist visits (mn) in 2012	CAGR (2008-2012)	Rank improvement (2008-2012)	Tourism spend (INR mn) 2011-12	% of Overall likely state expenditure 2011-12
Andhra Pradesh	1	207	12%	-	106	0.02%
Tamil Nadu	2	188	17%	1	307	0.13%
Uttar Pradesh	3	170	8%	(1)	261	0.06%
Karnataka	4	95	64%	6	2400	0.63%
Maharashtra	5	71	33%	-	4855	1.16%
Madhya Pradesh	6	53	24%	-	727	0.32%
Rajasthan	7	30	0.2%	(3)	281	0.10%
Uttarakhand	8	27	7%	(1)	1111	1.42%
Gujarat	9	25	12%	-	2691	0.71%
West Bengal	10	24	4%	(2)	430	0.19%
Bihar	11	23	17%	-	304	0.14%
Delhi	12	21	47%	4	155	0.10%
Jharkhand	13	20	36%	-	250	0.20%
Punjab	14	19	147%	3	224	0.19%
Himachal Pradesh	15	16	13%	(3)	174	0.52%
Chhattisgarh	16	15	141%	3	479	0.29%
Jammu & Kashmir	17	13	13%	1	1392	2.11%
Kerala	1	11	7%	(5)	1530	1.27%
All India	-	1057	16%	-	23991	0.49%

Source: *Ministry of Tourism, Govt. of India*

Andhra Pradesh has consistently stayed on top of the list during 2008-2012 even with a low level of state expenditure spend towards tourism sector. Being a major pilgrimage destination, it witnessed the highest number of tourist visits in 2012. Availability of good quality infrastructure further supports the growth of tourism. Tamil Nadu is another major pilgrimage destination in the south with major tourist attractions as Chennai, Madurai and Rameshwaram.

Karnataka witnessed the largest increase in rank with increased spend towards tourism sector at 0.63 per cent of the overall likely state expenditure during 2011-12. The effectiveness of its marketing campaign is evident from the fact that its website popularity improved by 7 ranks from 13 in 2009 to 6 in 2011.

Delhi being a key commercial and leisure destination in the country enjoys the necessary infrastructure and high number of tourist visits. Maharashtra, a key commercial and business destination scores well on all infrastructural, economic and demographic parameters with fifth largest number of branded rooms per sq km of area, fifth largest GDP per capita in the country and 83 per cent state literacy rate.

ISSN 2394 - 7780

Gujarat with 0.71 per cent of state expenditure allocated for the tourism sector witnessed a considerable increase in its budgetary allocation proportion. With the success of the Gujarat tourism campaign with the brand ambassador as Amitabh Bachchan and other marketing and promotional activities, Gujarat has improved upon its tourism appeal many fold. Marketing and promotional campaigns such as 'Bioscope: Hindustan Ka Dil Dekho' in 2006, 'Eyes Campaign' and advertisements with hand shadowgraphy with the theme as 'MP ajab hai, sabse gajab hai' in 2010 helped Madhya Pradesh gain position amongst the top 10 tourist states of India.[22] New ad campaigns based on the idea of presenting the state through beautiful, vivid colours in 2013 are expected to further augment the tourism potential of the state.

Rajasthan, West Bengal, Himachal Pradesh, Uttarakhand and Kerala are states that have witnessed decline in their positions as preferred tourist destinations. While an increase in funds allocated towards tourism sector in these states is required, effective implementation of the funds may require careful assessment of the impact of marketing and promotion activities in the state. Other areas requiring consideration are improvements in overall state infrastructure.

While Kerala scores highest on literacy levels, low GDP per capita and low urbanisation levels have had a negative effect on the tourism appeal. However, adequate infrastructure in areas of accommodation and passenger transportation along with the government's focused marketing and promotion activities are expected to help Kerala regain its lost position.

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

MUTATION BREEDING ON *VICIA FABA* – A REVIEW

Akil A. Khan
Department of Botany, Gandhi Faiz-e-Aam College, Shahjahanpur

Mutations are inherited changes in the genetic material which produce new genetic variation that allows organisms to evolve. They have been employed to improve morphological, physiological, disease resistance and quantitative characters including yield and yield contributing traits. Hugo-de Vries in 1901 for the first time used the term mutation for the appearance of a new type in evening primrose *(Oenothera)* plants. He published the book entitled "The Mutation Theory". In this he showed that if humans learn command over origin of mutations, superior strains of plants and animals can be produced. In his first paper, Muller (1927) on 'Artificial trans mutation of gene' hoped that practical breeders need no longer lie on the mercy of the existing limited genetic variability. He found that X-rays considerably enhance mutation rate in *Drosophila.* Success with X-rays was achieved by Stadler (1928a, b) in barley and maize. Indications about the possibility of induction of mutations by the use of chemical mutagens started appearing within a decade after discovery of the phenomenon. The first elaborated report was presented by Auerbach and Robson (1942) who showed that mustard gas (dichloro-ethyl sulphide) could induce chromosomal breaks in *Drosophila.* These studies opened a flood gate to research into the mutagenic effects of a variety of chemicals. In 1969, the joint FAO/IAEA Division started to organize course for plant breeders on the induction and use of mutation and in the same year published first edition of the manual and mutation breeding may, therefore, be justified to consider 1969, as they earth at marked the establishment of mutation breeding as a practical tool available to plant breeder in their endeavors to develop more productive cultivars with better resistance to stresses, pathogens, and pests, and with improved quality characteristics for plant products used as food, feed or industrial raw material. Brock (1970) considers that induced mutations are as an alternative to naturally occurring variations, as the source of germplasm for plants improvement programmes and as an alternative to hybridization and recombination in plant breeding programmes.

2.1. INDUCTION OF MUTATIONS BY HYDRAZINE HYDRATE

Studies the genotoxicity of hydrazine hydrate in different organisms confirmed the induction of reverse gene mutation (de Flora, 1981; Parodi et al., 1981; Bayer, 1989), chromosome aberration (Khursheed et al., 2015; Amin *et al*., 2017), while the carcinogenicity of hydrazine hydrate was confirmed by Steinhoff and Mohr (1988, 1990) and as for mutagenecity hydrazine hydrate induces methylation of guanine into 7- methylguanine and O^6 methylguanine (Leakakos and Shank 1994). There is a certain amount of evidence about the mutagenic action of hydrazine in both prokaryotes and eukaryotes. It was sometimes classified as an inactivating agent with weak mutagenic activity (Fishbeain *et al.,* 1970) but studies with bacterial species suggested that it can fairly be a potent mutagen with little or no toxic effect (Kimballand Hirsch, 1975). A useful review of the earlier work with special emphasis on the chemical basis of mutagenesis of hydrazine was given by Brown *et al.* (1966). Hydrazine was reported to induce a variety of morphological, physiological and colour mutants in several crop plants such as barley (Shangin Berezovsky *et al.,* 1973), Maize (Chandra shekhar and Reddy, 1971), potato (Upadhya *et al.,*1974), rice (Ratho and Jachuck, 1971; Reddy and Reddy, 1972; Reddy *et al.,*1973), tomato (Jain and Raut, 1996; Jain *et al.,* 1969; Raut, 1969; Yakovleva, 1966) and chickpea (Parveen, 2006). In general, hydrazine in these studies appeared to be a successful as the other potent mutagens. However, it appeared to differ in two ways.

i. It produced a number of mutations detectable in M_1 generation where as the other mutagens produced fewer or none,

ii. The spectrum of mutational changes (phenotypic classes) for hydrazine was generally very different from that of other mutagens (Kimball, 1977).

Hydrazine has been reported to react with the pyrimidines in DNA to saturate the 5,6 double bond, especially of thymine from N4-amino cytosine and to open up the pyrimidine ring with consequent loss of pyrimidines from DNA or through intermediate radical reactions including the formation of hydrogen peroxide depending upon the hydrazine derivatives involved (Kimball, 1977). There are some unexpected features concerning time of detection and locus specificity that are not yet explained. The mutations produced by hydrazine seen to be mainly or entirely single locus changes (Parveen, 2006). It is known in microorganisms that the base specific chemical mutagen, hydrazine directly acts on thymine, pH8.5, one of the four bases of deoxyribonucleic acid (DNA), which might bring about mutations (Frease, 1963). In higher organism like *Drosophila* and *Lycopersicon*, hydrazine is known to induce homozygous recessive mutations in the first generation M1) (Jain

ISSN 2394 - 7780

et al., 1969). Multiple stock of maize ten dominant genes located on ten different chromosomes, when treated with hydrazine, gave recessive endosperm and seedling mutants in M_1 itself due to the mutation of both the alleles of a locus on homologous chromosomes (Chandra shekhar and Reddy, 1971). Ratho and Jachuck (1971) on sequential treatment with hydrazine and hydroxylamine, designed to induce awnless condition in rice, failed to show any more phological or chlorophyll mutation in M1. Even in M2 surprisingly, chlorophyll, mutations were absent and only the desired awnless mutant beside two other morphological mutant were observed. In view of the above, the present study was undertaken to see hydrazine induces mutations in rice in the first generation after treatment (Reddy and Reddy, 1972).

2.2. INDUCTION OF MUTATIONS BY MALEIC HYDRAZIDE

Schone and Hoffman (1949) discovered that maleic hydrazide is a potent inhibitor of plant growth, since then the compound has been widely used in agriculture as a selectively weed killer and as a depressant of plant growth in various circumstances. Shortly after introducing MH as a major commercial herbicide Darlington and McLeish (1951) discovered its potent chromosome breaking activity in Plant cell. Structurally, MH closely resembles the pyrimidine· base urasil. Mode of action of MH involves interference with sulphydryl group which reduce the synthesis of those enzymes in which SH- groups are required. Therefore, this chemical affects SH-bond in some way as a consequence of which the proteins necessary for formation of spindle apparatus are also affected.

2.3. EFFECT ON CELLULAR METABOLISM

MH is readily absorbed both by roots and leaves, although the uptake MH has not been studied extensively for its ability to induce point mutation either in prokaryotes or eukaryotes. According to few data available, it appears to be mutagenic in some systems, but in others no point mutations were induced. In higher plants, MH produced a low frequency of chlorophyll mutations in barley, and according was claimed to be a weak mutagen as compared with *N*- nitroso-N methylurea (Malepsy and *et al.,* 1973). On the other hand, Sanz and Hack (1970) did not observe induction by MH of resistance to wheat rust *(Puccinia graminis)* in wheat plants. According to Coupland and Peel (1972a, 1972b) and Smith *et al.,* (1959) the compound accumulates preferentially in areas of active growth. The dividing cells are generally considered to be the place of the primary action of MH in plants. It has been established that, in several plants species, MH interferes with the metabolism of nucleic acids and proteins. Povolotzkaya (1961) observed inhibitory effect of MH on the synthesis of nucleic acid in germination of potato tubers. The effect being greater in isolated meristems than in intact tissues. Evanz and Scott (1964) reported the inhibition of DNA synthesis by MH in *Vicia faba* they used an auto radiographic method with 3H-labeled thymidine. In the study of cell cycle duration these authors proved that MH treatment extends the DNA synthesis period by about 13h. It was postulated by Lobov (1971) and by Lobov *et al.,* (1969) that, in plant cells, MH can replace a pyrimidine or urine base in DNA precursors, both nucleosides and nucleotides. If this is true, nucleotides in which the nucleic acid base is replaced by MH can block the activity of DNA polymerase, resulting in a decreased rate of DNA replication. Another possibility is that inhibition-of DNA synthesis is due to incorporation of MH containing nucleotides in to the growing polynucleotide chain.

2.4. INDUCTION OF CHROMOSOMAL ABERRATIONS

Auerbach and Robson (1942) presented first elaborate report that mustard gas could induce mutations as well as chromosomal aberrations in Drosophila. Formalin was also reported to have mutagenic effect when fed to *Drosophila* (Rapoport, 1946). Sodium azide was found to be a very effective mutagen under certain treatment conditions (Kleinhofs *et al.,* 1974), it made possible to obtain high mutation frequency, mostly gene mutations, with negligible frequency of chromosomal aberrations. In higher plants, chromosomal aberrations induced by mutagens have been extensively reported (Chowdhury and Nirmla, 1976; Datta and Biswas, 1985; Kaul and Murthy, 1985; Jayabalan and Rao, 1987; Reddy, 1990; Zeerak, 1991; Reddy and Annadurai, 1992; Chaudhury *et al.,* 1992; Ahmad, 1993; Saeed, 1993; Sinha and Gandhi, 1994; Kumar and Dubey, 1998b; Dhamayanthi and Reddy, 2000; Pagliarini *et al.,* 2000; Kumar and Singh, 2003; Kumar and Gupta, 2007; Laskar *et al.,* 2018; Amin *et al.,* 2016, 2017, 2018). Laxmi *et al.,* (1975) and Amin *et al.,* (2017) reported different meiotic abnormalities like chromatin bridges, laggards, fragments, cytomixis, inversion, micronuclei and unequal separation of chromosomes in pearlmillet following treatments with gamma rays and EMS. Lagging chromosomes and unequal separation of chromosomes were more frequent than other anomalies. They further reported that gamma rays were more effective than EMS or combination treatments in inducing chromosomal anomalies. Increase in the frequency of meiotic anomalies with the increase in dose and duration of mutagens was reported by Venkateswarlu *et al.,* (1988) in *Catharanthus roseus*, Ignacimuthu and Sakthivel (1989) in *Vigna radiata*, Suganthi and Reddy (1992) in cereals and Mitra and Bhowmik (1996) and Amin *et al*., (2017) in *Nigella sativa*. Gamma rays, MH and gamma rays + MH treatments showed disturbed mitotic behaviour

ISSN 2394 - 7780

(Grover and Tejpaul, 1982) in *Vigna radiata*. The sticky chromosomes, fragments and ring chromosomes at metaphase and the laggards and bridges at anaphase were noticed by these workers. The chromosomal aberrations were found to be significantly correlated with dose. The combined treatment enhanced chromosomal aberrations. Groverand Virk (1986) made a comparative study on the induction of chromosomal aberrations in the two varieties of mungbean by gamma rays, MNNG, EMS and HA. All the chemical mutagens and gamma rays induced chromosomal aberrations. The maximum frequency was noticed with gamma rays followed by MNNG, EMS and HA. G-65 variety was found to be more sensitive with treatment of EMS and HA. Kumar and Gupta (1978) observed an induced asynaptic mutant of blackgram which had shown a large number of univalents and an irregular anaphase division. Bandyopadhyay and Bose (1980) reported chromosomal aberrations and pollen sterility in M1 generation of blackgram following ethyleneimine (EI) and hydroxylamine (HA) treatments. Cytological effects of gamma rays on mitotic anomalies like misorientation at metaphase, bridges at anaphase, fragmentation and multinucleolate condition were observed by Shah *et al.,* (1992) in *Vigna mungo*. Vandana *et al.,* (1996) reported the meiotic anomalies induced by EMS and dES in *Vicia faba*. These anomalies were found to increase with the increase in the concentrations of mutagens applied. Overall frequency of meiotic anomalies induced by various concentrations of dES was higher than those of EMS. A relative account of cytological effects of gamma rays, EMS and MMS on meiotic features and pollen fertility in *Vicia faba* L. was provided by Bhat *et al.,* (2005). The induction of meiotic abnormalities was observed to be higher with MMS treatments, followed by gamma rays and EMS, suggesting that MMS could be more effective in inducing chromosomal abnormalities followed by gamma rays and EMS. The occurrence of univalents, ring and rod bivalents due to the mutagenic treatments was previously reported by Mansour (1994), Bione *et al.,* (2002), Vinita *et al.,* (2004) and Amin and Khan (2018). Khan and Tyagi (2009) reported bridges and laggards in soybean after treatments with EMS, gamma rays and their combination. They also reported that laggards were absent in EMS treatment in var. Pusa-16 of soybean. Studies on different plant species have shown that the decline in seed production is correlated with meiotic irregularities (La Fleur and Jalal, 1972; Dewald and Jalal, 1974; Smith and Murphy, 1986; Pagliarini and Pereira, 1992; Pagliarini *et al.,* 1993; Consolaro *et al.,* 1996; Khazanehdari and Jones, 1997). Pollen sterility showed a close relationship with meiotic abnormalities (Khan, 1990; Goyal and Khan, 2009). The least mutation frequency at higher doses may be attributed to chromosomal aberrations or saturation in the mutational events which may result in the elimination of mutant cells during growth (Blixt and Gottschalk, 1975).Chromosomes breaking effect of MH in plants was first described by Darlington and McLeishin 1951. According to their data and those reported later by Mc Leish (1953) in *Vicia faba,* MH induced chromosomal aberrations were preferentially localized in heterochromatic segments, the effect was of the delayed type and the aberrations, only of chromatid type, were produced with normal rejoining of broken ends. Chromosome breaking effects of MH in plants have been confirmed for a number of plant species, such a soat, maize, soyabean (Carlson, 1954), barley (Kagramanyan, 1975; Mann, 1977; Prize and Schank, 1973), *Cerpis capillaries* (Dubinina and Dubinin 1968, Bhatia *et al.,*1974), *Nigella domescena* (Natarajan and Ahnstrom, 1969), *Allium cepa* (Mc Manus, 1960) and *Aloe vera* (Gupta and Malik, 1971).

Localization of MH induced chromosomes damage in heterochromatic regions has been studied in Michaelis and Rieger (1968) and by Rieger (1973) with the use of the new karyotype of *Vicia faba* characterized by transfer of individual chromosome segments to another position within the karyotype. The transfer of chromosome segments in which aberrations were preferentially localized was accompanied by a corresponding shift in aberration distribution. Preferential localized of aberrations induced by MH in heterochromatic segments of *Vicia* chromosomes was also reported by Slotova *et al.,* (1971), Natarajan and Ahnstrom (1969). Graf (1957) also observed in maize a distinct correlation between the number of anaphase bridges and that of heterochromatic knobs in the variety studied. The frequency of chromosomal aberrations induced by MH in plants depends strongly on pH and temperature during treatment. According to Kihlman (1956) in *Vicia* the yield of aberrations is about 4 times higher at pH 4.7 than at pH 7.3 and increase with temperature. Chromosome breaking effects of MH can be inhibited by respiratory inhibitors such as cyanide, carbon monoxide and azide and enhanced by the presence of oxygen, although the compound has also a considerable effect under anaerobic conditions. It was reported by Loveless (1953) that, in *Vicia faba* the rate of production of chromosomal aberrations by MH was not affected by pre post or simultaneous treatments with 10 times the concentration of uracil, Thymine or orotic acid. The observation of Coupland and Peel (1972a) that uracil does not inhibit the uptake of MH seems to explain the data of Loveless (1953) on the lack of effect of uracil on production of chromosomal abnormalities by MH. According to Kaul and Choudhary (1975) the chromosomal breaking effect of MH were decreased in onion and barley by sodium thiosulphate, a similar protecting effect of Thiol groups was also reported for alkylating agents.

ISSN 2394 - 7780

2.5. SENSITIVITY TO THE TOXIC EFFECTS OF MH

Higher plants are particularly sensitive to MH, and respond to its action by growth retardation, depending on the dose and length of exposure, can be only temporary or lethal. However, among higher plants there are clear species, specific differences insensitivity to the toxic effects of MH. Selective action of - MH on higher plants was described by Currierans and Crafts in 1950. These authors observed strong inhibition of barley growth, whereas in the same conditions cotton was apparently unaffected. It was also found that young plants usually responded more intensively to MH than older representatives of the same species. MH has been used as a non selective grass killer owing to its ability to kill young plants of every species (Craft, 1961; Hebbleth waite and Burbidge, 1976). It can be assumed that differential sensitivity to MH observed among plant species depends both on their ability to take up and degrade MH by plant metabolism.

2.6. MUTAGENIC SENSITIVITY AND DOSE EFFECT

The dose required for high mutation frequency of a physical or chemical mutagen depends on properties of mutagenic agents and of biological system in question. Many workers feel that a dose close to lethal dose-50 (LD_{50}) should be optimum. It is that dose of the mutagen which would kill 50% of the treated individuals. The LD_{50} of a particular genotype varies greatly. This is due to the fact that genetic architecture of an organism is a potent factor in determining the genotypic difference towards the mutagens. Polyploid species have been found to be slightly resistant to the action of mutagens than their diploid ones (Reddy *et al.,* 1991) and, therefore, the effective dose is likely to vary in an individual crop. The frequency and the spectrum of mutations differ somewhat depending on the mutagen used and the dose applied. Physical mutagens have the advantage of good penetration power, however chemical mutagens present particular problem such as uncertain penetration to the relevant target cells, poor solubility and finally the risk of safe handling (Khan, 1990). A considerable amount of mutagenic work has been done by physical and chemical mutagens on *Vicia faba* inducing morphological as well as cytological abnormalities. Case of reduced seed germination in *Vicia faba* have been ported by Vandana and Dubey (l988a) by the treatment of ethyl methane sulphonate (EMS) and diethyl sulphate (DES). The dose required for high mutation frequency of a physical or chemical mutagen depends on properties of mutagenic agents and of biological system in question. In general, the dose effect of physical and chemical mutagenic treatment comprises several parameters of which the most important are concentrations, duration of treatments, temperature and pH during treatments. Lethal dose (LD_{50}) gives an idea about the appropriate dose of mutagen in mutation breeding experiments. In chickpea, (Singh, 1988) reported LD so value for gamma rays at 400Gy (var. G130) and 483Gy (var. H208) and for EMS at 0.25% (var. G130) and 0.27% (var. H208). Kharakwal (1981) reported higher lethality in 0.2% EMS treatment comparedto400 Gy and500Gy gamma rays. Higher LD_{50} values for gamma rays in chickpea in comparison to other pulse crops such as 300Gy in black gram (Khan, 1988) and 200Gy in lentil (Singh, 1983) indicate its greater resistance to mutagen. Further, differences have been observed for LD_{50} values in different chickpea varieties, which are attributed to their differential radio sensitivity. Both gamma rays and EMS have shown to have a close related reduction in seed germination and pollen fertility (Nerker, 1977; Rao and Laxmi, 1980; Khanna and Maherchandani, 1981; Gautam *et al.,* 1992; Wani, 2007). Dose linked effectiveness of EMS and gamma rays were noted in chickpea in terms of germination, reduction in pollen fertility, chlorophyll mutations and seedling height (Kaba *et al.,* 1981; Kharkwal, 1981; Khanna, 1991; Gumber *et al.,* 1965; Parveen, 2006). Similar effects were also reported in peas (Salim *et al.,* 1974), *Vigna radiate* (Singh and Chaturvedi, 1998; Khan and Wani, 2004), *Lens culinaris* (Sharma and Sharma, 1981; Wani, 2003), *Arachis hypogeal* (Venkatachalam and Jayabalan, 1995) and *Nigella sativa* (Amin and Khan, 2018).

With a view to enhance the mutation rate and also to alter the spectrum of mutations, many variations in the treatment methodology have been used by different workers. Treatments with chemical mutagens have been given to dry as well as to soaked seeds, seedling at different developmental stages, different phases of cell cycle at variable temperature and ionic concentrations (Chopra and Pai, 1979).

2.7. BIOLOICAL DAMAGE

The variations in terms of bio-physiological damages, gene mutations and chromosome mutations induced by mutagens in any mutation breeding programme have been used as criteria in determining the mechanism of action of the mutagen in question and also the sensitivity of the biological material towards the mutagenic treatments. Among the variations caused, gene and chromosomal mutations may be transferred from M1 to the subsequent generations, whereas, biological and physiological damages are generally restricted to the M_1 generation**.** It is possible to identify plants which suffered maximum damage due to mutagenic treatment using different types of parameters and in different experimental layout, either individually or in combination, of M_1 generation plants. Different parameters like seed germination, seedling height, plant survival at maturity, pollen and seed fertility, cytological abnormalities, aberrations on leaf surface, estimation of chlorophyll and

ISSN 2394 - 7780

biochemical contents, the activities of certain enzyme assays etc. have been studied by different workers in analyzing the biological and physiological changes in M_1 generation due to mutagenic treatments, both in laboratory and in field conditions. The effects of single and combination treatments of physical and chemical mutagens on different biological and physiological parameters in M1 have been reported in *Oryza sativa* (Fujimoto and Yamagata, 1982; Sarawgi and Soni, 1994; Cheema and Atta, 2003), *Vigna radiata* (Khan, 1990; Sharma *et al.,* 1995; Khan *et al.,* 1994; Khan *et al.,* 1998; Rehman *et al.,* 2000; Khan and Wani, 2005a), *Vigna mungo* (Gautam *et al.,* 1992), Triticale (Edwin and Reddy, 1993a), *Brassica juncea* (Singh *et al.,* 1993), Triticum spp. (Xiuzher, 1994), *Eleusine coracana* (Kumar *et al.,* 1996), *Plantago ovata* (Sareen and Kaul, 1999), *Lens culinaris* (Reddy *et al.,* 1992; Verma *et al.,* 1999), *Capsicum annum* (Siddiqui and Azad, 1998; Dhamayanthi and Reddy, 2000), *Gossypium hirsutum* (Muthusamy and Jayabalan, 2002), *Stipa capillata* (Zaka, *et al.,* 2002), *Cicer arietinum* (Barshile *et al.,* 2006; Hameed *et al.,* 2008), *Nigella sativa* (Amin and Khan, 2018) and many such examples are being reported for other crops of economic importance. Brunner (1995) in *Vicia faba* reported that M_1 parameters as seedling height, survival and fertility decreases with increasing doses of gamma and fast neutron radiations while chlorophyll and morphological mutant frequencies in segregating M_2 population increase up to a maximum and decrease thereafter due to M1 injury. Bhat *et al.,* (2007) studied the comparative analysis of meiotic aberrations induced by diethylsulphate (DES) and sodium azide (SA) in broad bean *(Vicia faba* L.). They found that both mutagens DES and SA elicit various chromosomal aberrations in meiosis and reduction in seed germination, pollen fertility and seedling survival. Such effects were dose dependent. Khan *et al.,* (2007a) investigated the clastogenic effects of 8-hydroxyl quinolone (8-HQ) in *Vicia faba* L. They took six different concentrations (0.25, 0.50, 0.75, LOO, 1.25 and 1.50%) of 8-HQ and observed the effect of the concentrations on meiosis and pollen fertility in var. major of faba bean. The meiotic studies revealed a dose dependent decrease in chiasma frequency from 18.56 in the control to 17.80 at 1.50 % 8-HQ at prophase- I and from17.76 in the control to 16.92 at 1.50% 8-HQ at metaphase-I. The other meiotic aberrations observed were stickiness, laggards, univalents, multivalents, bridges, fragments, precocious separation etc. The stickiness of the chromosomes was the most common aberration, followed by the precocious separation and laggards. Among the different stages of meiosis, the frequency of chromosomal aberrations was maximum at metphase stage. Khan *et al.,* (2007b) investigated comparative analysis of meiotic abnormalities induced by caffeine, and DES in *Vicia faba* L. var major. Mutagens exhibited various kind of chromosomal abnormalities, and caused reduction in pollen fertility. However, the Percentage of abnormalities induced by DES was higher than that of caffeine, suggesting that DES could be more effective in inducing genetic changes compared to caffeine in this crop. Bhat *et al.,* (2007) studied meiosis in two varieties viz. minor and major of *Vicia faba* L. after EMS treatments. Cytological analysis revealed different types of meiotic abnormalities such as stickiness, univalents, multivalents, disorientation of chromosomes, precocious separation of chromosomes at metaphase and bridges, laggards and unequal separation of chromosomes at anaphase. Var. minor showed more chromosomal abnormalities compared with var. minor showed more chromosomal abnormalities compared with var. major. Fatma and Khan (2009) observed the effect of dES on the two varieties of faba bean namely ELl17792 and EL354984. Various types of chromosomal abnormalities such as stickiness, bridges, nonsynchronization, misorientation and cytomixis were recorded in mutagen treated population. A dose dependent increase in meiotic abnormalities was observed in the two varieties. However, the induction of chromosomal abnormalities was higher in the var.EL-117792than the var.EL-354984, indicating that it was more sensitive to the chemical mutagenic treatment and the improvement in yield related trait can easily be made. Mansour and Kamel (2005) studied the interactive effects of heavy metals and gibberellic acid on mitotic activity and some metabolic changes of *Vicia faba* L. plants. Result showed that different types of chromosomal aberrations *were* observed in response to heavy metals.

Prasant and Verma (2005) studied asynaptic mutant in faba bean induced by EMS. They isolated asynaptic mutant of *Vicia faba* from M2 population of 0.2% EMS. The mutant was designated as medium strong asynaptic mutant. There was a significant decrease in the number of chiasmata and pollen fertility in this plant as compared To the control. The inheritance of this synaptic mutant was monogenic recessive type. Prashant *et al.,* (2004) they treated seeds of *Vicia faba* with 0.005% colchicine for 8h and reported high frequency of colchicines Induced autotetraploids. Presoaking the seeds in distilled water for 20h proved more effective in inducing polyploidy. Haroun *et al.* (2004) Observed cytomixis in the microsporgenesis of *Viciaf aba* L. Cytomi. xis Was observed to occur in forms of cytoplasmic connection and direct fusion. The first type was more frequent than the second one. The percentage of pollen fertility was also affected by cytomixis. Haroun and Al-Shehri (2001) studied cytogenetic effects of *Calotropis procera* extract on *Vicia faba* L. Low doses of the extract increased the mitotic index (Ml) and caused stimulatory effects on germination percentage and plant height. On the other hand, high concentrations gave rise to substantial reduction in MI, germination percentage and plant height. Various types of mitotic and meiotic abnormalities were observed. Dolezel *et al.,* (1992)

ISSN 2394 - 7780

investigated a high yield procedure for isolation of metaphase chromosome from root tips of *Vicia faba* L. Khan *et al.,* (2004) treated the seeds of two varieties of *Cicer arietinum* L. with EMS, HZ and SA and found a broad spectrum of morphological mutations in M_2 generation.

The extended variability among these mutations was analyzed in term of mutation frequency. The frequency of these mutations varied depending on variety and mutagen. EMS induced wider frequency and spectrum of mutations followed by HZ and SA. Var. Avarodhi produced maximum frequency of leaf mutants where as var. BG-256 gave maximum frequency of seed mutations. Khan and Wani (2005) reported the genetic variability and correlation studies in M3 mutants of chickpea varieties Avrodhi and BG-256 following the treatment with 0.02% hydrazine hydrate. The study indicated that sufficient genetic variability was present for number of fertile branches, pods and plant yield in mutants. Thus, these mutants may have a higher selection value and breeding significance. Kak and Kaul (1975) studied the mutagenic activity of hydrazine hydrate in the treatments, were administered alone or in the combination of maleic hydrazide and X-rays. Hydrazine was able to produce chlorophyll mutations in the M1 generation itself if applied alone or in a mixture. Khan *et al.,* (2005) obtained a broad spectrum of chlorophyll mutation in M_2 generation by using EMS, SA and HZ in two varieties of *Cicer arietinum* L. Lower and moderate concentrations of EMS gave higher frequency of mutations whereas no such trend was noticed with other two mutagens. Total chlorophyll mutation frequency was found maximum with EMS treatment followed by HZ and SA. George (2000) examined three heavy metals Pb, Hg and Cd for the induction of meiotic abnormalities and changes in M2 seed storage protein banding patterns of *Vicia faba* plants. The results showed that lead and mercury have more mutagenic potentialities than cadmium. Amarnath and Prasad (2000) studied induced mutations in homozygous and heterozygous genotypes of tobacco. Six types of chlorophyll and ten types of morphological mutants were isolated in M2 generation. Frequencies of chlorophyll and morphological mutants were higher in treated heterozygous material as compared to treated homozygous material. Khan *et al.* (1998) studied the response of two varieties viz; PS-16 and K-851 of green gram (*Vign aradiata* (L.) Wilczek) to maleic hydrazide. They found the linear dependence of seed germination and pollen fertility on dosage was evident in both the varieties.Var.PS-16 was found to be more sensitive than var. K-851. Genetic variability increased for all the quantitative characters but the different characters responded differently to the mutagenic treatments. Maximum variability was observed for plant height in both the varieties.

Patil and Bhat (1992) reported a comparative study of MH and EMS in the induction of chromosomal aberrations on lateral root meristem in *Clitoviatematea* L. Cytological observations of MH treated plants have been studied by many workers and it has been reported that MH induce chromosomal damage and also different types of chromosomal aberrations (Michaelis *et al.,* 1998). On the other hand ethyl methane sulphonate (EMS) is a powerful chemical mutagen. It has been reported that the localization of breaks along the chromosomes result from the affinity of EMS for guanine rich areas.

Adverse effects of mutagens on number of leaves, leaf area and colour of leaves have been reported in *Vicia faba.* (Vandana and Dubey, 1988b) variation in shape and size of leaflets (Vandana, 1992). Chlorophyll mutation (Vishnoi and Gupta, 1980) and reduction in pollen fertility by gamma rays Kumar *et al.,* 1993) have been reported in *Vicia* faba. Remarkabale loss in yield has been experienced in *Vicia faba* by Kash (1988) in terms of reduced number of pods, seeds and weight of seeds per plant by the treatment of acriflavin and gamma rays. The protein content was not necessarily increased if yield was increased (Blixt 1970; Hartwig, 1979). A lot of work has been done on root tip cells of *Vicia faha.* Spindle disturbances and bridge formation. Were caused by herbicide tribunal (Mansour, 1984), terbutryn (Badr, 1986), chlorosulfuron Badr and Ibrahim, 1987) and by combination of some herbicides (Micieta, 1987). Moreover, spindle disturbances and formation of binucleate cells were observed by Ashour and Abdou(1990) with igran, topogard and eptam treatments. Abraham and Annie,1989), chromosomal aberrations by benzylphenyl urge (Aabdel Rahem and Ragab, 1989), chromosomal aberrations and sister chromatid exchange by effect of gamma rays (Kuglik*etal.,*1990), chromosomal damage by benzo alfapyrene,2-amino fluorine and cyclophosphamide (Kanaya, 1990), by the combined treatment of maleic hydrazide (MH) and triethylene melamine (TEM) (Riegerand Michaelis, 1992) and disturbed mitosis by insecticide temic 15g (Ghareeb and-geor.ge, 1997) are someof the important studied mitotic chromosomes. The occurrence of micro nuclei in root meristems of *Vicia faba* have been reported by the treatment of gamma rays (Diehl and Bianchi, 1982; Soran*etal.,* 1981), X-rays (Rizzoni *et al.,* 1987), heavy Metals like cadmium and chromium (Demarco *el al.,* 1988). Magnesium sulphate (Abraham and Nair, 1989), herbicides at razine, glycophosphate and maleic hydrazide (Demarco *et al.,* 1992) and temic 15g (decarb) (Ghareeband George, 1997). The reports of multipolar telophase-I are also available in *Vicia faba.* Micronuclei were also observed at telophase II of meiosis by mutagenic treatments By Amer and Farah (1987) in *Vicia faba.*

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019

ISSN 2394 - 7780

OPEN SOURCE SOFTWARE: A POTENTIAL TOOL TO EMPOWER LIBRARIES

Supriya Gaikwad
HOD & Librarian, Amity University, Mumbai

ABSTRACT
The contemporary society is progressing from data age to learning society thereby posing prominent difficulties for to confront. The entire knowledge of library has now changed from accumulation of books to a solitary window learning repository. This paper examines the definition and highlights of open source library the executives programming, criteria of determination of best open source library the executives programming, their favourable circumstances and constraints. Open source library the executives programming is an answer for lessening that cost. The paper depicts in a nutshell about the component of a portion of the open source library the executives programming like Greenstone Digital Library, DSpace, KOHA, E-Prints, NewGenlib, PhpMyLibrary, OpenBiblio, Avanti, and so on., which are helpful for creating advanced library and institutional archives.

Keywords: open source, software, empowering libraries, feasibility.

Library is an indispensable organization of educated and civilized society. The increased growth, use and value of information generated the concept of information society or information oriented society "Libraries may not create civilization; but a civilization cannot exist without them." (Hutchings, 1969). In other words libraries are treated as the temple of learning where users can find out relevant information from the collection and services to satisfy the thrust of knowledge. But in present era the library has been define as an organization which identifies selection, collection, management, process and dissemination at the right time to the right person. Now libraries are perceived as places where information is retrieved through sources like electronic catalogue listings, full-text periodicals and Internet access.

Although libraries have changed significantly over the course of history, they remain always responsible for acquiring or providing access to books, periodicals, and other media that meet educational, recreational and informational needs of their users. They continue to keep the business, legal, historical and religious records of a civilization. The trend of that time was to build collections. But in this era of specialization, the strength and weaknesses of libraries will be measured by the services provided by them not by the physical collection they have.

This overwhelming flow of information has made difficult to control and dissemination of library materials. Therefore, in order to avoid obsolesce of information; a library professional should apply the advanced technologies in order to meet the information requirements of the user community. The innovation of computer itself is the pioneer of radical changes in almost all fields. Once librarian was excluded in library underestimating his/her need for library services, but today still he/she is replaced but the story behind is different. The man made computer is main cause for replacing them in library. It would be better to say that the librarian and library services are assisted by computer hardware and software now. Library automation has become a burning issue, with pros and cons, among librarians throughout the world. The computer has proved its success in the fields of library acquisition, cataloguing, classification, circulation, serials control, and information storage and retrieval activities.

The automation is economically feasible and technologically required in modem libraries to cope up with the requirements of new knowledge, the enormous increase in the collection of materials, problems of their acquisition, storage, processing, dissemination and transmission of information (Bhardwaj & Shukla, 2000). The capabilities of computer associated peripheral media and its application in library activities and services led to a highly significant quantitative and qualitative improvement especially in online technology. Library automation has multifarious aspects to be discussed but this study is limited to the status of library software being used in libraries of colleges.

Software selection is a very complicated issue, on the observation of experts, a discussion should be made by the selection committee and most suitable in regard of flexibility, capacity, expandability, security, economic, user friendly modules based and updated with the latest technology is to be procured. Therefore, an evaluation of appropriate software packages is very much needed in any academic or other libraries for user friendliness, efficiency and cost effectiveness. The study will provide guidelines in the selection or development of appropriate software packages to librarians. Libraries cannot afford the cost of library automation as a whole.

ISSN 2394 - 7780

Library Automation Software: Due to the vast explosion of information, the librarians are facing difficulties to meet the user demand and are forced to take up the task of systematic organization of the recorded knowledge. On the other hand, the computer programs are being very much advanced day by day in each and every activity.). It has been seen increasing activity and complexity in the information field. As a result acquisition cataloguing, circulation and serial management have become more specialized function demanding a high degree of efficiency.

Software A set of command is known as programme, and a set of programme is knows as software. The hardware operates on the basis of a set of programmes of software (Sharma, 1993). Basically, software is the program that runs the computer to produce the required results. It is said that, "A computer without software is similar to a man without his brain, or a library with neither books nor librarians". Therefore, on principle, the selection of software comes before hardware. The author emphasized the software needed for library housekeeping routines and information retrieval services in detail (Malik, 1994).

Types of Software Although the range of software available today is vast and varied, most software can be divided into two major categories: 1. System Software 2. Application software

System Software: System software is a set of one or more programmes, designed to control the operation and extend the processing capability of a computer system. In general, a computer's system software performs one or more of the following functions.

• Supports the development of other application software

• Supports the execution of other application software

• Monitors the effective use of various hardware resources, such as CPU, memory, peripherals, etc.

• Communicates with and controls the operation of peripheral devices, such as printer, disk, tape, etc. The programmes included in a system software package are called system programmes, and the programmers who prepare system software are referred to as system programmers (Sinha, 2003). Some of the most commonly known types of system software are:

• Operating System

• Programming Language Translators

• Communication software

• Utility Programmes

Application software: Application software is a set of one or more programmes, designed to solve a specific problem, or do a specific task. Some of them are available in the market-place as software packages. They are as follows:

• Word Processing Software

• Spreadsheet Software

• Database Software

• Graphic Software

• Personal Assistant Software

• Education Software

• Entertainment Software

• Desktop Publishing Packages

• Library Management Software

• Expert systems Today, readymade software packages are available in the market for a wide range of applications and their capabilities differ, prices vary and their versions keep on changing. Selection of suitable software package is an important factor in library automation system. There are not many publications or case studies discussing the criteria for selecting suitable software. The selection is based on specific needs of the institution, its environment, budget, user's aims and objectives (Malwad, 1995). One of the software distributors Soft-link Asia declared "Our Mission is to make information accessible to specialists, as well as general groups of society, through effective employment of information technology in libraries- the epicenter of knowledge

ISSN 2394 - 7780

storage and discrimination center". The software featured is a mixture of commercial software, shareware, and Open Source Software. These three basic kinds of software packages can be seen in the present day context. Commercial Software Hundreds of commercial library software have been developed and run successfully today in the world and there are many software directories and other tools available that help librarians to select suitable software for their libraries (Malik, 1994). Commercial software typically provides solutions to particular application problems. Since they are developed on a commercial scale in a competitive market for use by a variety of customers, a great amount of skill and effort is put in their development. In the context of developing countries, LIBSYS, Alice, SLIM, EASYLIB, SOUL are few examples of the most popular commercial library automation software. Some software is expensive and some have reasonable price. It is beyond expectation to use commercial software for some libraries, due to the lack of budget to buy and sustain the software package as the recurring cost involved by way of maintenance and newer versions. But the library which is financially strong can purchase and use commercial software to automate their library. It is public domain software which is usually obtained through shareware libraries. It is also called freeware software packages and its licenses usually prohibit modifications and commercial redistribution. Free software is defined in terms of giving the user freedom. This reflects the goal of the free software movement. Shareware is essentially available free of charge although users are likely to be asked to pay a nominal charge to the library to cover the costs of copying the software and the disks on which it is provided. In addition, the original writers of the software usually charge registered users for manuals. This type of software can be used by anybody for noncommercial purposes. CDS/ISIS developed by UNESCO, is one such freeware, specially designed for handling textual information which is very popular in developing countries.

Features of Good Library Software Packages The library should have the best software for fulfilling the entire activity and to satisfy the users. Besides storage and retrieval, there are other housekeeping functions also which should be there in the software. Computerization of operation requires procurement of hardware and software. The first step towards this will be the automation of the individual libraries and information centers and for this each organization has to follow and maintain certain standards. Several options are available for acquiring upgrading a library management system. (Rowley, 1993) Buy or license a commercial software package 2. Join or make use of the system of a cooperative 3. Develop own system Different types of libraries required library software packages with different dimensions and capabilities. For example, The University library where big collections and heavy circulation work has to be perform, a fully integrated software package is required with good response time and strong searching facilities, whereas for research libraries or other special libraries where the collections are limited but the readers have very specific requirement, a software with good searching capability is needed, which will enhance the search and present the result what is exactly required (Ahmad, 1993). Even though, the software directories with the names and commercial details are available, it doesn't help librarian for the critical selection. It is obvious that by looking into the brochure or by the demonstration of the software for picture, inside capabilities and drawbacks of the software cannot be identified. Some of the most important and basic things like, the ease of inputting records, editing, cursor navigation, response time and user friendliness can be experienced only by using the 61 software. The software should be tested by taking actual examples and by entering and manipulating several dozens of records in to the packages (Ahmad, 1993) A software package used for library work and services should have at least the following qualities (Sharma, 1993)

1. Database Management System (DBMS) features
2. High level integration
3. Data entry facility
4. Data updating/editing
5. Search/inquiries
6. Report/Display/Print
7. Menu driven and user friendly
8. Compatibility
9. Reputation of the sponsoring
10. Scope for local variation

ISSN 2394 - 7780

CONCLUSION

Thus the development of Open Source Software is an effectiveway to automate library operations without undertakingsubstantial financial investment. Libraries are taking upOpen Source Software as a way to reduce the costs ofexpensive commercial products and as a viablealternative to the often expensive proprietary libraryautomation systems. Librarians need to understand opensource license for promotion the use of Open SourceSoftware. This is the only way to face the challengesposed by commercial software in the market. It will alsoincrease the autonomy and control of the professionalover software solutions. In conclusion, the advent of opensource library software has ushered in a revolution in thefield of library and information resources management,and has become popular choice for most library andinformation professionals because of their numerousbenefits and useful features.

REFERENCES

- Ahmad, Dawood (1993). Common Library Software Packages Available in India: A Comparative Study. Unpublished Dissertation, Submitted to Indian National Scientific Documentation Centre, New Delhi.
- Courant P N, Griffiths RJ (2006). Software and collaboration in higher education: A study of open source software. Organization for Open Source Software Study.Available at http:// www.ithaka.org/strategicservices/oss/OOSS_Report_FINAL.pdf.
- Dhamdhere S (2011). "ABCD, Open Source Software for Modern Libraries", Chinese Librarianship: an International Electronic Journal 32 Available at: http://www.iclc.us/cliej/cl32dhamdhere.pdf.
- Hutchings, F.G.B. (1969). Librarianship; A Short Manual. Oxford: Oxford University Press.
- Sharma (Subedi), Madhusudhan (1990). Fundamentals of Library and Information Science. New Delhi: Nirala Pub.
- Sharma, S.K (1993). Library Computerization; Theory and Practice. New Delhi: EssEss Pub.

WEBLIOGRAPHY

- http://www.winisis http://www.google.com/technology accessed on 11.04.2019
- http:// koha.org.retrieved on 11.4.2019
- http://www.LibSys.co.in/home.html accessed on 16.04.2019
- http://www.softlikasia.com accessed on 09.05.2019

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019

ISSN 2394 - 7780

A STUDY OF APPROPRIATENESS OF TEMPLE ENCLOSURES FOR CONGREGATIONAL ACTIVITIES

Anirvan B. Gupta[1], Laxman M. Chaudhari[2] and Vijay H. Raybagkar[3]
[1]Research Scholar[1] and Associate Professor[2,3], Department of Physics, Nowrosjee Wadia College, Savitribai Phule Pune University, Pune

ABSTRACT
In recent times, very few worship spaces are designed to fulfill the expectations of devotees. Devotees come to worship spaces to attain the most required peace of mind from the everyday customary to-do list. Inside a temple, the 'peaceful feeling' is to a large extent related to its 'spatial acoustics', but this area is often neglected during design and construction phase. The acoustics of temples plays a significant role here and it is dominated largely by the temple's structure, particularly the inner sanctum, the garbha-griha and the hall, the ardha-mandapa. Therefore, there should be a method established to find out which activity is to be undertaken in a particular temple enclosure. To analyze the above problem, a study was conducted among two prominent temples in India, The spaces under study were then divided into two categories - one that may be used for musical performances or mass prayers and other to be used exclusively for discourse or religious talks.

Keywords: ardha-mandapa; discourse; garbha-griha; spatial acoustics; worship spaces

1. INTRODUCTION
Traditionally, temples were the places where people would gather for prayers and meditation or even for public meetings. Such spaces were therefore designed with an acoustically good hall called 'Ardha-Mandapa' and a highly reverberant inner sanctum called the 'Garbha-Griha' [1]. The spaces were required to have good acoustical characteristics apart from a superior structure. It should also be noted that during the times heritage temples were constructed, there were no electronic public address system, which further made it necessary for temples to have good acoustics. In present times, many temples are simply houses of God, made with bricks and mortar, but not fulfilling the acoustic standards as they were in the past.

Worship spaces are heritage monuments, many of them preserved by the Archaeological Society, and therefore, utmost care has to be taken while carrying out any research and analysis work in such spaces. Here, 'non-destructive testing' technique was adopted so as to keep the structures and materials undamaged. For this purpose, bells, which were already a part of temple structures, were used as primary source of sound, which would never cause any damage to the structures. Temples built years ago were perhaps constructed with a sole purpose of providing peaceful feeling to devotees or to serve as a place where people would come together from different strata of the society during some occasion. Hence, many a times it is found that acoustical characteristics of temples may not go in tune with theoretically ideal values. To bring the temple acoustics at par with scientifically created auditoriums or halls, proper renovation could be done by selecting appropriate materials; however, this was intentionally avoided so that the original acoustical characteristics could be judged.

Every temple structure may not be suitable for musical performances like '*keertana*'- group prayers or vocal activities like discourse. This fact was perhaps known to the organizers and head priests but there is hardly any literature to provide evidence to this. Temples were the places where people would prefer to gather for such activities. The temples under study were Kashivishweshwar Temple (Figure 1) and Siddheshwar (Dhom) Temple (Figure 2) around Pune District, with the help of computer softwares, namely Wavanal, VizIR and Sigview.

Fig-1: Temple Site at Kashivishweshwar Temple

ISSN 2394 - 7780

Figures 3 and 4 give the impulse response of bell sounds from Kashivishweshwar temple and Siddheshwar temple, respectively. The photos of temples, as shown in Figures 1 and 2, are to provide an idea about the structures only. The bells were hung at approximately 7 feet from the floor level near the entrance door. This was not in-tune with the belief of authors that the bells should be more at the centre of inner sanctum or the hall *(mandapa)*, where the energy centers would probably coincide. It appears that there were some alterations in positioning the bell inside the temple without giving much thought to its acoustical significance. Had the bells been within the *garbha-griha*, the sound should have lingered for a longer time. As evident from the impulse responses, the damping occur must faster.

Fig-2: Temple site at Siddheshwar temple

2. THEORY

Acoustic study of spaces evaluates the distribution and dissipation of sound energy within a certain space. This is accomplished by assessing a set of acoustic parameters defined with respect to their objective and subjective characters. The former correspond to measureable physical parameters which strongly relate to enclosure's architectural characteristics, while the latter correspond to acoustic aspects subjectively acknowledged by a listener. These two characteristics are, however, interrelated. The impulse response of the temple spaces (Figures 3 and 4) were obtained by computer software. These were then used to retrieve the acoustic parameters under study in order to characterize the acoustical quality of the spaces.

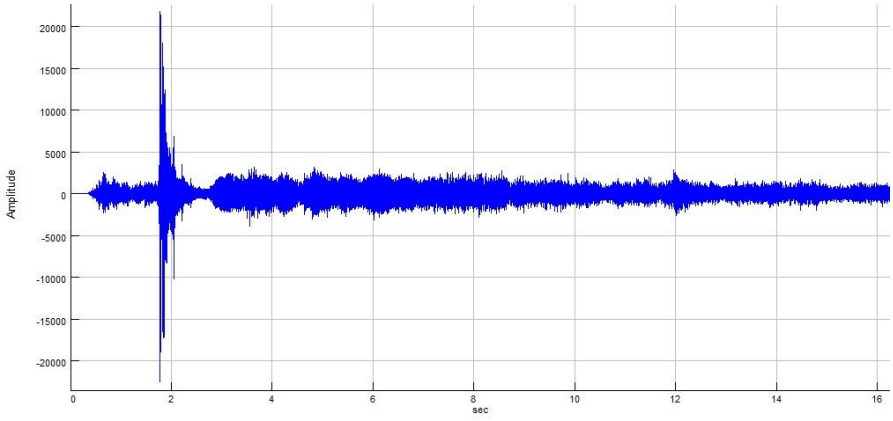


Fig-3: Impulse Response of Sound from the bell at Kashivishweshwar temple

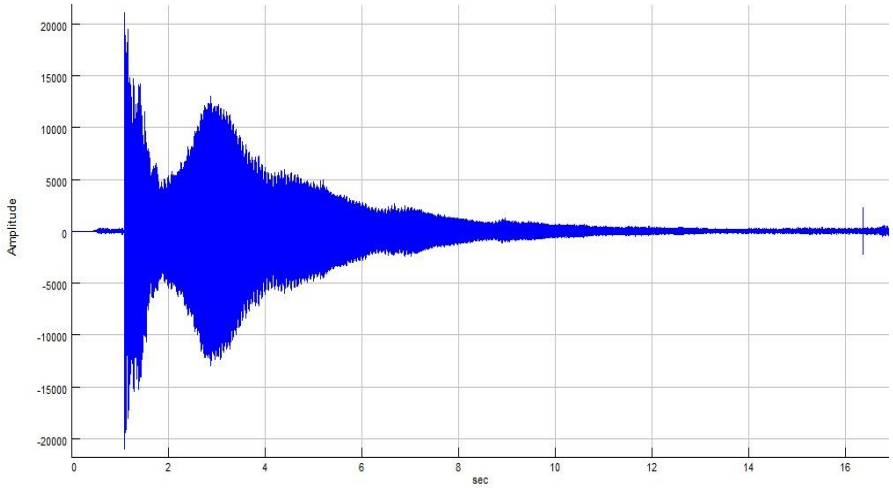


Fig-4: Impulse Response of Sound from the bell at Siddheshwar temple

ISSN 2394 - 7780

For temples, however, there are no pre-defined values of the parameters since architecture of each temple is different. Also, apart from music and speech, temples are meant for mass prayers and worship purposes, for which acoustic characteristics are entirely different, though significant.

Temples are usually meant for individual prayer, mass prayer, meditation, religious speech (like the *Keertana / Pravachana*) and musical performances. The acoustical characteristics for all such activities would have divergent requirement keeping in mind the varied expected end effects of acoustical response which should benefit the priests/artists and the devotees alike. The quality of sounds as perceived by a listener essentially depends on four factors:

1. Physical characteristic of sound source (the source here may be a human being, a group of priests and/or devotees, a temple bell, a conch shell or a gong, or all of these sounded simultaneously);
2. The relative position of the sound source and listener;
3. Architecture of the space (temple);
4. Impact/sensation by the sound stimuli perceived by devotees.

It is possible to quantify the first three parameters objectively, while the fourth factor remains on the boundary of measurements between Physics and Psychology [2-5]. This is because every individual would have his or her own opinion about the acoustical quality of the space. This depends, to a very high extent, on the sensation of quality of perceived sounds and also on the kind of training an individual has been exposed to in understanding the nature of sound.

3. STRUCTURE OF THE ANALYSIS

The work done here is aimed at measuring values of reverberation time (RT), Early Decay Time (EDT) and Clarity of sound (C_{80} and C_{50}) for bell sounds in the two temples under study. The temples are heritage temples dedicated to Lord Shiva and material used for construction were mainly stone cut-outs with different architectural styles [6-8]. These acoustical parameters are basically based on how sound energy is propagated through space in time. These parameters are calculated by using computer software Wavanal and VizIR [9][10]. Sigview software was used to see the Fourier transform of sound waves and to determine which sound partials are more prominent in the two temples[11][12].

Figures 5 and 6 shows the major five amplitudes obtained from the bell sound in both the temples. It is observed that for Kashivishweshwar temple, the maximum amplitude of sound is around a frequency of 495 Hz, while that for Siddheshwar temple, it is around 750 Hz. It is suggested by the Wavanal program that these frequencies correspond to 'hum' partials which are the lower frequencies extending for a longer duration. Their significance lies in the fact that these frequencies could be picked up easily by naked ear without any acoustical training.

4. OBJECTIVE MEASUREMENTS AT SITES

To design an enclosure meant for speech and/or music, like a temple, the reverberation time is usually considered depending upon reverberation that is needed [13]. Using Sabine's formula, then, the appropriate volume of the enclosure may be predicted. However, in case of temples, it is not clear if acoustical characteristics were taken into consideration prior to, or during or after designing of the temple structure. Also, from a subjective point of view it is necessary to specify the early decay times (EDT) within a specified range [14]. In temples, therefore, the differences between EDTs and RTs may be quite large at certain frequencies. In the present time, for design purposes we need to know the causes of significant differences between these two parameters. Here we consider the ratio between EDT and RT since this appears more appropriate from the point of view of comparison [15][16]. If the full decay in an enclosure is perfectly linear, the EDT and RT are the same. EDT is dependent on position in the enclosure whereas RT is more stable.

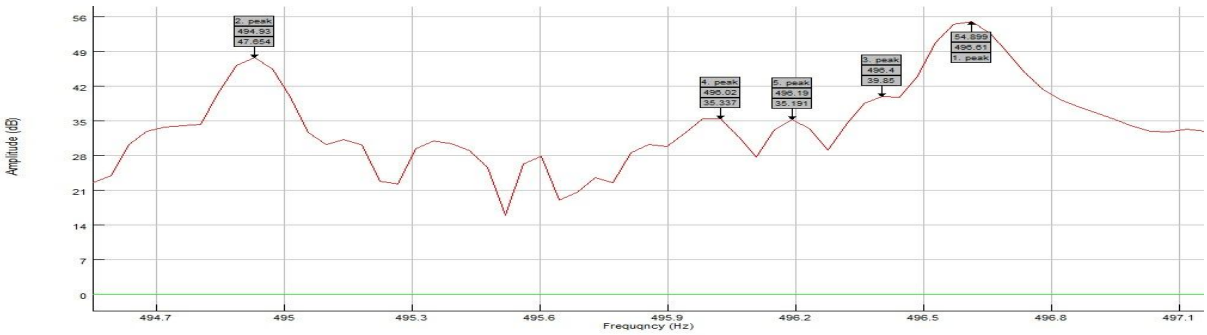


Fig-5: Five major peaks from bell sound at Kashivishweshwar Temple

ISSN 2394 - 7780

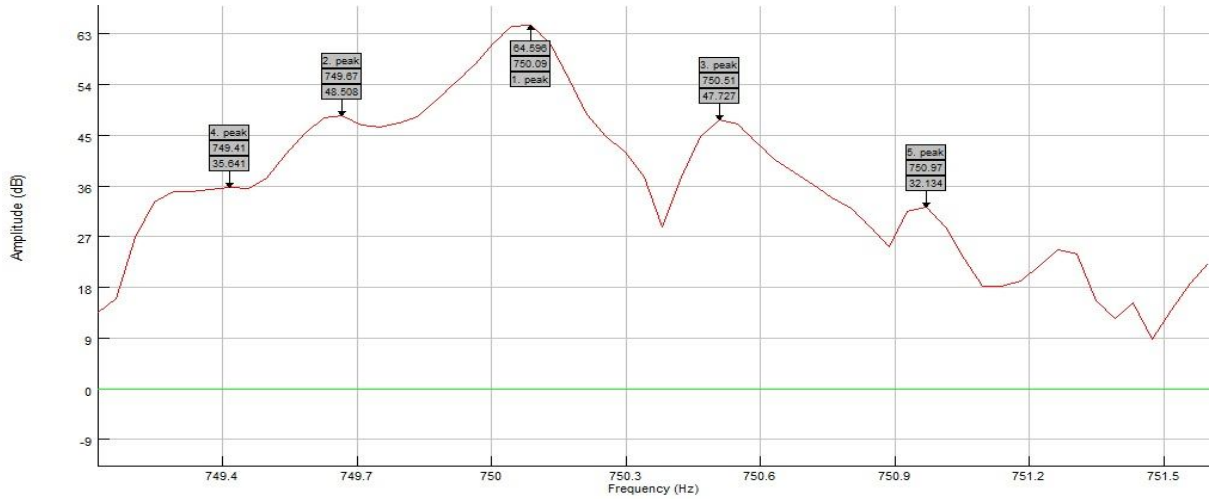


Fig-6: Five major peaks from bell sound at Siddheshwar Temple

Results are presented here in terms of the standard deviation divided by the mean EDT for each temple. This dimensionless ratio is the 'coefficient of variation' of the EDT or the 'relative standard deviation' of EDT. Typical values for the relative standard deviation are 0.73 for Kashivishweshwar and 0.94 for Siddheshwar temples. It is observed that although there is an excessive variation of EDT and standard deviation of EDT in the temples but the variation in relative standard deviation is small and below 1. It is observed that in case of Siddheshwar temple, the coefficient of variation of EDT is 73% while that in case of Kashivishweshwar temple, it is 94%. In both the cases, the data is spread out more around the mean EDT, however, the spread is larger in case of Siddheswar temple. The coefficient of variation is also used here so as to compare the values with the maximum spread of 100%, which may be considered as the standard.

Table-1: RT, EDT, C50 and C80 vales for Bell sound at Kashivishweshwar Temple

	Octave (Hz)					Mean	Standard deviation	Coeff. of variation of EDT
Criteria	**125**	**250**	**500**	**1000**	**2000**			
T30	0.3	0.1	0.2	0.7	3.8			
T60	0.5	0.1	0.5	1.3	7.6			
EDT	0.5	1.0	0.5	1.3	2.6	**1.2**	**0.9**	**0.7**
EDT : T60	1	10.0	0.9	1.0	0.03	**2.6**		
C50	2.9	-3.6	3.8	0.5	1.2			
C80	7.9	1.6	10.6	3	2.2			

Table-2: RT, EDT, C50 and C80 vales for Bell sound at Siddheshwar Temple

	Octave (Hz)					Mean	Standard deviation	Coeff. Of variation of EDT (Relative)
Criteria	**125**	**250**	**500**	**1000**	**2000**			
T30	1.2	1.5	6.3	6.3	1.4			
T60	2.4	3.1	12.7	12.7	2.8			
EDT	0.8	0.8	10.5	10.5	3.6	**5.2**	**4.9**	**0.9**
EDT : T60	0.3	0.3	0.8	0.8	0.1	**0.5**		
C50	0.2	-2.3	-17.8	-17.8	-11.7			
C80	3.1	2.3	-15.8	-15.8	-10.7			

Table-3: Relative standard deviation of EDT with octave frequency

Frequency (Hz)	EDT		Stdev of EDT		Relative Stdev of EDT with frequency	
	Kashivishweshwar	Siddheshwar	Kashivishweshwar	Siddheshwar	Kashivishweshwar	Siddheshwar
125	0.5	0.8	0.9	4.9	0.6	0.2
250	1.0	0.8			1.2	0.2
500	0.5	10.5			0.5	2.1
1000	1.3	10.5			1.5	2.1
2000	2.6	3.6			3.0	0.7

ISSN 2394 - 7780

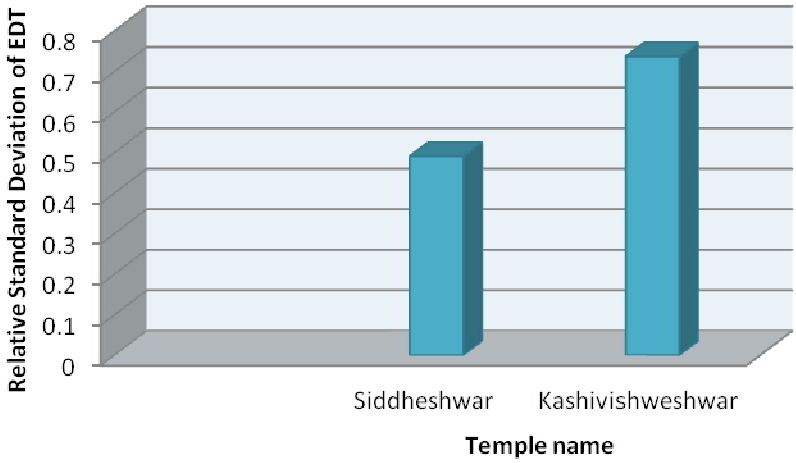


Fig-7: Relative Standard Deviation of EDT for two temples

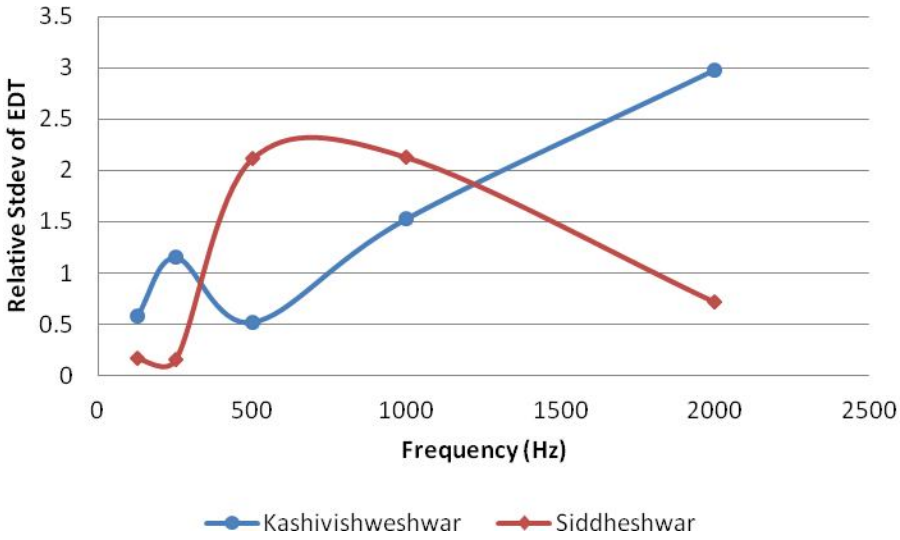


Fig-8: Relative standard deviation of EDT for two temples with frequency

It is observed that for Kashivishweshwar temple, the relative standard deviation of EDT almost linearly increases with frequency beyond 500 Hz, whereas for Siddheshwar temple, the value drops beyond this frequency.

i) Differences between EDT and RT values

To establish reasons for differences between EDT and RT values, here we use the parameters C_{80} and C_{50} - the early to late sound index, called 'clarity' of sound. A common observation for both temples is that with increase in early decay time, the early to late sound index goes on decreasing. C_{50} values are positive when early sound is higher than the reverberated energy, while C_{80} values are generally negative and are defined for enclosures meant for music. It is seen that there is a negative correlation between the early-to-late index and EDT-RT ratio.

It is observed that, for Kashivishweshwar temple, the reverberation time (60 dB) range from 0.1 to 0.5 seconds for 125 Hz to 500 Hz octaves, and it is 1.3 seconds at 1000 Hz. These values agree with the data available for enclosures meant for speech. However, at 2000 Hz the RT shows a drastic change which shows that such high frequency sounds are not suitable inside the temple enclosure. Such frequencies would, on the contrary, make the enclosure noisier. For Siddheshwar temple, the RT is in the range of 2 to 3 seconds for 125 Hz and 250 Hz sound, while RT is on a higher side above 500 Hz frequency octaves. This shows that the temple enclosure may be used for music performances or mass prayers for 125 and 250 Hz sounds and higher frequency sounds may be avoided for better performance within the enclosure. The judgment is reasonable since mass prayers or meditations are generally done at low frequency octaves. The data obtained for RT and EDT are therefore in agreement with standard data. An important point to note here is that, ladies voice generally comprises mostly of higher frequencies and the temples were built at a time when the Indian society was largely male-dominated. Whether this is a deliberate architectural design or merely a coincidence, may be focused upon in future.

ISSN 2394 - 7780

It is observed that in Siddheshwar Dhom and Kashivishweshwar temples, mean EDT values are shorter than RT. This means that the strongest reflections are coming from large surfaces which do not form the actual temple enclosure. These surfaces are nearby pillars which extend from the floor to the ceilings. Further, in such places, the decay curve must be steep in its first stage and thereafter flatten out and attain a value in accordance with the reverberation time of the enclosures. This also shows that the early energy is directed more towards the rear side of the temples than on the front side. However, in none of the temples, mean EDT is much smaller than RT and hence, there is always some amount of 'liveliness' in the temples. Higher RT values may be accepted for musical performances if the enclosure is well diffused. In Siddheshwar Dhom and Kashivishweshwar, large part of first reflections are directed towards the devotees in the hall and only a small part reaches the people ringing the bell while in other temples, the sound field is more diffused.

It is observed that Kashivishweshwar temple shows positive C_{50} for most of the frequency octaves which is generally observed for enclosures meant for speech; whereas Siddheshwar Dhom temple shows negative C_{80} values for most of the frequency octaves, generally for enclosures meant for musical performances.

ii) **Prominent Frequencies**

To determine the audible frequency spectrum, Fast Fourier Transforms (FFT – 'Spectrogram Plots') and 3-D Time Fast Fourier Transforms ('Waterfall Plots') were plotted. It is seen that spectral distributions for the two recorded sounds are different and hence, sound perception of the two bell sounds will be different. For Kashivishweshwar Temple, the peaks are more concentrated near the lower frequencies and the partials maintain their amplitudes with time. However, at certain intermediate frequencies, sharp peaks are seen revealing that at these frequencies, the sound would carry more energy, but for a short amount of time, and hence devotees may be abstained from such energy. For Siddheshwar Temple, however, the peaks are highly concentrated near the lower frequency spectrum but the partials do not maintain their amplitudes with time and diminish at a faster rate. The bell produces some sound energy in a finite time interval and the surroundings transmit and absorb this energy in some other finite time interval. The images given here are a picture of dispersion of sound spectrum. The prominence of energy received is a function of both, the amplitude of sound and the time for which sound is received. Having very large amplitude for infinitesimally small time doesn't carry lot of energy. Similarly, very small amplitude (at any frequency) for a long time cannot convey much energy. It is the integration that matters.

However, sizable amplitude for a sizable time does carry significant amount of energy, and this is represented in the Time FFTs.

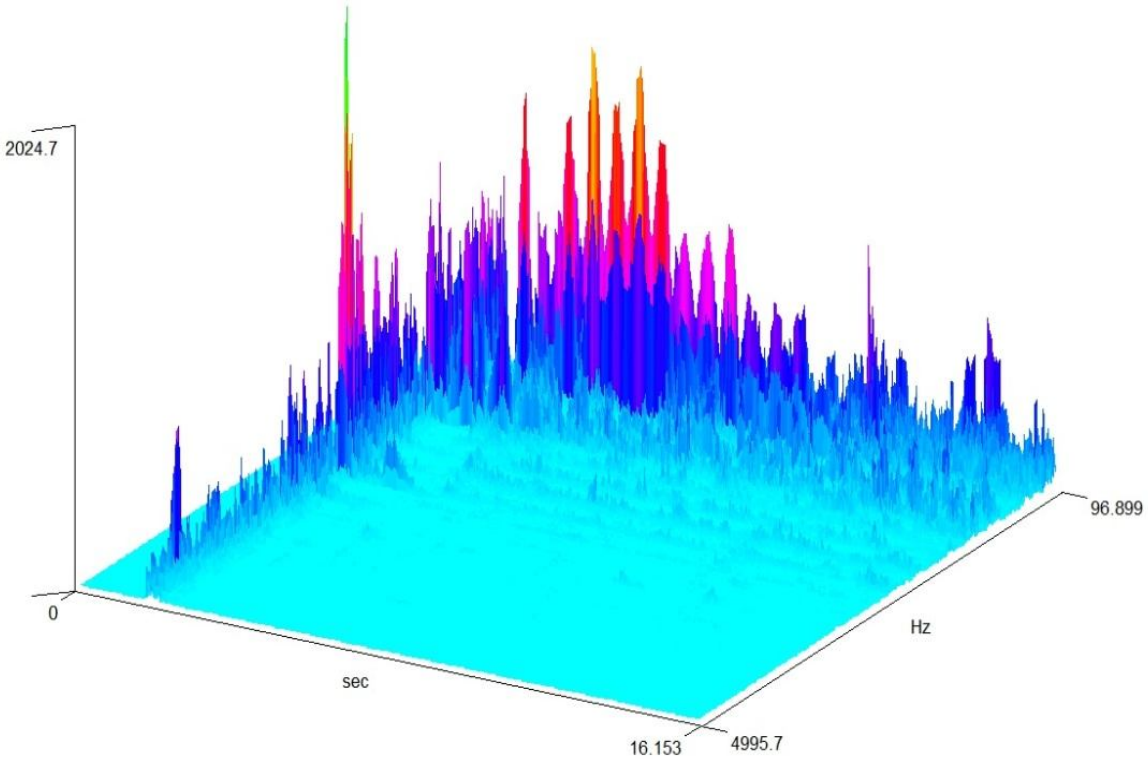


Fig-9: Time FFT plot for Kashivishweshwar Temple (Waterfall plot)

ISSN 2394 - 7780

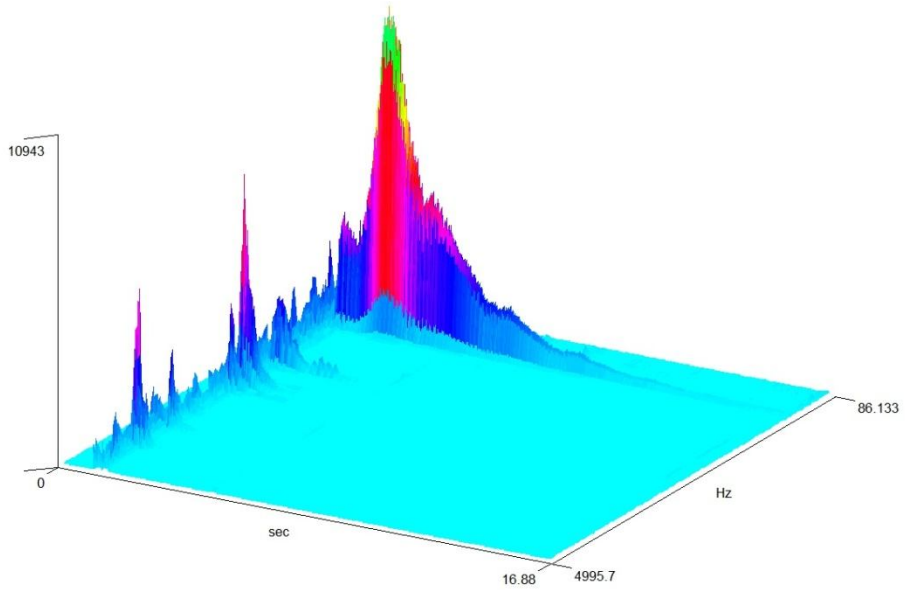


Fig-11: Time FFT plot for Siddheshwar Temple (Waterfall plot)

iii) Final Conclusions

The authors therefore conclude that, Kashivishweshwar temple is more suited to speech, like prayers or religious preaching whereas Siddheshwar Dhom temple is best suited for activities like musical performances or prayers with musical accompaniments. A high value of the early to late index (C_{80}) may be due to either a high level of early sound or a low level of late sound, and either of these may also result in low values for the early decay time. The corresponding causes of high values for the EDT relative to the RT may be due to weak early sound or a high level of late sound. In both the worship places, the lower frequencies appear to be more prominent, with varying time intervals for which the sound energy is propagated through space. It is the value of early-to-late sound index which is more helpful in determining the appropriateness of the spaces for speech or musical performances.

Future work may include using some suitable materials, in combination, though temporarily, to alter the surface coatings of the temples to make temples appropriate for music and speech both, however care has to be taken to preserve the heritage temples and not hamper the quality of original materials that were used for construction.

ACKNOWLEDGEMENT

The Authors are thankful to the Managements of Sandip Foundation and Sandip University, Nasik, and Nowrosjee Wadia College, Pune for supporting the research activity. Timely help received from the Principals, Deans, Heads and Colleagues at both the Institutes is gratefully acknowledged.

REFERENCES

1. **Prasad, M.G., Rajavel, B. (2017)** *Acoustical Studies of Worship Spaces in Hindu Temples*. Proceedings of 24th International Congress on Sound and Vibration, London.
2. **Fastl, H. (1997)** *The Psychoacoustics of Sound Quality Evaluation*. Acta Acustica united with Acustica, **83**(5), 754-764.
3. **Fastl, H. (2006)** *Psychoacoustic Basis of Sound Quality Evaluation and Sound Engineering.* Proceedings of the 13th International Conference on Sound and Vibration.
4. **Beranek, L.L. (1962)** *Music, Acoustics and Architecture*, USA, John Wiley and Sons Inc.
5. **Beranek, L.L. (1996)** *Concert and Opera Enclosures : How They Sound*, New York, Acoust. Soc. Amer.
6. **Thapar, Binda. (2004)** *Introduction to Indian Architecture*, Periplus Editions, 143
7. **Michell, George (1998)** *The Hindu Temple : An Introduction to its Meaning and Forms*, Univ of Chicago Press, Chapter 1
8. http://www.culturalindia.net/indian-architecture/ancient-architecture/temple-architecture.html
9. http://www.hibberts.co.uk/wavanal.htm#wavanal
10. https://www.sonium.fr/acoustique-architecturale

ISSN 2394 - 7780

11. https://www.sigview.com
12. **Gupta, Anirvan and Raybagkar, Vijay (2018)** *Acoustical Analysis of Bell Sounds from two temples in Maharashtra and Gujarat*. Acoustics Bulletin, **43**(2), 42-50
13. **Shroeder, M.R. (1982)** *New Method of Measuring Reverberation Time*. J. Acoust. Soc. Amer., **71**, 619-629
14. **Jordan, V.L. (1970)** *Acoustical Criteria for Auditoriums and Their Relation to Model Techniques.* J. Acoust. Soc. Amer., **47**, 408-412
15. **Gupta, A.B., Chaudhari, L.M. and Raybagkar, V.H. (2018)** *Analysis of Acoustical Characteristics for Understanding of Sound Quality and Acoustic Environment Inside Temples*. Int. J. Engineering Technology Science and Research, **5**(3), 1908-1920
16. **Barron, M. (1995)** *Interpretation of Early Decay Times in Concert Auditoria*. Acta Acustica united with Acustica, **81**(4), 320-331

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

TO UNDERSTAND THE TRENDS IN GREEN FINANCE – BANKING SECTOR

Prof. Navin Bhatt[1], Prof. Jai Kotecha[2] and Dr. Dipali Pulekar[3]
Assistant Professor[1,2], Finance, Thakur Institute of Management Studies and Research, Mumbai
Assistant Professor[3], HR, Thakur Institute of Management Studies and Research, Mumbai

ABSTRACT
Green finance involves financing of private and public green investments in the areas of environmental goods and services including prevention and minimization of damages to the climate and environment. The core concept of green finance is to provide finance support for green growth without damaging future generations or environment. In green financing the banks and companies promote environmentally responsible investments with the aim to create harmony between economy and environment. The main objectives are to promote green industry, environmental pollution prevention projects, achieve the goal of low carbon economy and to undertake renewable energy development projects. Factors which has necessitated promotion of green finance in organizations are climate change and energy constraints. India is one of the major emerging countries practicing green finance for long term sustainability and benefits. This paper mainly highlights the green banking initiatives by public and private banks, perspective in Indian economy and challenges in green finance initiatives based on secondary data.

Keywords: Green Finance, Low Carbon Economy, Renewable Energy

INTRODUCTION

The finance sectors play a vital role in the performance of the economy in terms of its growth and development. With the increasing environmental concerns, it is very important for the finance sectors to take heed of the environmental issues and challenges. With this perspective the concept of green finance has been evolved which is an innovation in the field of finance. The banking sector has a important role in the economic development of a country. Importance of finance in creating and developing more environment friendly technologies which address concerns regarding the environmental protection is now known to the world. If the bank facilitates funding of projects in areas of renewables and cleantech, it helps to develop the new technology which will ultimately bring down the cost bring down the cost.

The basic tenets of Green Finance are to make investments in projects which are environmentally sustainable aims at reducing or avoiding greenhouse gas emissions, controlling and minimizing industrial pollution, waste management, water sanitation, and protection of biodiversity. Concept of green finance also includes green investments i.e. stocks, exchange traded funds and mutual funds of the companies whose operations aims at improving the environment.

RESEARCH OBJECTIVES

1. Brief overview of the Indian perspective on green finance.
2. Initiatives taken by banks on green banking
3. Green finance products available in the markets
4. Future scope of Green Finance in India

DATA COLLECTION

The data is collected from various secondary sources such as research papers, annual reports, company's website, articles, annual reports, etc.

Sample – The banks selected for the study is on the basis of convenience sampling wherein two public and two private sector banks were selected for study.

LITERATURE REVIEW

(Goel, 2016) conducted study on the initiatives taken by various public sector and private sector banks on green banking practices like introduction of paperless banking, employment of wind power as an alternative source of energy to thermal power, building of solar plants, concessional rates of interest charged on green projects etc.

(Hoshen, et al., 2017) highlighted present scenario of green financing in Bangladesh, ongoing initiatives of the banks and NBFI, green finance in different products, disbursement of green finance of the country, refinance scheme for green products, environment risk management, CSR activities of bank etc. Main findings are Private Commercial banks play a vital role in green projects contributing (80.4 percent) of total green finance, Bangladesh Bank has sanctioned more amount of money in FY16 than FY15 in CSR activities.

ISSN 2394 - 7780

(Reddy, 2018) studied that Government of India has taken various steps for sustainable development but the private sector participation for sustainability is in the nascent stage. There are various constraints in the growth path of green finance (like low profitability of green industries, less awareness among consumers and investors etc.), but the removal of these will definitely lead to the development of green finance.

(Dileep G Menon, 2017) studies the green initiatives undertaken by Indian Banks and green products and services available in the market. Also highlighted the advantages of green banking and financing.

GREEN FINANCE – AN INDIAN PERSPECTIVE

As per the report of Bloomberg New Energy Finance (BNEF), India secured second place in the global ranking towards renewables and increasing investments in the environmentally friendly energy sector. India has set an ambitious target of 175 GW through renewable energy by 2022, representing a 50-percent increase in India's current electricity generation capacity of 345 GWAs. India is also aiming to electrify its transportation system through completing the electrification of its broad-gauge rail (16,500 km) by 2022. There has been seven-fold increase in the sale of Electric Vehicles from 10,321 vehicles in 2015 to 72,482 in 2017. E-rickshaws have grown to an estimated 1.5 million

According to the High-Powered Expert Committee appointed by the Ministry of Housing and Urban Affairs, over the next 20 years, about Rs. 39 lakh crores at 2009-10 prices is required for the creation of urban infrastructure. Out of this, about 44 percent was needed for roads and 20 percent for services such as sewerage, water supply, storm water drains and solid waste management. This estimates excludes investment in infrastructure that service the cities' needs like electricity grids and generation which is outside the city, or buildings which are funded by private developers. The Housing for All by 2022 programme aims to construct 20 million houses in seven years with a subsidy of US$ 1500 per house to cover slum clearance expenditures and US$ 3400 per house (net present value) for lower income focusing on 1049 towns and cities.

The Government of India has estimated that US$ 4.5 trillion is needed to meet India's ambitious targets for renewable energy and urban sustainability over the next ten years – around US$ 450 million per year

India is facing fund constraint for investment in new technologies and innovation, equally more difficult for both government and private sources. Public finance is the major source of getting funds for these sustainable activities, but government of India already has large fiscal deficit which makes the availability of funds difficult. Moreover, Indian economy has also come under middle income class group as per the classification of World Bank, because of which the flow of funds from international financial institution will also decline. So, the development of green financial system/ sustainable financial system which capitalises the private finance into sustainable development is vital.

The Indian green bond market had its first green issuance three and a half years ago and 20 green issuances have happened since. By November 2018, the total green bond issuance reached US$ 7.15 billion making it the 12th biggest issuer in the world by dint of the size of the Indian economy and the sophistication of its financial sector.

Issuing institutions have included non-financial corporates like Greenko, private banks like Yes Bank and also public sector backed entities like IREDA, and the Indian Railway Finance Corporation.

Issuing institutions have included non-financial corporates like Greenko, private banks like Yes Bank and also public sector backed entities like IREDA, and the Indian Railway Finance Corporation. Bond proceeds have been used to finance utility scale renewables, energy efficient buildings and large-scale transport infrastructure.

GREEN BANKING INITIATIVES TAKEN BY INDIAN BANKS

Today banks are promoting extensive usage of green banking products and effectively initiated initiatives of green banking measures towards sustainability and environmental protection. Some of the measures and initiatives taken by the banks are highlighted below -

AXIS BANK

Axis bank's environmental management efforts are inclined towards resource conservation, renewable energy and energy efficiency. Through its Green Banking Initiative, the bank –

1. In order to reduce paper consumption, Axis Bank encourages its customers to subscribe for e-statements and other electronic formats of communication
2. Encourages to adopt green building concept for its office space (Bank's corporate office 'Axis House' is designed and constructed as a Platinum LEED-Certified "Green Building") and many other similar activities.

ISSN 2394 - 7780

3. Programs like planning of trees were initiated (Plant a Sapling initiative)
4. For the purpose of street lighting uses renewable energy units were encouraged.
5. Water collected from rainwater were used for harvesting system and a sewage treatment plant.
6. Uses furniture made out of recycled materials.
7. Use of solar-based UPS for ten ATMs under its Independent ATM Deployment (IAD) model.

Loan sanctioning is a stringent process in Axis Bank and all the projects have to undergo thorough necessary scrutiny process on environmental background.

ICICI Bank

1. In order to reduce the carbon footprints of the customer ICICI Bank introduced the convenience of anytime anywhere banking through Inter-net banking, i-Mobile banking.
2. Bank offers Auto 50% waiver on processing fee on car models which uses alternate mode of energy. The models identified for the purpose are, Maruti's LPG version of Maruti, Honda Civic etc.
3. Concession is given in loan processing fee customers who purchase homes in 'Leadership in Energy and Environmental Design' (LEED) certified buildings.
4. The bank has stopped sending physical statements for saving accounts.
5. Shredding and recycling all paper internally
6. Use of emails, voice mails, electronic files, voice mail instead of paper memos
7. Use of two-sided printing when possible as well as limiting printed materials
8. Replacing incandescent bulbs with CFLs when they need to be replaced
9. Use of "Webinars" for shorter meetings that involve people who might otherwise have to travel a long distance
10. Encouraging use of carpool and use public transportation

State Bank of India

1. Helping entrepreneurs for construction of wind farms
2. Financing construction of new buildings on conditions that the building will adopt green standards including constructions with natural lightings and water harvesting of recycled water.
3. Financing of the projects having low carbon emission
4. Less use of papers and extensive use of online transactions and money deposit and withdrawal through ATMs.

Punjab National Bank

1. Use of energy efficient appliances in various branches of the banks.
2. Financing of commercial projects which are producing renewable energy
3. Sanctioning of projects involved in the production of wind energy
4. Introduction of e-solutions through paperless transactions and extensive use of communication through e-networks resulting in judicious usage of resources.
5. Introduce the concept of green audits to spread awareness of green practices in various branches of the banks.

Overview of Green Finance Products and Services

Corporate Investment Banking

a. Project Finance for companies promoting renewable energy projects
b. Venture capital at the time of raising of IPO
c. Green Index, banks introduced index for loan sanctioning considering green initiatives

Asset Management

a. By purchase of green fiscal fund customers are exempted from paying capital gain tax

ISSN 2394 - 7780

b. Introduction of carbon fund for funding of companies involved in reduction in carbon emission.

Insurance

Issuance of Insurance product with insurance premium having environmentally related characteristics.

Issuance of Insurance for emission reducing activities and clean technology

Retail Banking

Green Mortgage – To reduce the borrower's expenses and invest more in mortgage payments

Green Credit Cards – To reduce carbon footprints of every transaction

Green Loans – for promoting eco – friendly products to small borrowers.

Green Building Loans – For constructing environmentally friendly construction with less pollution

FUTURE SCOPE OF GREEN FINANCE IN INDIA

Sustainable environment is the global concern on a worldwide level thereby increasing the potential for investment in green projects particularly utilizing renewable energy resources. Hence financial institutions and banks are looking forward for investment in this particular sector. Major funding source of the projects will be through issuance of green bonds. In India renewable energy could be lowered by max 50% in the year 2030 by investing in energy efficient technologies and green projects promoting safe environment free from pollution. International Finance Corporation is playing a major role in this respect and decided t invest US $ 75 million in green bonds issued by PNB Housing Finance Ltd. Various steps has been taken in 2007 for mitigation of climate change under the supervision of Prime Minister like Jawahar Lal Nehru National Solar Mission, National Clean Energy fund, National Mission on Strategic Knowledge for Climate Change etc.

Recent initiatives taken by the Government are as follows –

1. Generation of 10% of its power from renewable energy resources by 2015 and 15% by 2020
2. Encouraging public and private leaders and work in partnership for investment for green growth
3. Provide venture capital for investment in solar projects
4. Introduction of CNG in train operations and use of solar energy for lightings in platforms and buildings

CONCLUSION

India is listed among the most 5 populated cities in the world. Today India is facing chronic issues towards excessive construction activities, tree cutting at various places, emission of pollution from increased vehicles on roads and industrial activities resulting to increased pollution posing threat to sustainability to environment. Banks and financial institution have to play a critical role to protect our environment by spreading awareness to various stakeholders and indulge in transactions (mainly digital and online) which are environment friendly. Extensive use of green banking / financing products and services like issuance of green bonds, online banking, mobile banking etc should be encouraged. Project finance should be sanctioned by banks on conditions meeting green standards. Banks should be rated in accordance with green initiatives and quality of operations which will help to shape the economy towards green and sustainable environment.

REFERENCES

1. **Dileep G Menon, S. S. (2017). Green Banking Initiatives: A review of Indian Banking Sector. *IEEE International Conference on Technological Advancements in Power and Energy (TAP Energy)*.**
2. Goel, P. (2016). GREEN FINANCE: A STEP TOWARDS SUSTAINABLE FINANCIAL SYSTEM. *Abhinav International Monthly Refereed Journal of Research in Management & Technology*, 22-31.
3. Hoshen, M. S., Hasan, M. N., Hossain, S., Mamun, M. A., Mannan, A., & Mamun, D. M. (2017). Green Financing: An Emerging Form of Sustainable Development in Bangladesh . *IOSR Journal of Business and Management*, 24-30.
4. Reddy, A. S. (2018). GREEN FINANCE-FINANCIAL SUPPORT FOR SUSTAINABLE. *International Journal of Pure and Applied Mathematics*, 645-651.
5. https://www.sbi.co.in/
6. https://www.pnbindia.in/
7. https://www.axisbank.com/
8. https://icicibank.com/

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

CLINICAL IMPORTANCE OF THE PROCESS PRODUCING ROUGHNESS IN BODY: PERSPECTIVE OF AYURVEDA

Shrikant Pandey[1] and B. K. Dwibedy[2]
Senior Resident[1] & Ph. D. Scholar and Professor[2], Department of Siddhant Darshan, Faculty of Ayurveda, I.M.S., B. H. U., , Varanasi

ABSTRACT
Rukshana is relative karma of Snehana karma. Infact it is opposite to Snehana Karma. As its name suggests with the help of different Dravyas if we create/increases the Rukshata/roughness in body it is called Rukshana Karma. It is one among the six procedure adopted for treatment in Ayurveda. No any procedure is beyond these procedures in context of treatment in Ayurveda. There are so many drugs described for Rukshana Karma which are used on the basis of Roga and rogi. Rukshana Karma is done many diseases. This process can be applied independently or as a supporting procedure to Langhana karma. Other procedure may also be synchronised with the process of 'Rukshana' karma.

INTRODUCTION
Ayurveda is the oldest science related to health and human being. This science is existing from beginning to till now with it's fundamentals of basic principles and Charak Samhita is the one of the most important text book of Ayurveda. Acharya charak has categorized all the remedial procedures under six groups, in the sutrasthan of charak samhita. Rukshana karma is one among them and is opposite to the Snehana karma which produces unctuousness and much more in the body. Rukshana karma is performed in specific diseases, specific patients, at specific time by specific drugs and/or food and/or regimen. There is a need to collect and compile all the related matter to clarify its concept. In this paper it is tried to do so.

Definition of Rukshana
Dravya producing Rukshata (dryness), Kharata (roughness), Vishadata (cleanliness) are Rukshana (producing dryness) Dravyas.[1]

Properties of Rukshana Dravya
Dravya having properties such as Rukshata (dryness), Laghuta (lightness), Kharata (roughness), Tikshnata (sharpness), Usnata (hotness), Sthirata (supporting property), Picchilata (sliminess), mostly Kathina (hard) Dravyas are known to be Rukshana (producing dryness) Dravyas.[2]

Rukshana Dravyas have counter qualities of Snehana Dravyas.[3]

Persons suitable for Rukshana
Oleation therapy is not beneficial to the patients who are eligible for Ruksana (drying) therapy except for the purpose of administering Samshodhana (elimination therapy); also to those in whom Kapha and Medas (fat) are aggravated.[4]

Methods for performing Rukshana Karma
Drying therapy constitute Intake of Katu (pungent), Tikta (bitter) and Kasaya (astringent) substances, Khali (oil cake of mustard and Til), buttermilk, honey, etc. and uncontrolled sexual indulgence.[5]

Application of Ruksha Sveda
Persons in whom are Kapha is aggravated, should be administered dry sudation with dry liquid. In case of diseases of Kapha and Vata, Snigdh (unctuous) sudation and also Ruksha (dry) sudation alternately should be given.[6]

Signs and symptoms of proper and excessive Rukshana
It is same as that of Langhana therapy.[7]

Rukshana Dravya
Minuteness, dryness, roughness, coldness, lightness, cleanliness, excessive perceptivity to touch, slightly bitter in taste and prominently astringent are the properties of Dravyas having Vata Mahabhuta as dominant part and it functions as cleansing, lightening, drying agent and causes movements.[8]

As Nidana of various diseases
1. Karsyata: Excessive emaciation is caused by the intake of ununtuous diets, drinks, fasting, intake of food in inadequate quantity, over administration of elimination therapies, grief, suppression of natural urges including the urge for sleep.[9]

ISSN 2394 - 7780

2. Vataja Jwara : Ruksha, Laghu, Sheeta Ahaara and Vihara, Atiyoga of Sodhan Karma etc. causes aggravation of Vata and genesis of Vaatika Jwara.[10]
3. Vataja Prameha: Excessive use of Kasaya, Katu, Tikta, Ruksha, Laghu, Sheeta Dravyas and other things causes aggravation of Vata quickly and genesis of Vataja Prameha may occur.[11]

In treatment of various diseases

1. Dhoompaan Atiyoga : If symptoms appear due to Atiyoga (untimely and over)of smoking, patient should be treated with intake of ghee, administration of nasal drops, collyrium and demulscent drinks are prescribed. These should be prepared with unctuous drugs in the event of vitiation of Vayu associated with Pitta, with cooling drugs in the case of Raktapitta, and with arid drugs in the event of vitiation of Kapha and Pitta.[12]
2. Sotha (Jalagadabha): Langhana (fasting), Raktamokshana (blood-letting), Virukshana (applications of ununctuous ointments), Vishodhana (elimination of the Dosas from the body) (by emesis, purgation, etc,) should be given. Different forms Dhatri (embelia officinalis) should be administered to such a patient and cooling ointments should be in variably be applied.[13]
3. Kasa : The Virukshana (drying therapies) should be administered when Vatika and Kaphaja types of Kasa are associated with expectoration of the phlegm, if not, then Snigdha (unctuous) therapies should be administered.[14]

   Food and drinks mixed with bitter ingredients, should be given, If Kaphaja Kasa is associated with Pitta.
4. Arsha: The association of bleeding piles with the secondarily aggravated Vayu due to ununctuous food and regimens, should be determined first.[15]
5. Visharpa: In the beginning drying therapies should be given, if these Ama-Dosas are located in the Ashaya of Vayu (lower part of the body). As the disease involves the vitiation of Rakta (blood) and Pitta (in the Samanya-Samprapti or general pathogenesis), Snehana (oleation therapy) in the beginning, is not useful.[16]

   In Visarpa it is not beneficial to apply Snehana (oleationtherapy) in the very beginning of the treatment but it is helpful to administer Langhana (fasting), Rukshana (drying therapy), Raktavasek (blood letting), Vamana (emesis) and Virechana (purgation) therapies in beginning of treatment.[17]
6. Switra: After purification therapies, Shonitamokshana (blood letting), Virukshana Bhakshana (use of dry corn flour as food), Switra (leucoderma) gets cured of the person, when his sins have decreased.[18]
7. Jalagardabha: For the treatment of Jalakgardabha, Vilanghana (fasting), Raktavimokshana (blood letting), Virukshanam (drying therapy), Vishodhana (purification therapies), recopies of Dhatri, cold application of body should be applied.[19]

DISCUSSION

Rukshana Karma is based on Ruksha Guna. This Guna is applied directly. The aim of Rukshana to make dry, thin, softless, smoothless etc. Some dictionaries indicates this process makes hardness. It's characteristics are indicated as dryness, roughness etc. The eight Gunas exist in Dravyas which is regarded as Ruksha i.e. Ruksha, Laghu, Khara, Teeksha, Usna, Sthira, Picchila, kathina. Acharya vagbhatta has not mentioned the Gunas applied in Rukshana directly but he has mentioned the relative Gunas and indicated that if any Dravya has counter quality of Guru, Sheeta, Sara, Snigdha, Manda, Sukshna, Mridu, Drava can be applied in Rukshana procedure. It means Laghu, Usna, Sthira, Ruksha, Teekshna, Kathina, Sandra etc. Gunas have role in Rukshana. The Ruksha Guna have a specific effect of SOSHANA ¼'kks"k.k] Absorbtion½. It absorbs the fluid of body. The Teekshna Guna opens the orifices of Srotas. Fluid takes away by Ruksha. The Picchila Guna keep sliminess and Kathina Guna has role for hardness. Infact this Rukshana process a supporting procedure of Langhana. The maximum Gunas of Langhana Dravyas are maintained or exist in Rukshana Dravya. Specially this process is applied in case of Kaphaja and Medaja vikara. In some specific cases of Amavastha, Rukshana is applied. In this procedure there are no specific tools and techniques have been described but this process is proceeded through drug and diet internally and externally through other techniques like in case of Amavata, Ruksha sweda is applied. Ruksha sveda may be regarded as a Rukshana Chikitsa. But the technique is Svedana so a specific type of Svedana named as Ruksha sveda has been described. It is counter of Snehana Karma, where body is over Snigdha, this Chikitsa should be applied. The some techniques applied externally or on the basis of Rukshana, as Utsadana, Pradeha etc. Methods of Internal Rukshana is based on diet and drug. In this reference it is indicated that Katu, Tikta, Kasaya, Dravyas have role for Rukshana because in three Rasas, Vayu Mahabhuta is common in which main Guna is Ruksha.

ISSN 2394 - 7780

In Katu Rasa, Vayu Mahabhuta is with Agni which has Usna Guna. In Tikta Rasa Vayu with Aakasha Mahabhuta and in Kasaya Rasa, Vayu with Prithvi Mahabhuta which has Sthira, Khara and Kathina Guna. Except this some specific Dravya are also indicated for Rukshana like Khali, honey, Pinyaka etc. Some diet and drugs are indicated for Rukshana Karma such as Chanaka, Kareera etc. Some disease and conditions are managed by Rukshana Chikitsa given here - Sotha, Kasa, Arsha, Visarpa, Switra, Jalagardabha etc.

REFERENCES

1. Sharma R.K., Dash Bhagwan, CarakaSamhita, Vol. 1, Sutrsthan, 22;10 series 2009, pg. 388
2. Sharma R.K., Dash Bhagwan, CarakaSamhita, Vol. 1, Sutrsthan, 22;14 series 2009, pg. 388
3. Muthy K.R. Srikantha, Astanga Hridaya, Vol. 1, Sutrsthan, 16;1 series 2007, pg. 208
4. Sharma R.K., Dash Bhagwan, CarakaSamhita, Vol. 1, Sutrsthan, 13;53 series 2009, pg. 257
5. Sharma R.K., Dash Bhagwan, CarakaSamhita, Vol. 1, Sutrsthan, 22;29 series 2009, pg. 391
6. Muthy K.R. Srikantha, Astanga Hridaya, Vol. 1, Sutrsthan, 17;13 series 2007, pg. 221
7. Sharma R.K., Dash Bhagwan, CarakaSamhita, Vol. 1, Sutrasthan 22;39 series 2009, pg. 393
8. Sharma P.V., Susruta Samhita, Vol. 1, Sutrsthan, 41;4 series 2010, pg. 382
9. Sharma R.K., Dash Bhagwan, CarakaSamhita, Vol. 2, Sutrsthan, 21;11 series 2017, pg. 376
10. Sharma R.K., Dash Bhagwan, CarakaSamhita, Vol. 2, Nidansthan, 1;19 series 2017, pg.
11. Sharma R.K., Dash Bhagwan, CarakaSamhita, Vol. 2, Nidansthan, 4;36 series 2009, pg.
12. Muthy K.R. Srikantha, Astanga Hridaya, Vol. 3, Chikitsasthan, 1;40 series 2009, pg.
13. Sharma R.K., Dash Bhagwan, CarakaSamhita, Vol. 3, Chikitsasthan, 12;100 series 2009, pg. 516
14. Sharma R.K., Dash Bhagwan, CarakaSamhita, Vol. 3, Chikitsasthan, 17;133 series 2009, pg. 150
15. Sharma R.K., Dash Bhagwan, CarakaSamhita, Vol. 3, Chikitsasthan, 14;172 series 2009, pg. 616
16. Sharma R.K., Dash Bhagwan, CarakaSamhita, Vol. 3, Chikitsasthan, 21;46 series 2009, pg. 278
17. Muthy K.R. Srikantha, Astanga Hridaya, Vol. 3, Chikitsasthan, 18;1 series 2005, pg. 161
18. Sharma P.V., Astanga Hridaya, Vol. 2, Chikitsasthan, 20;18 series 20005, pg. 182
19. Sharma P.V., Astanga Hridaya, Vol. 1, Uttartantra, 32;6 series 2005, pg. 299

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

PRACTICE OF INTEGRATED MEDICINE: SCOPES AND LIMITATIONS

Deepti Singh
Assistant Professor, Department of Kriya Sharir, Jeevak Aurveda Medical College and Research Centre, Ekauni, Chandauli, Varanasi

ABSTRACT
Conventional system is failing to cover whole population of country with complete and proper health care system because of increasing cost of medicines and health care system. Traditional system is also unable to cover whole population and all aspect of health and diseases because of unavailability of proper drug, poor palatability of drugs, lack of emergency medicines etc. Therefore, a high need is developed to facilitate the health progress in India by practicing integrated medicine. With the use of this kind of practice some highly beneficial results were found but also some significantly negative aspects came forward. Therefore now, it is very important to think about all the aspect of this kind of medicinal practice. In this paper such type of issues are discussed.

INTRODUCTION
Conventional system is failing to cover whole population of country with complete and proper health care system because of increasing cost of medicines and health care system. The nature of disease changing with time but with proper sanitation program & giving attention to the infectious diseases by expanding primary health care to rural areas & developing the primary prevention period, there is decline in the rate of mortality and morbidity with infectious diseases. Current time is the era of various resistant pathogens and a frequently used group of drug called NCDs which are the new challenges for the WHO. Conventional system of medicine is sufficiently effective against these problems so WHO promoting the integral system of medicine. Therefore in many cases, for better efficacy and safety, modern therapies are combined with conventional medicine. Thus the term alternative medicine has been dropped and replaced with some different terms like complementary medicine, integrative medicine etc. so, integrative medicine is a combined form of modern medicine and alternative medicine. A lot of countries have accepted the Alma-Atta declaration (1978) to achieve the goal of 'Health for All' through primary health care system. WHO emphasized to achieve this goal in large scale yet could have not covered a large number of populations.

INTEGRATED MEDICINE
In present scenario of treatment policies, a new terminology, which is quite popular, has evolved known as Complementary and Alternative Medicine (CAM). The new goal of WHO to be achieved is Universal Health Coverage. Regarding this aim, strategies have been made by WHO for the acceptance of integrative medicine system. It's a form of medical path which accepts and combines the treatment principles from traditional and complementary medicines with the conventional medicine for their clinical application and better consequences.

This article is aimed at seeking special attention on the scope and limitations of the practice of integrated medicine. All the points regarding this will be discussed under four categories along with the two objectives i.e. prevention and cure-

1. Policy making level/ Country level
2. Institutional level/ Educational level
3. Management level/ Hospital level/ Practitioner level
4. Public level/ Patient level

1. **Public level**:-

Scope-

The present status of conventional system of medicine is raised cost price of medicines along with the location of infrastructure of proper and complete health care system mostly at district headquarters and tehsil level.

With the integrated system of medicine, patient will be able to make approach for better coverage in prevention and cure of disease.

a) At level of prevention-

- Promotion of health can be achieved by remembering and increasing the uses of local herbs and methods.
- Following proper Dincharya, Ratricharya and Ritucharya, people can accommodate more comfortably with their environment.

ISSN 2394 - 7780

- Promotion of health or immune system can be achieved by advising traditional/ Ayurvedic Rasayan therapy and thus help in preventing infectious diseases with immunization.

b) At level of cure-

- Study reveals that 2-3% of growth in poverty is due to costly health care system, however, people through alternative system of medicine, can approach cheap and better treatment.
- Treatment can be managed accordingly in order to minimize its duration.
- Success can be made in the direction of decreasing the rate of morbidity and mortality by managing the complication in better ways.
- Patient will be more conveniently able to approach their health care systems.

Limitations-

It requires more appropriate and proper management of public health issues, and then only they will be benefitted. Else, if ill-managed or wrong approaches are made, it will result in bad consequences.

It seeks a certain level of awareness or knowledge in public regarding systems of medicine and type of diseases which could be managed in better way by each of them.

2. **Policy level**:-

Scope-

- National goal can be achieved by in more confined duration of time with least cost and less health care systems.
- Country can implement the Universal Health Care Coverage policy in more efficient way to achieve Health for All.
- This will lead to increased rate of GDP of our nation by achieving a healthy population.

Limitation-

- Policy makers need to understand the significance of traditional medicines in order to provide proper attention and place for the development of system.
- Initial requirement of nation is the increment in health care budget for improving the quality of researches, educational infrastructures and traditional health care system.
- Researches seek their promotion, for uniform criteria at national level, in the direction of management of each disease through traditional system.
- Promotion of publishing and collection of data related to the safety and efficacy of drugs used in the management of each disease in order to increase faith in scientific forum, institutional bodies and public level.
- Methods and techniques required in researches are the major source of limitation for policy makers because the language and fundamental concepts of traditional medicines are just like north and south directions as compared to conventional system.
- Last but not the least, how should the integration be approached? Whether integration of all systems should be brought and developed under one roof or requires individual development and flourishing with their fundamental principles and techniques, and then bring them under one roof for their merge and practical application. This could be a big question for policy makers.

3. **Institutional level**:-

Scope-

- Health and disease can be understood in more appropriate and elaborative manner by the teachers and students. As they make attempts to learn and compare different systems of medicine, they are the right candidates for making appropriate use of modern tools and techniques along with methods of differential diagnosis of various diseases. Thus, they better understand the merits and demerits and the lacunae of one's own and other system of medicine and this may provide new light in the direction of development and advancement of their own system of medicine. Again, by knowing the lacunae of other systems of medicine, efforts can be made to strengthen own system. However, because our ancient seers have stated to continuously upgrade knowledge, we have to take help of other pathies also.

ISSN 2394 - 7780

Limitations-

- For learning other pathies too, syllabus will become vast and will require more duration of study.
- Multiplicity of syllabus will lead to divergence in the concentration of institute and student towards conventional system of medicine which will hamper proper growth and development of traditional system of medicine.

4. **Practitioner level**:-

Scope-

- While practicing conventional medicines, one lacks alternative thoughts and other new ideas in the management of emerging complications with respect to diseases and disease patterns, e.g. in MDR-TB (multidrug resistant infection), there is lack of proper management of such non-communicable diseases and also lacunae of wholesome-unwholesome regime indications. Therefore, by adopting the integrated approach one my get new direction in the field of disease management.
- On the other side, in traditional system, there is lack of proper acute and emergency management of diseases i.e. absence of antimicrobial, proper analgesic management. Thus, through the adoption of integrated system, they can manage their lacunae and appropriate efforts can be made in the direction of management of such conditions.
- In relation to infectious diseases, integration of medicines may support in decreasing the dose and duration of antibiotics by promoting immunity of patients through traditional medicines. However, in many other diseased conditions, one can also avoid the use of antibiotics. Thus, the risk of resistant development against many such antibiotics can be abstained/ prevented.
- In case of management of NCDs, integration may reduce the cost of treatment by making efforts in right direction against the etiological factors of diseases and thus, the rate of morbidity and mortality can also be decreased.
- On whole, through integration an increment can be made in the safety and efficacy measures of drugs and techniques utilized in the management of each disease. Also, new emerging challenges can be tackled accordingly.

Limitations-

- How to integrate different systems at practioner's level is one of the biggest issues at present time.
- However, giving knowledge and rights to every physician for practicing every system of medicine will lead to consequences like-

i. Emergence of such doctors who will be 'Master of none, Jack of all'.
ii. It will lead to increased Medico-legal cases.
iii. There will always be a fear to the traditional system, as conventional system of medicine are dominating in policy, in emergency and acute case management, in society. Thus, in the fear of being suppressed by practioners of conventional system of medicine, practioners of traditional system will quit from their mainstream.
iv. By practicing integrated medicine, no new challenged will be faced by traditional practioners thus will lead to cessation of new thought processes and development of new ideas, way of management of diseases.

- If we limit integration by allowing practicing, every expert in their own field only and by asking the referral of pateints to the disease expert only then there will be ego conflict, faith conflict at practitioner level and at patient level in respect to decreased cost and medicine it will be increased cost and medicine. And also burden to go all the OPDs.
- If these issues will not be sort out then practice of integrated medicine will be beneficial only for the pharmaceutical industries by taking or stealing the better thoughts of traditional medicine, and after modification, marketing them under the terms of conventional system of medicine. For example, Himalaya, Charak pharmaceuticals; by taking the concepts of Ayurveda, they develop drugs on the basis of modern parameters and modern science, naming drugs like modern medicine, and thus increasing their turnover just on the basis of allopathic practioners.

ACKNOWLEDGEMENT

I am very thankful to Dr. Rahul Jaiswal. All the ideas inside this paper are highly influenced by him. Thank you Sir.

International Journal of Advance and Innovative Research
Volume 6, Issue 2 (XXIV): April - June, 2019
ISSN 2394 - 7780

AN ANALYTICAL STUDY OVER THE CONCEPT AND APPLIED ASPECT OF PATHYA: A DRUGLESS THERAPY

Dr. Hirdesh Kumari
M.D.(Ay), Department of Samhita and Sanskrit, Faculty of Ayurveda, I.M.S., BHU, Varanasi

ABSTRACT
World is now making approach in the direction of drugless therapy. Every science has its own field of expertise and specialty. Ayurveda possesses two-way approach for the welfare of human being i.e. the maintenance of health of healthy individual and cure of ill people; which causes the dhatusamya. Ayurveda endorses a life style which comprises of wholesome diet and activities along with the self-awareness of a healthy person in order to maintain the healthy status. Ayurveda proposes three-way approach to cure the disease i.e. use of Ahara, Vihara and Aushadha to alleviate the vitiated doshas. Out of these fundamentals, pathyasevana is one of the most important tools in the fulfillment of the aim and objectives of Ayurveda and is now on the track to get succeed in expanding their roots in the world of health management and making boom all over the world. Thus, this article focuses on unveiling the concept of pathya with each of its minute point to be kept in mind by physician while selecting pathya in particular ailment for patients.

Keywords: Ayurveda; Pathya; Anapeta; Manasah-priyam; Wholesome; Diet; Regime.

INTRODUCTION
Historical review about pathya concept unveiled that in Samhita kala, its related subject matter was found in abundance, especially in Brihattrayi and literatures of later period i.e. medieval and modern period followed the Brihattrayi in majority. However, treatises of later period like Bhavaprakasha, Yogaratnakara, Bhaishajyaratnavali, Vaidyaka Jivana, Pathya-apathya Vibodhaka etc. shifted from Adhyatmika (holistic and conceptual) side of Ayurveda to more on Treatment side. Thus most of these literatures emphasized on the causes, symptoms, diagnosis and line of treatment of diseases. Texts of later period were more focused on the concept of pathya ahara and vihara for the preventive as well as post-treatment management aspect of diseases.

The term Pathya is derived from root word 'Pathin' with 'Yat' suffix through 'Dharmapathyarthanyayadanapete' sutra.[i] Pathya word is related to word Patha which literally means- a way or channel. As per Cakrapani, the srotas are the channels of Vatadi dosha and rasa-raktadi dhatu, or the whole body.[ii] According to Shabdacandrika certain substances which are beneficial to srotas and assist in treatment for early recovery are pathya and Rajanighantu refers to Atmiya and Ayushya from the term pathya.[iii] Synonyms of pathya are salutary, wholesome, beneficial, agreeing with (said of a medicine, diet, advice etc.).[iv] Concept of pathya is directly related to the srotas. Anything which is beneficial to these patha or srotas is called pathya. This also means that maintaining the health of healthy person and curing the disease of ill patient is 'pantha' or patha and anything which assists it and is not harmful is designated as pathya.

AIMS AND OBJECTIVES
Principle of Pathya described in Ayurveda holds the power to withstand new step in the direction of drugless therapy and shoot the health issues. Thus, this article focuses on unveiling the concept of pathya with each of its minute point to be kept in mind by physician while selecting pathya in particular ailment for patients.

DEFINITION OF PATHYA
The definition of pathya given by Caraka reveals that there are two criteria for a dravya/ substance to be called as pathya. Primarily, it should be anapayi i.e. non-harmful to the srotas; and second one is, it should be manasah-priyam i.e. pleasant for mind.[v] But in the same context, Caraka has cleared that first criteria is of utmost importance while second one is not necessary to be always present. Explaining it, Cakrapani stated that while conduciveness to the maintenance of normal health and the alleviation of various diseases forms an essential part of the definition of pathya (wholesomeness), personal liking cannot always be the determinant factor for pathya (wholesomeness) of a given drug or diet. However, in another context, Acarya Caraka has advised that pathya should be made manonukula i.e. according to personal liking because if pathya (therapeutical measures) are agreeable to the mind and senses, they promote tushti (mental satisfaction), urja (mental strength), ruchi (relish), bala (strength), and sukha-bhogata (easy to take or easy to consume); as a result of which the severity of the disease gets diminished.[vi] Due to constant use and unpalatability, pathya or wholesome regime may become repulsive. Such wholesome but repulsive regimes may again be made palatable by processing them through different modes of cooking.[vii]

ISSN 2394 - 7780

IMPORTANCE OR NEED OF PATHYA

Pathya is of utmost significance in fulfilling both the aims of Ayurveda i.e. maintenance of health and the cure of diseases. Pathya being wholesome in all the conditions, its significance is stated by Lolimbaraja that if a person follows the pathya for particular disease there is very little significance or requirement of drug application; and when a person is exposed to apathya, the drug application will have no value because drug taken will not be able to cure the disease. Similar verse has been also quoted by kaviraja Vishvanatha revealing that without indulging in medicaments one can pacify his/ her disease only by following pathya ahara and vihara in proper manner; on the other hand, thousands of medicines fails in curing disease if one is continuously involved in apathya ahara and viharasevana.[viii] While focusing on need to observe wholesome rules, Caraka stated that the wise persons who always avoid the intake of unwholesome food are held in high esteem by saints.[ix]

CLASSIFICATION OF PATHYA

Pathya is that which is beneficial to the Patha i.e. srotas or channels of the body. Thus it could be in any form either Ahara (food), vihara (regimes/conducts) or aushadha (drugs). But in various contexts acaryas have referred to ahara and vihara by the term pathya.

a) For **svastha** (healthy person) and **rogi** (ill-patient) have been described separately. For healthy individuals, concept of dinacarya, ritucarya, sadvrit, achara rasayana and various contexts related to diet and their rules have been described. Ahara is one of the three sub-pillars of the body for which every acarya has emphasized mainly on ahara factor. Caraka has mentioned some of the common wholesome foods in Matrashitiya adhyaya like shashtika, shali rice, etc. which should be taken regularly and the lists of best among the wholesome and unwholesome dietetic article in various categories of food articles in Yajjahpurushiya adhyaya.[x] Wholesome conducts or regimes have been described in detail according to day and various seasons. On the other hand, acarya Sushruta has described various hitakara-ahitakara, pathya-apathya in a separate chapter. Acaryas have also laid emphasis on the describing pathya-apathya for every disease mentioned in Ayurveda. In this context, both wholesome and unwholesome diet and regimes for every disease have been mentioned. Caraka has also mentioned pathya as the synonyms of bheshaja signifying it as the major part of treatment and as aushadha itself.[xi]

b) Other form of pathya could be considered as **sharirika pathya and manasika pathya**. Sharirikapathya includes none other than the daily regimes, seasonal regimes, elimination of non-suppressible urges etc; the manasika pathya includes achara rasayana, suppression of suppressible urges, prashamahpathyanam, sadvacanam-anushtheyanam, brahmacaryam-ayushyanam, sankalpo-vrishyanam, saumanasya-garbhadharananam, harshah-prinananam, nivritti-pushtikaranam, etc.[xii]

c) **Upashaya** (exploratory therapy) described in detail by Cakrapani is nothing other than the pathya ahara, vihara and aushadha (wholesome diet, regimes and drugs).[xiii]

d) Pathya are considered in **shamana and shodhana therapies** too. In shamana therapy pathya ahara and vihara have been duly considered along with prescribing aushadha, where pathya becomes a supportive therapy to drug or rather assists the drug action. Whereas, in shodhana therapy, the whole sansarjana karma is dependent on pathya kalpana which are manda, peya, yavagu, vilepi etc., advised for agni-pradipana (to increase digestive fire).

REQUISITE PROPERTIES OF PATHYA

As pathya are defined as something which is beneficial to srotas of the body, thus it should possess the properties which can counteract the different types of srotodushti (sanga, vimarga-gamana, granthi and atipravritti) accordingly. For example, in case of sira-granthi pathya should be of the property which could breakdown that granthi i.e. it should possess the chedana property; and where ever sanga is present in srotas, pathya possessing the bhedana property would be applicable; while in case of ati-pravritti, pathya should possess the stambhana property. However, pathya are also selected according to properties of vitiated dosha, means substance having properties opposite to that of vitiated dosha are pathya in that particular case.

POSSIBLE MODE OF ACTION OF PATHYA

Dosha get aggravated in either of the two different ways, viz., kathinya which occurs internally and unbhava which occurs in gross form; two being the caya and acaya prakopa of dosha respectively. By wholesome food and regimes, these kathinya and unbhava dosha get softened or reduced in quantity respectively as a result of which the morbid manifestation will be of mild nature.[xiv] This means that the potency of doshas for causing disease becomes milder leading to reduction in severity of that disease. Following pathya in itself is a treatment procedure. Therefore, inspite of the intake of pathya (wholesome food etc) even if any kind of disease gets

ISSN 2394 - 7780

manifested , then for its cure, after ascertaining its nature, pathya should be either increased in quantity or should be continued to be taken habitually for longer duration.[xv]

Area of pathya action may be dosha, dhatu, srotas etc. but different acaryas specifically described the action of pathya on srotas. Pancabhautika sangathana and prabhava of pathya ahara and aushadha help the srotas to remain in their normal state. Pathya helps in early recovery of disease as they not only removes kha-vaigunya but also strengthens the dhatu. Therefore, pathya may help in prevention of dosha-dushya sammurchana which is a significant process in pathogenesis. It reveals that pathya maintains the srotas in healthy state both structurally and functionally. Pathya vihara for healthy person is designed in such a way that it may prevent any type of srotodushti. Thus, by using pathya, the role of medicine becomes minimum because pathya increases the agni of body and improves patency of channels and inadequate digestion are prevented so that the digested Ahara rasa properly reaches to various body tissues.

FACTORS INFLUENCING THE SELECTION OF PATHYA

Pathya ahara and vihara for both healthy individual and ill-patient are selected very wisely keeping in mind various factors. These factors are dosha, dhatu, srotas, vyadhi, satmya, agnibala, vaya etc.

a) **Dosha**- Acarya Caraka has prescribed four types regimes for the benefit of four categories of individuals having vatala, pittala, shleshmala and sama-prakriti.[xvi] For an individual having the balanced state of all dosha (sama-prakriti), all the wholesome regimes to be adopted by him should be of balanced type. When there is predominance of any dosha i.e. vata, pitta or shleshma, person should adopt the regimes which is contradictory to the predominating dosha, till there is normalcy of agni.[xvii] Further, Caraka has mentioned in detail the diet and regimes which an individual with particular doshika prakriti (constitution) or vyadhi (disease) should adopt either to remain healthy or pacify his disease if ill.[xviii] In the similar way, acarya Vagbhata has described about the wholesome diet, regimes and therapies in a separate chapter mentioning in brief about type of diet, order of rasa in diet to be taken in case of increased vata, pitta or kapha.[xix]

b) **Dhatu and Srotas**- Pathya selected for particular dhatu is generally same as selected for srotas, means the pathya for dhatus and their respective srotas are common. Describing the line of treatment of dhatu-pradoshaja vikara, Caraka has indicated the applicable and wholesome diet, regimes and therapies. For example, diseases due to vitiation of majjadhatu and shukra dhatu can be treated with diets of sweet as well as bitter tastes, sexual intercourse, exercise and timely elimination of dosha in proper quantity; and so on.[xx] In the similar way, other pathya for dhatus and srotas could be considered for increasing strength and immunity of the Srotas, like- for Pranavaha srotas- Pippali, marica, bhallataka, amalaki, kasturi; for Annavaha- shunthi, lashuna, marica, shankha bhasma (ash of conch); for Mutravaha - Punarnava, Varuna, Gokshura, coconut water; and so on.[xxi]

c) **Vriddhi-kshaya Avastha**- Vriddhi and kshaya condition of the dosha, dhatus, upadhatus and mala have been also considered while deciding pathya for an individual. In condition of diminution of dosha, dhatu, mala and strength, food substances resulting in increment of these diminished dosha, dhatu, mala and strength are indicated.[xxii] For example, in condition of artava-kshaya, patient is advised to take all agneya dravya i.e. having hot potency; in case of stanya-kshaya, patient should take substances which increases kapha.[xxiii] Caraka has also mentioned some other examples of pathya for the kshaya avastha of vata, pitta, kapha, shukra, mutra and purisha. In the same way, in conditions of vitiation of dosha, dhatu etc substances possessing properties opposite to them are prescribed. Example, in increase of mansa-dhatu, honey, yava, mudga, koradushaka, shyamaka, uddalaka etc and exercise which will emaciate the mansa and kapha dosha are indicated.[xxiv]

d) **Vyadhi (disease)**- Pathya, where on one hand has been given specifically for each disease mentioned in Ayurveda, on the other hand, in many diseases wholesome diet and regimes becomes the main treatment of that particular disease. For example, in treatment of atisthaulya and atikrisha, wholesome diet and regimes plays major role in controlling the disease, for which acarya have laid more emphasis on it. Similar focus has been given in treatment of prameha roga, as it is a yapya vyadhi. Thus, it is observed that in acute disease wholesome diet and regimes are supportive or assistive to the drug prescribed, whereas in chronic disorder observance of the pathya becomes the main line of treatment.

e) **Satmya**- A substance conducive to an individual is called satmya and the use of such substances results in the well-being of that individual.[xxv] Decision or selection of pathya also includes prime importance and consideration on satmya of any substance to a particular person. For example, in patient of rajayakshma, mansa-rasa is prescribed only to that individual who is satmya (habitual) to it. Similarly, while indicating

ISSN 2394 - 7780

snehapana, unctuous preparations (sneha-pravicarana) rather than pure unctuous substances are prescribed for the individuals who have aversion for taking unctuous substance i.e. sneha is not satmya to them.[xxvi]

f) **Bala**- Bala includes agni bala, roga bala and rogi bala (strength). It is said that even pathya ahara (wholesome diet) should be taken in proper quantity which depends upon the agni bala i.e. the power of digestion (including metabolism).[xxvii] Four types of agnis have been described according to the four prakriti of individuals and one is advised to take diet in accordance to these agnis.[xxviii] Whereas, the dosage of drug and the type of potency of drug depend upon the vyadhi bala (seriousness/ severity of the disease) as well as on rogi bala (strength of the patient).[xxix] The selection of mridu virya, madhya virya or tikshna virya of drugs or even wholesome diet depends upon the severity of the disease along with the strength of the patient.

g) **Vaya (age)**- Selection of pathya also depends upon the age of the individual or patient. Out of three groups of vaya, in balyavastha (kaphadosha predominent stage/age of life), one should indulge in diet and regimes which are growth and strength promoters; in madhyavastha (pitta dosha predominent), one should intake diet accordingly and more physical exercise can be performed due to presence of more strength; and in jirnavastha (vatadosha predominent), one should indulge in diet which is easily digestible (laghu paki) and mild physical exercise as the dhatu and indriya strength are in deteriorating phase. Acarya Sharngadhara has mentioned ten components or qualities which deteriorate at each ten years of age. These are- balya (childhood), vriddhi (growth), chavi (complexion), medha (intelligence), tvak (skin), drishti (eye power), shukra (sexual capacity), vikrama (courage), buddhi (memory) and karmendriya (motor organs).[xxx] Thus, at each level, for these quality deterioration, certain specific wholesome diet have been considered by ancient scholars.

h) **Kala**- Two types of Kala are described in Samhitas viz. nityaga and avasthika.[xxxi] Avasthika kala is the condition of the individual whether healthy or ill which has been discussed above. Nityagakala is the day time or season, according to which wholesome diet and regimes have been described in ritucharya chapter by all acaryas.

FACTORS INFLUENCING THE ACTION OF PATHYA

The factors which directly affect the pathya are matra (dose), kala (time-day or season), kriya (method of preparation/ combinations), bhumi (habitat), deha (body), dosha.[xxxii] By the influence of these factors even the most tasteful and wholesome substance might get converted to unwholesome and vice-versa. Thus it could be understood that a single substance can be pathya for one individual and apathya for another one just by the impact of these factors. This has been explained by citing an example of ghrita. Ghrita is generally regarded to be the wholesome diet but intake of ghee in excessive quantity is matra-apathya (unwholesome due to dosage); intake during spring season is kala-apathya (unwholesome due to time); when it is prepared with drugs of opposite qualities it is kriya-apathya (unwholesome due to processing); intake of ghrita by the individual of anupa desha (marshy land) is its bhumi-apathya (unwholesome according to land/habitat); and so on.[xxxiii] Conversely even an unwholesome drug like poison becomes wholesome, if taken wisely in proper quantity. Bhallataka, being a poison, is used wisely as rasayana in different formulations which is kriya-pathya (wholesome according to method of preparation).[xxxiv] Thus, it reveals that the definition of pathya(wholesomeness) relates only to its natural form and so is also about apathya (unwholesomeness). The effective wholesomeness and unwholesomeness is however always to be determined in accordance with the dosage (matra), time (kala), preparation (kriya) etc.[xxxv]

Besides these factors, there are some mental factors also which influences the pathya action. Thus it is said that even wholesome food taken even in proper quantity do not get properly digested when the individual is afflicted with chinta (tension), shoka (grief), bhaya (fear), krodha (anger), dukha-shayya (uncomfortable bed) and prajagara (excessive vigil).[xxxvi]

DISCUSSION

Pathya-apathya vichara (consideration of wholesome & unwholesome entities/substances) is an important approach of Ayurvedic medicine & has been an integral part of Ayurveda. Both pathya and apathya are mentioned in context of treatment of each & every disease in Samhitas, as pathya-apathya is considered as an integral part of the medicine. That is why pathya is also said as one of the synonyms of Cikitsa. Inspite of this, there was no separate treatise on pathya-apathya in ancient times. Gradually it attained more prominence & drew attention of scholars and physicians. Lolimbaraja (17th A.D.) observed its significance to this extent that if pathya is observed what is the need of other remedies, on the contrary, if it is not observed what remedies would do? This was the period when separate texts dealing with pathya-apathya came into existence. Both physicians

ISSN 2394 - 7780

and patients became conscious to this concept which prompted the authors to compose treatise on this subject. Broadly, pathya-apathya as upashaya-anupashaya, cover entire areas of aushadha, ahara and vihara while in restricted sense, it is concerned with diet and activities only. The literature on pathya-apathya can be divided into 2 categories - preventive & curative.

For prevention of diseases & maintenance of health of a healthy individual, the concept of pathya in the form of Dinacarya, Ratricarya, Ritucarya etc. have been mentioned. Further for curative purpose, in all cases the physician should consider carefully the 3 entities—Nidana, dosha and dushya and accordingly pathya should be advised. At the first instance, etiological factors should be avoided and then the patient should be asked to abstain from the unwholesome substances using only wholesome substances.

Two features of a pathya substance are given by acarya Caraka which should be possessed by it i.e. anapeta and manasah-priyam. Here question arises that how these two factors form perfect definition of pathya. This could be explained in following way. Anapeta, meaning not harmful to the srotas or patha, is the first and most important feature which has to be present in every pathya. However, this 'anapeta' term unveils that the properties possessed by pathya and its selection depend upon certain other factors and being non-harmful to srotas is just a feature which should be kept in mind while deciding the pathya according to respective conditions. Although, Caraka considered another feature of being favourable to mind as secondary feature but accepted its importance also and stated that pathya should be made pleasant to mind if they are not acceptable to the patient. There stands a strong reason behind it that any substance being more pleasant to mind brings the mental satisfaction, mental and physiological strength, relish and easy to consume which is conducive to diminish the strength of the disease. Example, patients of rajayakshma are advised to have drinks (alcohols) which are favourable to them, food articles which bring pleasantness in their mind, affectionate friends and elders having positive attitude and all other factors which are pleasant for mind. Also, the substances which are pathya/ beneficial to the patient and are not acceptable to them are advised to be converted into favourable forms. For example, varieties of meats which are wholesome but not favourable like vulture, crow, snake etc are given to the patients through disguising. Similarly, other forms of pathya which are tasteless and not palatable are advised to be made palatable by processing with favourable items.

This can also be understood in another simpler way. If we consider only first condition i.e. anapeta (not harmful to srotas) to be present in pathya and ignore the second one (manasah priya), then although the pathya will be effective in disease but being not favourable, its palatability and dosing gets disturbed which affects the application. This results in failure of getting the desired effect. Thus, it is always advised to prescribe palatable dosage forms; and for this various dosage forms of pathya and medicine like sanskrita-asanskrita form, manda, peya, mansa-rasa, svarasa, vati, curna, avaleha, asava-arishta etc have been described in Ayurveda. Similarly, if we consider manasah priyam factor and ignore first one, then all the substances which are favourable to mind but not good for body (anapeta) like alcohol, sleep, tasty food etc will be over consumed which may result in abnormality in srotas.

Another point to be focused is that why acarya has mentioned only two factors (anapeta and manasah priya) and not more than this. For this, if we consider more factors which can be included in the definition as the mode of action of pathya, example, rasa, guna, virya, vipaka etc, then these factors already fall under the category of anapeta. Again, if we consider other factors like ahara-kalpana (odana, krishara, bhata etc), pathya-kalpana (manda, peya, vilepi, veshvara etc) and aushadha kalpana (curna, vati, avaleha, kvatha, asava etc) as the different dosage forms, then these factors again fall under the category of manasah-priyam. This reveals that only these two conditions (anapeta and manasah priyam) cover all aspects of pathya properties. Hence, it is proved that 'pathyam patho-anapetam yadyaccoktam manasah priyam' is complete and perfect definition of pathya.

In Samhita, in many contexts, both the terms, pathya and hita, are used as synonyms because both are said to be the synonyms of bheshaja. Pathya is that which is beneficial to patha or srotas or is not harmful and is not opposite to the rules mentioned in svasthavritta. According to 'hitam poshakatvat' whatever is beneficial to the body is hita. Thus, both hita and pathya could be used as synonyms. However, there exists a difference between pathya and satmya. Acarya Caraka has stated that a substance or conduct conducive to an individual is called satmya and use of such substance or conduct, having properties opposite to the properties of place (desha) and patient (rogi), results in well-being of that individual. Any of the food or regime which has been made conducive to the body through habituation is called oka-satmya. Even this oka-satmya can be of unwholesome substance also which becomes non-harmful to the body immediately but in long run it causes the harms. On contrary to this, pathya is always beneficial to body disregards of being favourable to mind or not.

ISSN 2394 - 7780

Every substance possesses its own specific properties. These properties are beneficial in certain pathological conditions, whereas these could be harmful in some other conditions. Diagnosing the properties of vitiated dosha and symptoms appearing in the disease, those substances are selected in treatment of disease which possesses properties opposite to the vitiated dosha and symptoms. When these substances through their properties counteract the properties of vitiated dosha and pacify the diseased condition, then these substances are called as pathya in that disease.

Broadly, selection of pathya depends upon two factors viz. pathogenesis of the disease and the dosha vitiated in that disease. The disease occurs in two ways, either through chaya prakopa or through achaya prakopa. Chaya prakopa involves the complete pathogenesis of disease, while achaya prakopa involves the direct vitiation of dosha only. In chaya prakopa (kathinyat) i.e. the pathogenesis of disease, apathya sevana leads to kha-vaigunya of patha/ srotas resulting in srotodushti. Due to this srotodushti, srotas become unable to transport ahararasa to various dhatu. This results in dhatu-vigunata and because of disturbed metabolism, vitiation of the three dosha occurs. This further leads to dosha-dushya-sammurchana and finally the occurrence of disease. In achaya prakopa i.e. the vitiation of dosha without their accumulation (sanchaya), dosha remain in mobile phase in srotas due to absence of sthana-sanshraya. Thus, the selection of pathya in case of chaya prakopa of any disease depends upon the types of pathogenesis i.e. the different types of srotodushti (sanga, vimarga-gamana, granthi and atipravritti). This means that in disease of sanga, pathya possessing the bhedana property should be indicated, example, in case of malabaddhata, kutaki is indicated. Similarly, in other type of srotodushti pathya can be selected. In case of achaya prakopa, pathya which possess the properties opposite to that of the vitiated dosha are prescribed. For example, in amlapitta disease where pitta dosha is vitiated, pitta-shamaka dravya like milk, dhatri, pravala etc are indicated. This means, the vitiated dosha or the disease which occurs either chronically or acutely in severe or mild form, are pacified by pathya i.e. their potency of causing disease is made milder which results in reduction of the severity of disease.

Pathya ahara and vihara in itself is a treatment procedure. Therefore, inspite of the intake of pathya even if any kind of disease gets manifested or the already manifested disease do not get pacified due to tolerance of that pathya, then for the cure of that disease, after ascertaining its nature, pathya should be either increased in quantity or should be continued to be taken habitually for longer duration or its dosage form may be changed, but the pathya should never be changed. Pathya has got wide scope in the field of health management due to its gravity at every step of health care either in healthy individual or in ill-patient. Pathya is of utmost importance not only in maintaining the health of healthy individual and treatment of disease of ill-patient, but also in the post-treatment management and prevention of recurrence of disease too.

It is the well saying of Thomas Edison that the doctor of future will no longer treat the human frame with drugs, but rather will cure and prevent disease with nutrition. This again provides weightage for the inclusion of pathya in treatment plan.

CONCLUSION

1. Literary review of pathya, reveals that acarya Caraka has given an ideal definition of pathya which includes- anapeta and manasah priyam qualities; and all those substances which are beneficial to the patha/ srotas are known as pathya.
2. Pathya dravyas act through their rasa, guna, virya, vipaka and prabhava and are capable in performing the function of sroto-shuddhi i.e. purification of srotas.
3. Pathya maintains the srotas in healthy state both structurally and functionally.
4. It is clear that there are numerous factors on which the action of pathya depends like satmya, bala, vaya etc and other factors which affect the action like matra, kala, kriya, dosha etc.
5. Scholars of later period laid more emphasis on pathya ahara and vihara for the better management of the diseases.

REFERENCES

[i] Shabdakalpadruma, Raja RadhakantdevaBahadura, edition 3rd -1967, volume 3rd, p.29.

[ii] Cakrapanidatta, Charak Samhita, Ayurveda Dipika Commentary, Vaidya Yadavji Trikamji Acarya, Sutrasthana, Yajjahpurushiya adhyaya (25;45 commentary), P. 133, Chaukhambha Orientalia, Varanasi, 2015.

[iii] Shabdakalpadruma, Raja RadhakantdevaBahadura, edition 3rd -1967, volume 3rd, p.29.

ISSN 2394 - 7780

[iv] Sanskrit-Hindi-kosha, Vamana Shivrama Apte, edition 2009, p.570.

[v] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Sutrasthana, Yajjahpurushiya adhyaya (25;45), P. 478, Chaukhambha Bharti Academy, Varanasi, 2013.

[vi] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Chikitsasthana, Yonivyapadachikitsa adhyaya (30;332), P. 887, Chaukhambha Bharti Academy, Varanasi, 2012.

[vii] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Chikitsaasthana, Yonivyapadachikitsa adhyaya (30;331), P. 887, Chaukhambha Bharti Academy, Varanasi, 2012.

[viii] Mahamahopadhyaya Kaviraja Vishvanatha, Pathyapathyam, Bambai Bhushan Press, Mathura, p. 4, First edition-1951.

[ix] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Sutrasthana, Vividhashitapitiya adhyaya (28;43), P. 575, Chaukhambha Bharti Academy, Varanasi, 2013.

[x] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Sutrasthana, Yajjahpurushiya adhyaya (25;38-39), P. 467, Chaukhambha Bharti Academy, Varanasi, 2013.

[xi] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Chikitsasthana, Rasayana adhyaya (1;1/3), P. 2, Chaukhambha Bharti Academy, Varanasi, 2012.

[xii] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Sutrasthana, Yajjahpurushiya adhyaya (25;40), P. 468, Chaukhambha Bharti Academy, Varanasi, 2013.

[xiii] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Nidanasthana, Jwaranidana adhyaya (1;10), P. 605, Chaukhambha Bharti Academy, Varanasi, 2013.

[xiv] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Chikitsaasthana, Yonivyapadachikitsa adhyaya (30;329), P. 886, Chaukhambha Bharti Academy, Varanasi, 2012.

[xv] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Chikitsaasthana, Yonivyapadachikitsa adhyaya (30;330), P. 887, Chaukhambha Bharti Academy, Varanasi, 2012.

[xvi] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Sutrasthana, Navegandharniya adhyaya (7;39), P. 165, Chaukhambha Bharti Academy, Varanasi, 2013.

[xvii] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Vimanasthana, Roganikavimana adhyaya (6;14), P. 720, Chaukhambha Bharti Academy, Varanasi, 2013.

[xviii] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Vimanasthana, Roganikavimana adhyaya (6;16-18), P. 721-723, Chaukhambha Bharti Academy, Varanasi, 2013.

[xix] Vagbhata, Ashtanga Sangraha, Shashilekha Commentary, Prof. Jyotir Mitra, Sutrasthana, Doshopkramaniya adhyaya (21;6), P. 165, Chaukhambha Sanskrit Series Office, Varanasi, 2016.

[xx] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Sutrasthana, Vividhashitapitiya adhyaya (28;28), P. 573, Chaukhambha Bharti Academy, Varanasi, 2013.

[xxi] Joshi YG, Rasayan Chikitsa, Kayachikitsa, Pune, Pune Sahitya Vitaran, Edition-4th, 2001, p. no. 35-60.

ISSN 2394 - 7780

[xxii] Sushruta Samhita, Ayurveda Tattva Sandipika Hindi Commentary, Shastri Ambikadutta, Sutrasthana, Doshadhatumalakshayavriddhi-vigyaniya adhyaya (15; 34), P. 81, Chaukhambha Sanskrit Sansthan, Varanasi, 2014.

[xxiii] Sushruta Samhita, Ayurveda Tattva Sandipika Hindi Commentary, Shastri Ambikadutta, Sutrasthana, Doshadhatumalakshayavriddhi-vigyaniya adhyaya (15; 16), P. 77, Chaukhambha Sanskrit Sansthan, Varanasi, 2014.

[xxiv] Sushruta Samhita, Ayurveda Tattva Sandipika Hindi Commentary, Shastri Ambikadutta, Sutrasthana, Doshadhatumalakshayavriddhi-vigyaniya adhyaya (15; 38), P. 82, Chaukhambha Sanskrit Sansthan, Varanasi, 2014.

[xxv] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Vimanasthana, Rasavimana adhyaya (1;20), P. 679, Chaukhambha Bharti Academy, Varanasi, 2013.

[xxvi] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Sutrasthana, Sneha adhyaya (13;82), P. 277, Chaukhambha Bharti Academy, Varanasi, 2013.

[xxvii] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Sutrasthana, Matrashitiya adhyaya (5;3), P. 102, Chaukhambha Bharti Academy, Varanasi, 2013.

[xxviii] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Vimanasthana, Roganikavimana adhyaya (6;12), P. 719, Chaukhambha Bharti Academy, Varanasi, 2013.

[xxix] Cakrapanidatta, Charak Samhita, Ayurveda Dipika Commentary, Vaidya Yadavji Trikamji Acarya, Sutrasthana, Apamargatanduliya adhyaya (2;17 commentary), P. 25, Chaukhambha Orientalia, Varanasi, 2015.

[xxx] Dr. Brahmanand Tripathi, Sharhgadhar Samhita, Purvakhanda, Aharadigatikathanam (6; 62), P.59, Chaukhambha Surbharti Prakashan, Varanasi, 2013.

[xxxi] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Vimanasthana, Rasavimana adhyaya (1;22), P. 682, Chaukhambha Bharti Academy, Varanasi, 2013.

[xxxii] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Sutrasthana, Yajjahpurushiya adhyaya (25;46), P. 478, Chaukhambha Bharti Academy, Varanasi, 2013.

[xxxiii] Cakrapanidatta, Charak Samhita, Ayurveda Dipika Commentary, Vaidya Yadavji Trikamji Acarya, Sutrasthana, Yajjahpurushiya adhyaya (25;46 commentary), P. 133, Chaukhambha Orientalia, Varanasi, 2015.

[xxxiv] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Chikitsasthana, Rasayana adhyaya (1;2/16), P. 33, Chaukhambha Bharti Academy, Varanasi, 2012.

[xxxv] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Sutrasthana, Yajjahpurushiya adhyaya (25;47), P. 478, Chaukhambha Bharti Academy, Varanasi, 2013.

[xxxvi] Agnivesha, Charak Samhita, Vidyotini Hindi Commentary, Shastri Kashinatha and Chaturvedi Gorakhanatha, Vimanasthana, Trividhakukshiya adhyaya (2;9), P. 688, Chaukhambha Bharti Academy, Varanasi, 2013.

MANUSCRIPT SUBMISSION

GUIDELINES FOR CONTRIBUTORS

1. Manuscripts should be submitted preferably through email and the research article / paper should preferably not exceed 8 – 10 pages in all.
2. Book review must contain the name of the author and the book reviewed, the place of publication and publisher, date of publication, number of pages and price.
3. Manuscripts should be typed in 12 font-size, Times New Roman, single spaced with 1" margin on a standard A4 size paper. Manuscripts should be organized in the following order: title, name(s) of author(s) and his/her (their) complete affiliation(s) including zip code(s), Abstract (not exceeding 350 words), Introduction, Main body of paper, Conclusion and References.
4. The title of the paper should be in capital letters, bold, size 16" and centered at the top of the first page. The author(s) and affiliations(s) should be centered, bold, size 14" and single-spaced, beginning from the second line below the title.

First Author Name1, Second Author Name2, Third Author Name3

1Author Designation, Department, Organization, City, email id

2Author Designation, Department, Organization, City, email id

3Author Designation, Department, Organization, City, email id

5. The abstract should summarize the context, content and conclusions of the paper in less than 350 words in 12 points italic Times New Roman. The abstract should have about five key words in alphabetical order separated by comma of 12 points italic Times New Roman.
6. Figures and tables should be centered, separately numbered, self explained. Please note that table titles must be above the table and sources of data should be mentioned below the table. The authors should ensure that tables and figures are referred to from the main text.

EXAMPLES OF REFERENCES

All references must be arranged first alphabetically and then it may be further sorted chronologically also.

- **Single author journal article:**

Fox, S. (1984). Empowerment as a catalyst for change: an example for the food industry. *Supply Chain Management*, *2*(3), 29–33.

Bateson, C. D.,(2006), 'Doing Business after the Fall: The Virtue of Moral Hypocrisy', Journal of Business Ethics, 66: 321 – 335

- **Multiple author journal article:**

Khan, M. R., Islam, A. F. M. M., & Das, D. (1886). A Factor Analytic Study on the Validity of a Union Commitment Scale. *Journal of Applied Psychology*, *12*(1), 129-136.

Liu, W.B, Wongcha A, & Peng, K.C. (2012), "Adopting Super-Efficiency And Tobit Model On Analyzing the Efficiency of Teacher's Colleges In Thailand", International Journal on New Trends In Education and Their Implications, Vol.3.3, 108 – 114.

- **Text Book:**

Simchi-Levi, D., Kaminsky, P., & Simchi-Levi, E. (2007). *Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies* (3rd ed.). New York: McGraw-Hill.

S. Neelamegham," Marketing in India, Cases and Reading, Vikas Publishing House Pvt. Ltd, III Edition, 2000.

- **Edited book having one editor:**

Raine, A. (Ed.). (2006). *Crime and schizophrenia: Causes and cures.* New York: Nova Science.

- **Edited book having more than one editor:**

Greenspan, E. L., & Rosenberg, M. (Eds.). (2009). *Martin's annual criminal code:Student edition 2010.* Aurora, ON: Canada Law Book.

- **Chapter in edited book having one editor:**

Bessley, M., & Wilson, P. (1984). Public policy and small firms in Britain. In Levicki, C. (Ed.), *Small Business Theory and Policy* (pp. 111–126). London: Croom Helm.

- **Chapter in edited book having more than one editor:**

Young, M. E., & Wasserman, E. A. (2005). Theories of learning. In K. Lamberts, & R. L. Goldstone (Eds.), *Handbook of cognition* (pp. 161-182). Thousand Oaks, CA: Sage.

- **Electronic sources should include the URL of the website at which they may be found, as shown:**

Sillick, T. J., & Schutte, N. S. (2006). Emotional intelligence and self-esteem mediate between perceived early parental love and adult happiness. *E-Journal of Applied Psychology, 2*(2), 38-48. Retrieved from http://ojs.lib.swin.edu.au/index.php/ejap

- **Unpublished dissertation/ paper:**

Uddin, K. (2000). A Study of Corporate Governance in a Developing Country: A Case of Bangladesh (Unpublished Dissertation). Lingnan University, Hong Kong.

- **Article in newspaper:**

Yunus, M. (2005, March 23). Micro Credit and Poverty Alleviation in Bangladesh. *The Bangladesh Observer*, p. 9.

- **Article in magazine:**

Holloway, M. (2005, August 6). When extinct isn't. *Scientific American, 293*, 22-23.

- **Website of any institution:**

Central Bank of India (2005). *Income Recognition Norms Definition of NPA.* Retrieved August 10, 2005, from http://www.centralbankofindia.co.in/ home/index1.htm, viewed on

7. The submission implies that the work has not been published earlier elsewhere and is not under consideration to be published anywhere else if selected for publication in the journal of Indian Academicians and Researchers Association.

8. Decision of the Editorial Board regarding selection/rejection of the articles will be final.